POSTGRADUATE HANDBOOK 2022

POSTGRADUATE SCHOOL

The Papua New Guinea
UNIVERSITY OF TECHNOLOGY
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MOROBE PROVINCE
PAPUA NEW GUINEA

Papua New Guinea

UNIVERSITY OF TECHNOLOGY

POSTGRADUATE COURSES HANDBOOK 2022

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Introduction

From late 2019 to 2021, the COVID-19 posed a real challenge for the whole world, including the Papua New Guinea University of Technology (PNGUoT). However, the University community galvanized and adapted to the *Niupla Pasin* to offer the required academic programs without compromising the quality. Despite the challenges, the PNGUoT launched its PNGUoT Strategic Plan 2020 – 2024 in April 2020 with a vision to grow world-class technocrats for the real world by 2024 and beyond. Our mission is to develop world-class technocrats through high-quality experiential teaching, research, and ardent application of science, technology, and innovation towards national development. There are seven (7) strategic domains of which the 2nd and the 3rd relate to academic excellence in teaching, research, innovation, and training. The visionary academic leadership has reviewed the teaching and research programs. It is adopting strategic objectives to ensure that knowledge capacity in science, technology, and the business sectors expands at PNGUoT. Implementing the plans towards achieving strategic goals strengthens PNGUoT as the knowledge hub of Science and Technology, delivering quality graduates, both under- and postgraduates, into the future. This development aligns with the Higher Education Technical Education plan aims 2017 – 2038, MTDP III, and Vision 2050. All the academic departments aligned their programs and research priorities to achieve the specific objectives of the Strategic Plan. The University reached another milestone through its provisional accreditation of Engineering programs.

Postgraduate research plays a significant role in building national content in science and technology for PNG resource development. The study opportunity allows students to develop quality graduate attributes and establish a stake in the University's knowledge bank. The PNGUoT continues to attract the support of major stakeholders, including the Government, Industry, and Development Partners, as the demand for quality graduates and the relevance of skills training and the research content is made available. It is a product (student quality and relevant research content) that PNGUoT is selling, and PNGUoT's Brand's promotion must continue. PNG is gifted with abundant natural resources, and PNGUoT will continue to be actively engaged in research and innovation, providing solutions to real-world projects presented by the Stakeholders.

The University is committed to providing greater accessibility and externalizing the postgraduate programs. All the 13 academic departments have postgraduate programs offering studies for degrees up to Ph.D level. The University has currently 20 PhD, 34 Masters, 1 PG Diploma, and 2 Postgraduate Certificate courses on offer. Some departments are also offering distance mode programs, and some departments are working towards introducing new course-based Master's programs.

This scenario was well demonstrated when 13 postgraduate students were awarded EU scholarships for a Master's degree to conduct research and develop science content for the National Forestry Inventory. Nine of those students graduated in 2019. The Agriculture, Forestry, and Food Technology Departments continue to attract funding support for similar programs. Engineering and Science Departments have ongoing research partnerships. Departments engaged in socio-economics, business, and the built environment research continue collaboration with industry. Given the ever-expanding developments in Information Technology and the Government initiative to transform livelihoods into a digital future, IT's research opportunities are looking numerous. It is a challenge for academics to strengthen links with industry and build relevant research capacity at the Departmental level. Two academic staff members and one Master's student successfully secured the funding from PNG Science and Technology Secretariat, demonstrating the strength and commitment of staff and PG students to research and development.

PNGUoT is now collaborating with various research institutes to integrate research between multiple faculties. However, there are cross-cutting issues across different sectors of the economy and a holistic approach must be taken to address the issues at hand. A clear example relates to any agricultural program that will need social scientists, engineers, and other technologists to support agricultural development. Recently, PNGUoT signed an MOU with the National Research Institute and other universities to strengthen research collaboration. The University also has bilateral MOU with many universities in Australia, Fiji, China, Japan, and New Zealand.

To this end, I congratulate Professor Shamsul Akanda, the Dean of Post Graduate School, for revitalizing the postgraduate program in the Mid-2000s with about 5 – 10 students, which has grown to approximately 200 registered students in MPhil, MSc, and PhD. All the Academic departments are now offering postgraduate courses up to PhD level. The engagement of academics in postgraduate supervision and the research culture at the postgraduate level is looking bright. I congratulate the Pro VC (Academic), Dr Augustine Moshi; Heads of the Departments, Professors, Lecturers, and Postgraduate Coordinators in the Departments for the publication of postgraduate Course *Handbook 2022*, which will be fully searchable and available on the website. Despite the challenges, I would like to see the 2022 academic year far more productive.

Associate Professor Ora Renagi (PhD)
Vice Chancellor

Preface

It is an absolute pleasure to present the ***Postgraduate Courses Handbook 2022***. The postgraduate handbook was first compiled in 2016 and updated every year since then. Previously, the postgraduate courses were integrated with those in the undergraduate program handbook. As the University's postgraduate programs are expanding under a separate Postgraduate School umbrella, an independent and elaborate Course Handbook is essential. This step is also in line with the objectives of the PNGUoT Strategic Plan 2020-2024 to strengthen the Postgraduate Programs in the University.

This handbook contains the course descriptions and syllabi of all the course-based postgraduate programs offered by the different academic departments of the PNGUoT. The handbook compilation reflects the commitment of the PNGUoT towards strengthening and promoting postgraduate studies and research culture. In addition to these course-based academic offers, such as the Master of Science degree program, the Postgraduate Diploma programs, and the Postgraduate Certificate programs, the University also offers research-based degree programs, such as the Doctor of Philosophy (PhD) and Master of Philosophy (MPhil) tracks. All 13 academic departments at the PNGUoT have postgraduate programs, and all of those offer PhD-level study opportunities. All the departments have adequate supervision and research facilities to carry out innovative research. The PNGUoT is working towards strengthening the in-house postgraduate programs to increase the numbers, offer more choices to the students, and develop a research culture. There are currently 20 PhD, 34 Masters, 1 PG Diploma, and 2 Postgraduate Certificate courses at the PNGUoT. In addition, as a part of internationalization, a few overseas students from Nigeria under the Queen Elizabeth Commonwealth Scholarships (QECS) are funded by the Association of Commonwealth Universities (ACU). The academic departments, namely Agriculture, Applied Physics, Business Studies, Civil Engineering, Communication and Development Studies, Electrical and Communication Engineering, Forestry, Mathematics and Computer Science, Mechanical Engineering, and Surveying and Land Studies, offer taught postgraduate programs along with research-based degree options.

Furthermore, the Department of Communication and Development Studies and the Department of Surveying and Land Studies also offer postgraduate programs in the distance mode. In addition, the distance mode MSc programs in *Agricultural Extension and Rural Development* from Agriculture has been approved to be offered soon. The remaining academic departments are also working towards developing course-based Master's programs. At the DHERST initiated External Assessment of Universities in 2019, the Postgraduate Studies criterion met all the requirements, a milestone achievement and recognition of PG

studies' quality at PNGUoT and a proud moment for the PNGUoT family. The University has many energetic, enthusiastic, and highly qualified academic staff with postgraduate training and supervision experience.

The PNGUoT has the largest postgraduate program in the country, with an increasing number of students every year. About two-thirds of the students are self-sponsored, while the others are either supported by a Graduate Assistantship Program (GAP), a scholarship program of the PNGUoT designed to attract high-caliber first-degree holders into academic careers or by industry offered scholarships. These initiatives demonstrate the enthusiasm and demand for postgraduate studies and research in the larger PNG community. In addition, the Government initiated the Higher Education Loan Program (HELP) to attract more postgraduate studies students.

This handbook will be handy for current postgraduate students and future students. It will be available on the PNGUoT website so that all potential students and stakeholders can obtain up-to-date and detailed information on the courses available for the programs of interest.

I want to take this opportunity to thank the Senior Executive Management Team of the PNGUoT for their assistance and insistence in strengthening the course-based postgraduate programs at the University.

I also take this opportunity to thank the Heads of the Departments of Agriculture, Applied Physics, Business Studies, Civil Engineering, Communication and Development Studies, Electrical and Communication Engineering, Forestry, Mathematics and Computer Science, Mechanical Engineering, and Surveying and Land Studies for their assistance in providing digital copies of the course-based postgraduate programs for straightforward compilation and editing the postgraduate courses handbook 2022. The students will find it very handy and valuable.

Professor Shamsul Akanda, PhD
Dean, Postgraduate School

DEPARTMENT OF AGRICULTURE

MASTER OF SCIENCE (MSc) IN AGRICULTURE

DEPARTMENT OF AGRICULTURE

Head of Department

Dr Macquin Maino, PhD (PNGUoT), MSc (UQ, Aust), BSc.Ag (PNGUoT), Dip. Trop. Agric. (Vudal), Dip. Sec. Teach. (UPNG-GTC), Cert.Res (TIC, Japan), PGSCT (PNGUoT).

Deputy Head of Department

Mr. Nick Kewa, MPhil., BSc. Ag, (PNGUoT), Dipl. BBM (PNGIBBM-POM), Coordinator, BARD Program.

Professors

Dr. Shamsul Akanda, PhD (OSU, USA) MSc.Ag., BSc.Ag. Hons. (BAU, Bangladesh), Dean of Postgraduate School.

Dr. Gariba Danbaro, PhD (Kobe, Japan), MPhil. Ag, BSc. Ag (Hons), Dip.Ed. (Ghana).

Dr. Tom Okpul, PhD (UQ, Aust), MPhil.Ag; BSc.Ag (PNGUoT), Dip.Ag (Vudal); Acting Director, Unitech Biotechnology Centre (UBC).

Associate Professors

Dr. Peter A. Manus, PhD (PNGUoT), M.Sc (Ag.Econ), (Reading), B.Sc. Ag-Hons. (UPNG). Executive Editor, *Niugini Agrisaiens* Journal

Dr. Jayaprakash, PhD (Poland), MVSc, (Agra, India), BVSc, (Bangalore, India).

Dr. Rajashekhar Rao B K, PhD, MSc.Ag, BSc.Ag (UAS, Bangalore, India), PGSCT (PNGUoT).

Dr Macquin Maino, PhD (PNGUoT), MSc (UQ, Aust), BSc.Ag (PNGUoT), Dip. Trop. Agric. (Vudal), Dip. Sec. Teach. (UPNG-GTC), Cert.Res (TIC, Japan), PGSCT (PNGUoT).

Senior Lecturers

Dr. Veronica Bue, PhD. (Curtin, Aust), MPhil. Ag, BSc. Ag (PNGUoT), PGSCT (PNGUoT). Coordinator of Postgraduate Studies; Acting Director, SPISARD.

Dr. Patrick Michael, PhD. (Adelaide, Aust.) MSc & MSc. Prelim (Nottingham, UK), BSc.Ag (PNGUoT), PGSCT (PNGUoT). Acting Farm Manager

Dr. Ronnie Dotaona, PhD. (Charles Sturt, Aust), MPhil.Ag; BSc.Ag (PNGUoT).

Lecturers

Mr. Nick Kewa, MPhil.Ag, BSc. Ag, (PNGUoT), Dip. BBM (PNGIBBM-POM), Coordinator, BARD Program.

Ms. Betty Tiko Motoro, MPhil.Ag, BSc.Ag (PNGUoT).

Mr. Frank Vidinamo, MPhil.Ag, BSc.Ag (PNGUoT), On study leave

Dr. Gwendolyn Ban, PhD., BSc.Ag (PNGUoT).

Mr. William Nano, PGDip-Ag. Sci (UNE), BSc.Ag-Hons. (UPNG).

Research Assistants

Ms Tabitha Parau, MSc.Ag, BSc.Ag (PNGUoT).

South Pacific Institute for Sustainable Agriculture Development (SPISARD)

Dr. Veronica Bue, PhD. (Curtin, Aust), MPhil. Ag, BSc. Ag (PNGUoT), Acting Director

Chief Technical Officer (CTO)

Mr. Timothy Bafiec, MSc.Ag (PNGUoT), BSc.Ag. (PNGUoT),.

Scientific Officer (Analytical Lab)

Mr. Tata Telawika, BAppl Sci (PNGUoT).

Principal Technical Officer

Mr. Joshua Yauwo, BARD PNGUoT, PCDip in Trop.Ag. (Vudal), Cert. in Trop.Ag. (Vudal).

Senior Technical Officers

Mr. Obert Lou, B. Trop. Ag. (UNRE).

Mr. Henry Gindo, Cert. HighTechEd (LaeTech)

Mrs. Totave Kamen, Dip. Lab. Tech. (Melbourne); Cert.Trop.Ag. (PAC).

Mr. Timothy Poy, B.Appl Sci (PNGUoT)

Ms. Peilyn Willie, BSc.Ag (PNGUoT).

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Technical Officers
Mr. Sovera Guti, Dip. App. Sc. (Lae Tech).

Mr. Topas Peter, BARD (PNGUoT), Dip. App. Sc. (Lae Tech).

Ms. Elizabeth Matrus, Dip. App. Sc. (Lae Tech).

Ms. Warendo Mark, BSc.Ag (PNGUoT)

Administrative Officer
Mrs Ngayamo Antonio, Cert. Management Studies (Lae Tech); Cert. Secretarial (Lae Tech).

Secretary
Ms. Danike Kose, Cert. Secretarial (POM CTC).

DEPARTMENT OF AGRICULTURE

Postgraduate Programs

Food security is a function of self-sufficiency. The higher a country's self-sufficiency, the lower the likelihood that its food security will be compromised. This justifies for a strong domestic production and reinforces the importance of agriculture in PNG. There is no substitute for the highly qualified, confident and dedicated agricultural scientists to meet the challenges of the 21st century agriculture. The Department of Agriculture is in the fore front to train the future cadets with required theoretical, practical and entrepreneurial knowledge and skills to take part in the nation building process.

The Department of Agriculture of the PNG University of Technology has been playing a leading role in providing postgraduate training in different areas of agriculture. Over the years, these training programs were not only intensified in their offering but got diverse in the nature of postgraduate trainings. The current postgraduate programs include: the Master of Science (MSc), the Master of Philosophy (MPhil) and the Doctor of Philosophy (PhD).

The Master of Philosophy MPhil program is a 2-year program and is completed by research thesis and is instituted for those who have a lot of field experience. The same applies to the Doctor of Philosophy program which is completed by research thesis for a period of 3-4 years. The Master of Science MSc programs is a two-year course-based program with a research thesis component. This program is targeted for young graduates who wish to develop a professional career in teaching, research and/or in the related industries.

The postgraduate programs are aimed at meeting the manpower needs of Papua New Guinea. The students can further their knowledge in professional areas including: Crop Production, Animal Production, Crop Protection, Agricultural Economics, Agricultural Extension & Rural Development, Soil Science and Agricultural Engineering and Post-harvest technologies.

The Department has a vibrant, inclusive, energetic and highly dedicated team of 16 academics 11 of whom with PhD capable to take any challenge in terms of postgraduate research and training. The University is in close proximity to the National Agriculture Research Institute (NARI) which employs the competent agricultural scientists. By building a partnership between Unitech and NARI, the NARI scientists will be a further synergistic complement to the Departmental academic staff. The department has the strength and capacity in terms of postgraduate training and research to build a future. The department wants to take the coordinated and holistic approach which is in line with the University's vision of developing the scholarship characters in terms of research and postgraduate training.

Research

The Department has concentrated research on selected food crops and small animals in the past. This is in line with the national government's shift in emphasis from plantation crops to food crops and livestock. For the last few years a research team representing different disciplines has been doing research on Rice. For the coming years, the emphasis of research will be on rice and other crops and small animals. With the expanded and coordinated research work on food crops and livestock proposed under the National Agricultural Research Institute (NARI), there is room for collaborative research between our staff and those of NARI and the agricultural industries.

South Pacific Institute of Sustainable Agriculture and Rural Development (SPISARD)-Outreach Extension Activities in the Rural Community

Since 2003, activities have been initiated by this Department for the mutual benefits of the rural people, students and the staff. Villages have been selected from different agro-ecological zones as conduit points for the Department's outreach activities. These activities are being conducted by the South Pacific Institute of Sustainable Agriculture and Rural Development (SPISARD) which is the outreach extension arm of the Department of Agriculture. The goal of the SPISARD is to improve the quality of teaching and research of the University through active participation with realities of PNG rural areas. Both staff and students are involved in research, demonstrations and need-based trainings in selected villages.

Linkages

National - The Department has established links with farmers, agricultural institutes, plantations, agribusiness, Provincial Governments, and the Department of Agriculture and Livestock (DAL) in the following provinces: Central, Morobe, Madang, Eastern Highlands, Western Highlands, Enga, East New Britain and West New Britain. MOUs have also been signed with NARI and DAL to do collaborative works.

International – International linkages have been established through MOUs followed by joint projects with some universities in Australia, the South Pacific, and the UK. These are: University of South Pacific (USP), Charles Sturt University (Australia), National Research Institute (NRI) of Greenwich University (U.K), South Australian Research and Development Institute (SARDI) of the University of Adelaide, Australia, and Canberra University.

Agriculture Farm

The Department has a farm of 39 ha located on the University campus and a larger farm of about 300 hectares still to be purchased and developed.

Main functions of the farm are to provide:

1.1 Physical and financial data on various farming activities from a known and reliable source for teaching, demonstration and research,
1.2 Materials (e.g. land, crops, livestock, machinery) for demonstration and practical training in agricultural techniques,
1.3 Facilities for research and development work by the University staff and students, and for outside bodies,
1.4 The opportunity for the students to have an active and intimate association over a period of time with a farming situation,
1.5 Land for staff and student gardens.
1.6 Provide an annual physical and financial report to the Agriculture Department.

MASTER OF SCIENCE (M.Sc.) IN AGRICULTURE

Program Objectives

Train and develop highly skilled agricultural professionals with specialization in different areas of agriculture to meet the increasing requirements for the agricultural industries including universities.

Program Outcomes

1. Demonstrate knowledge and understanding of a range of basic concepts and fundamental principles that underpin farming systems and agricultural production.

2. Apply advanced scientific knowledge, skills and technology to the existing systems of production to improve crop and animal production.

3. Identify problems of production and apply goal-orientated research to address farming problems.

4. Design experiments and develop research programs with minimum supervision in the field of study.

5. Apply appropriate oral and written communication and extension methods to disseminate agricultural messages to diverse audiences to enhance agricultural development.

6. Assess and apply knowledge and entrepreneurial skills to effectively manage farms and to promote farming as a business enterprise.

7. Prepare independently oral, written and visual formats of communication for dissemination of research findings.

Rules for MSc in Agriculture with Course-Work

The MSc degree in Agriculture will be fully governed by the existing "Rules for Master's Degree based on Course Work" of the PNG University of Technology with the following exceptions.

1. The degree offered will be MSc in Agriculture.
2. There will be a three-member advisory committee including the Principal Supervisor appointed by the HOD, Agriculture to help the student in selecting the courses and monitor the progress over the period of the study period. The major responsibility of guidance will lie with the Principal Supervisor.
3. The thesis will be marked as "Satisfactory" or "Unsatisfactory". To pass, the candidates have to have a satisfactory grade.

Program Duration and Course Schedule

The MSc degree in agriculture is a full-time program of studies extending over four academic semesters (two years). The students will be taking

the courses as per the following schedule along with a research (thesis) component.

Schedule of Courses for MSc in Agriculture

Year 1	*Contact Hrs/Wk*
First Semester	
Research Methodology and Scientific Writing (Core)	4
3 optional courses to choose. Each at 4hrs/wk	12
	16
Second Semester	
Biometry (Core)	6
3 optional courses to choose. Each at 4hrs/wk	12
Thesis	6
	24
Year 2	
First Semester	
Thesis	6
	6
Second Semester	
Thesis	6
	6

Courses to be taught	*Semester*
AG 501 Research Methodology and Scientific Writing	I
AG 502 Biometry	II
AG 503 Thesis	I, II
AG 504 Population Genetics	I
AG 505 Quantitative Genetics	II
AG 506 Plant Breeding	I
AG 507 Plant Genetic Manipulation Practical Techniques	I
AG 508 Advanced Crop Physiology	I
AG 509 Horticulture Science	I
AG 510 Tropical Farming Systems	II
AG 511 Crop Modelling and Climatology	II
AG 512 Chemistry of Soils and Fertilizers	I
AG 513 Methods of Soils and Plant Analysis	II
AG 514 Soil Microbiology	I
AG 515 Epidemiology and Plant Disease Management	I
AG 516 Integrated Pest Management	II
AG 517 Applied Insect Ecology	I
AG 518 Principles of Weed Science	II
AG 519 Monogastric Animal Production in Papua New Guinea	I
AG 520 Ruminant Animal Production in Papua New Guinea	II
AG 521 Nutrients Requirement and Quantitative Nutrition	I
AG 522 Feed Analysis and Feed Technology	II
AG 523 Advanced Farm Management	I
AG 524 Agricultural Projects and Planning	I
AG 525 Structure and Efficiency of Agricultural Markets	II
AG 526 Contemporary Extension Systems in South East Asia	II
AG 527 Socio-Cultural Change	I
AG 528 Rural Community Development	II
AG 529 Cultivation and Mechanization	I
AG 530 Agricultural Processing and Storage Technology	II
AG 531 Soil and Water Conservation Engineering	II
AG 535 Digestion and Metabolism in Farm Animals	II
AG 536: Advanced Animal Breeding	II

SUBJECT DETAILS

AG 501: RESEARCH METHODOLOGY AND SCIENTIFIC WRITING

Hours per week: 4 (2 Lect./2 Lab.)
Credit: 12

Learning Outcomes

Upon completion of this course, students will be able to:

1. Illustrate the scientific methods used in research
2. Define various types of research and the elements of research;
3. Identify research problem, formulate and test the hypothesis;
4. Illustrate the importance of research ethics.
5. Explain the importance of scientific communication;
6. Outline the components of various types of scientific reports including proposals, papers and theses;
7. Appraise the styles used in scientific communication and use various sources of literature.

Syllabus

Brief history and development in science. Research defined; types of research - quantitative (mainly bio-physical) and qualitative (mainly socio-economic), elements of research, research problem

identification, formulating study objectives, research hypothesis, formulation of research hypothesis, types and characteristics of research hypothesis, and testing of hypothesis. Methodology and steps in research design, components in experimental design, research data collection, analysis and report writing.

Review the principal research models, principles, methodologies, and skills, and assessing their validity for particular projects and research types. The sections of research report: introduction, review of literature, materials and methods, results and discussions and conclusions. Writing the different sections of the research report, adopting different language, citation and information conventions appropriate to each section. Writing the abstract, attribution of sources, foot notes and referencing. Presentation of graphs, tables and figures. Writing acknowledgements, and tables. Tailor scientific writing to thesis, proposals, reports, and journal and conference papers writing. Scientific editing.

References

- Kumar, Ranjit. 2005. Research Methodology – a step by step guide for beginners (2nd Edn.), Pearson Education Australia.
- Librero, Felix. 2003. How to write a thesis proposal- some practical guidelines (3rd Edn.), The University of Philippines.
- Lindsay, D. 1995. A guide to scientific writing (2nd Edn.), Melbourne, Longman.
- Snooks and Co. 2002. Style for Authors, Editors and Printers. John Wiley and Sons Australia Ltd.

A*ssessment*

Continuous Assessment	50%
Final Examination	50%

AG 502: BIOMETRY

Hours per week: 6 (3 Lect./3 Lab.)
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Understand statistical distributions and hypothesis testing;
2. Summarize experimental and survey data;
3. Design various agricultural experiments and surveys;
4. Analyze and interpret the results using sound. statistical principles and appropriate software.

Syllabus

Normal and other probability distributions, their properties and applications in agriculture;
hypothesis testing. Summarizing and exploring experimental data in agriculture;

Review of various experimental designs and their analyses: Completely randomized design; randomized complete block design; Nested experiments; Split plots; Factorial experiments; Confounding; Tests of means; orthogonal contrasts. Correlation and path coefficient analyses.

Regression analysis: Linear and multiple regression; examination of residuals; lack of fit; model building; selecting the best regression equation; coincidence and parallelism. Covariance analysis.

Multivariate statistical methods: factor analysis: principal components; discriminant analyses; canonical correlation; response surface experimentation; multiple analyses of variance; cluster analyses. Analyses of categorical data. Survey design and analyses.

Non-parametric statistics: Spearmans rank correlation; chi-square test; Kolmogorov-Smirnov test; Man-Whitney U test; Wilcoxons signed ranks test; Kruskal Wallis test; Friedmans 2-way anova by ranks; Kendall's tau

References

- Finney, D.J. 1972. An Introduction to Statistical Science in Agriculture. Blackwell Scientific Publications, London.
- Little, T,.M and Hills, F.J. 1972. Agricultural Experimentation. John Wiley and Sons, New York
- Sokal, R. R. and F. J. Rholf. 1981. Biometry (2nd Edn.), W. H. Freeman & Co., San Francisco.
- Steel, R. G. D. and J. H. Torrie. 1980. Principles and procedures of statistics (2nd Edn.), McGraw- Hill, New York.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 503: THESIS

Hours per week: 6 (semester 2, Year 1), 6 each semester of Year 2
Credit: 27

Learning Outcomes

Upon completion of this course, students will be able to:

1. Explain the principles of conducting scientific research and research ethics;
2. Identify the research problem;
3. Develop the research proposal;
4. Conduct research, collect and analyze data and interpret results;
5. Write up the thesis.

Instructions

The students should write and finalize the research proposal in consultation with the Principal Supervisor and the Advisory Committee and present the proposal in a Seminar at the end of first semester of the first year of studies. During the conduct of the research, the student should present another Seminar at the end of first semester of the second year reporting the progress so far in terms of research. By the end of second semester of year 2, the student should finish data collection, analysis and thesis preparation to submit for examination.

Assessment

As per the Higher Studies Regulations of the University of Technology

AG 504: POPULATION GENETICS

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Understand the processes determining the dynamics of alleles, genotypes, and phenotypes over space and time;
2. Apply insights gained from classic and modern genetic techniques to understand how genetic variation is produced, maintained, and distributed within and among populations;
3. Examine the effects of natural selection and genetic drift on genetic variation in natural populations;
4. Discusses how the analysis of DNA sequences can be used to understand the evolutionary forces acting on populations or species, either in general or at specific genes;
5. Apply principles of population genetics to animal and plant breeding.

Syllabus

Introduction and probability. Review of the genetic material, protein synthesis and gene regulation. Genetic variation: causes of variation including mutation, drift, migration, transposable elements; measures of variation, methods of detecting genetic variation. Contribution from Mendelian sampling

Random mating: Mendelian inheritance, Hardy Weinberg equilibrium and allele frequency estimation. Linkage disequilibrium and test of disequilibrium, sex linked genes

Inbreeding and kinship: Inbreeding coefficient, pedigrees, effects of inbreeding, regular systems of mating, assortative mating

Selection: types of selection, inbreeding and selection, measures of Fitness, Constant Fitness Models, Selection on Quantitative Traits

Genetic drift and inbreeding, heterozygosity, Wright-Fisher model, fixation probabilities, effective population size, effects on effective population size

Mutation: basic ideas, mutation-selection balance, balance between mutation and drift, mutation and Gene frequencies

Migration: Gene pools, Wahlund effect, models of migration, migration vs selection, estimation of gene flow, migrational load

Population structure: Heterozygosity, Wright's F statistic, DNA typing using markers Molecular population genetics: neutral theory, molecular evolution, patterns of nucleotide and amino acid substitution, mitochondrial and chloroplast DNA evolution, molecular phylogenetics

References

- Christiansen, F. B. and Feldman, M. W. 1986. Population Genetics, Blackwell Scientific Publishing, CA.
- Hartl, D. L. and A. G. Clark.1997. Principles of Population Genetics (3rd Edn.), Sinauer Associates, Sunderland, Massachusetts.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 505: QUANTATIVE GENETICS

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Understand the basic theory of inheritance of quantitative characters that underlies plant and animal breeding;
2. Carry out genetic evaluation of plants and animals;
3. Use linear models for the genetic improvement of plants and animals;
4. Design and assess breeding programs.

Syllabus

Genotype-phenotype model of quantitative traits; causes of genetic and phenotypic variation and their importance, genetic mean and variance.
Resemblance between relatives and the concept of heritability and repeatability
Estimation of variance components using various designs
Artificial selection: estimation of breeding value and response to selection
Inbreeding and crossbreeding
Correlated characters
Role of biotechnology in plant and animal breeding including selective breeding, artificial insemination, MOET, marker assisted selection, mapping of QTL for genetic improvement and gene transfer.

References

- Cameron, N. D. 1997. Selection Indices and the Prediciton of Genetic Merit in Animal Breeding CABI Publishing
- Falconer, D. and Mackay, T. 1996. Introduction to Quantitative Genetics, 4th Edition.
- Longman. . Lynch, M. and Walsh, B. 1995. Genetics and Analysis of Quantitative Traits. Sinauer Associates, Inc. Sunderland, Massachusetts, USA.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 506: PLANT BREEDING

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Demonstrate the acquired knowledge on advanced principles and prospects of plant breeding;
2. Apply the methods of plant breeding appropriately in crop improvement efforts in PNG context;
3. Apply one's understanding of the current issues underlying in plant breeding and the technologies involved and be able to make management decisions in plant breeding programs;
4. Assess production constraints in crops and make sound decisions on developing appropriate plant breeding programs to address them.

Syllabus

Source of variations – plant genetic resources, induced mutations, interspecific hybridization by sexual means, chromosome manipulation and ploypoidy, somatic hybridization, gene cloning and identification & the role of gene technology in plant breeding.
Assessment of variation – Biometrical genetics in breeding, biochemical characterization of populations
Manipulation of genetic systems – Self-and cross-incompatibility; male sterility; apomixes; micropropagation and somatic embryogenesis, andro- and- parthenogenesis.
Adaptations – genotype x environment interaction and adaptation, augmenting yield- based selection, resistance to abiotic stresses & resistance to parasites.
Methods of selections – selection strategies and choice of breeding methods, marker- assisted; gametophytic and sporophytic & *in vitro*.
Specific trait breeding – symbiotic nitrogen fixation, photosynthetic & respiratory efficiency, efficient root systems & utilization of renewable plant resources.
Cultivar registration, maintenance and Distribution – seed production, certification, registration procedure, production and distribution of pedigreed seeds, Plant Breeders Rights vs. Farmers Rights, Intellectual Property, issues in Plant Gene Patenting.

References

- Hayward, M. D., Bosemark, N. O. and Romagosa, I. 1993. Plant Breeding: Principles and Prospects. Chapman & Hall.
- Rup, L. and Sukanya, L. 2000. Crop Improvement Utilizing Biotechnology. CRC Press, Inc., Florida.
- Simonds, N. W. 1979. Principles of Crop Improvement. Longman, London. Vose, P. B. and Blixt, S. G. 1983. Crop Breeding. Pergamon Press, Oxford.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 507: PLANT GENETIC MANIPULATION – PRACTICAL TECHNIQUES

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Understand the difference between old biotechnology and modern biotechnology;
2. Apply genetic engineering techniques such as DNA fingerprinting, MAS, tissue culture etc. to enhance conventional plant breeding;
3. Employ PCR, nucleic acid hybridization and sequencing technologies for detection and diagnostics;
4. Demonstrate the acquired knowledge on molecular genetics on versatile techniques in recombinant DNA technology;
5. Explain the concept and applications of monoclonal antibody technology;
6. Explain the general principles of generating transgenic plants, animals and microbes;
7. Assess production constraints in crops and make sound decisions on developing appropriate genetic manipulation programs to address them.

Syllabus

Laboratory-based instruction in conventional and non-conventional techniques of plant hybridization, including *in vitro* pollination, *Agrobacterium*-induced transformation using wild- type and engineered strains, tissue culture and micropropagation, fusion of protoplasts, plasmid isolation for DNA uptake studies, RAPD and microsatellite analyses for confirmation of hybridity/DNA fingerprinting, biolistic, analysis of transgenic plants (PCR and RT-PCR), Southern analyses, chromosome preparations.

References

- Collins, G. B. and Petolino, J. F. 1984. Plant Genetic Engineering. The Hague Martinus.
- Gatehouse, A. M., Hilder, V. A. and Boulter, D. 1982. Plant Genetic Manipulation for Crop Protection. Wallingford, C.A.B. International, UK.
- Walden, R. 1988. Genetic Transformation in Plants. Milton Keynes, Open University Press.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 508: ADVANCED CROP PHYSIOLOGY

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Evaluate the environmental factors affecting the physiological basis of crop biological yield;
2. Determine the relative importance of various crop physiological functions on crop production;
3. Explain the physiological process of photosynthesis that determines the economic yield of crops;
4. Explain the drought, salt and acid physiology and resistance, tolerance and avoidance mechanisms in field crops;
5. Design and carryout advanced research on different crop physiological processes of crop production.

Syllabus

Introduction to crop physiology, advances in crop physiology, physiological basis of biological yield development, community of plants interaction, harvesting energy from the sun as food, feed and fiber. Crop yield magnitude and seasonal input of solar energy, Water and CO_2 on crop yield, Crop productivity, crop canopy and its efficiency of photosynthetic conversion of the solar radiation into

dry matter. Canopy structure and photosynthesis, Biomass production and crop growth rate, intercepted solar radiation and crop growth rate, water availability in the soil, water use by plants, crop response to environmental stresses including water stress, salt stress and soil acidity.

References

- Goldsworthy, P. R and Fisher, N. M. 1984. The Physiology of Tropical Field Crops. John Wiley, New York
- Hay, R. K. M and Walker, J. A. 1989. An introduction to the Physiology of crop yield. John Wiley sons. New York.
- Street, H.E. and Opik, H. 1991. The Physiology of flowering plants, their growth and development. London.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG509: HORTICULTURE SCIENCE

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Illustrate the history of horticultural crops and the importance in the PNG economy;
2. Examine the advanced production system of major tropical and temperate horticultural crops grown in PNG;
3. Evaluate the different planting techniques and crop management practices;
4. Assess the merits and demerits of harvesting and post-harvest technologies;
5. Assess the potential use of growth regulators in horticultural crops;
6. Design and carry out advanced research with horticultural crops.

Syllabus

Introduction to horticulture, overview and status of horticulture industry in PNG, significance and roles of horticultural crop production and their prospects in the economy, nursery and green houses, principles and practices of horticultural crops, breeding and physiology of horticultural crops, plant classification and distribution, agronomy and physiology of horticulture crops. Fruits and Nuts, Vegetables, techniques of plant propagation, use of growth regulators and plant hormones, bud grafting, marcoting. Field and storage pest and diseases management. Post-harvest technologies and handling of selected perishable crops. Processing and Marketing of horticultural crops. Floriculture and landscaping, Hydroponics, media, nutrients and fertilizers.

References

- Burton, W G (1982) Post harvest physiology of food, Longmang, London.
- Prately, J. E. 1984. Principles of Field Crop Production. Longmans, London
- Simmonds, N. W. 1976. Evolution of crop plants, Longmans, Green revolution
- Yamaguchi, M. 1983. Principles, production and nutritive values, Vai, Nostrand Publishers
- Waering, P. F and Philips, I. D. J. 1981. Growth and differentiation in plants (3rd Edn.), Pergamon Press, Sydney.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG510: TROPICAL FARMING SYSTEMS

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Describe farming systems as a dynamic farm enterprise in response to physical, biological and socio-economic environments;
2. Evaluate farming systems research and its potential;
3. Identify constraints and opportunities for small farm development in Atoll agriculture system;
4. Integrate potential cropping, grazing and livestock systems;
5. Design and carry out farming systems research.

Syllabus

Overview of tropical farming systems, agricultural systems, determinants of agricultural systems, physical, biological and socio-economic components of farming systems. Farming Systems Research

(FSR), concepts and importance, characteristics, methodology of farming systems research, structures and dynamics of farm household system. Goals and performance criteria for productivity and sustainability, socio-economic aspect of farming systems, characteristics of cropping, grazing and livestock systems and its potentials, Atoll agriculture systems, productivity and identifying constraints and opportunities for small farm development. Holistic approach in FSR, Integration of components in systems research.

References

- Association for Farming Systems Research/Extension. 1992. Towards new paradigm for Farming Systems Research/Extension. Michigan State University, USA.
- Conway, G and Barbier, E. B. 1990. After the Green Revolution: Sustainable Agriculture for Development. London: Earthscan
- Harwood, R. R. 1979. Small Farm Development: Understanding and Improving farming systems in the Humid Tropics. Boulder: Westview
- Ruthenberg, H. 1980. Farming Systems in the Tropics (3rd Edn.). Oxford: Clarendon.
- Shaner, W.W., Philipp, P.F. and Schmehl, W.R. 1982. Farming Systems Research and Development: Guidelines for Developing Countries. Boulder: Westview.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG511: CROP MODELLING AND CLIMATOLOGY

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Describe the importance and basic concepts of crop modeling;
2. Explain various types of crop models and the parameters;
3. Compare the relative advantages and disadvantages of various crop models;
4. Demonstrate the crop modeling and simulation using the appropriate climate, crops and soil data and software to predict crop yield;
5. Use GIS to predict crop yield and management decisions.

Syllabus

Basic concepts of modeling, models (physical, mathematical, stochastic, static and dynamic), system or model components, Model development, model evaluation or validation and calibration, parameterization, uncertainty and sensitivity of models, data assimilation, data set requirements and quality. Simulation, Simulation of growth processes and crop production, modelling and simulation tools (CROPSYST, ORYZA, APSIM, CROPGROW, CERES, CENTURY, DSSAT, EPIC), models for multiple field utilization and decision supporting. Contribution of climatology to simulation of crops, Use of spatial data and GIS for crop modelling, applications of modelling in production forecasting, yield estimation, Yield gap analysis, Water budgeting, optimizing management decisions on plot scale and scaling- out, plant phenology and physiological predictions, applications in soil processes, climatic predictions in regional and global scale

References

- Bouman B. M., Kropff M. J., Tuong T. P., Wopereis, M. C. S. ten Berge H. F. M. and van Larr, H. H. 2001. Oryza2000: Modelling Lowland Rice. International Rice Research Institute, Los Banos, (Philipines) and Wageningen University Research Center.
- Tsuji, G. Y., Hoogenboom, G. and Thornton, P. K. 1998. Understanding options for agricultural production. Kluwer Academic Publishers
- Wallach, D., Makowski, D. and Jones, J. 2006. Working with dynamic crop models- evaluation, analysis, parameterization and applications. Elsevier Publishers, Netherlands

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 512: CHEMISTRY OF SOILS AND FERTILIZERS

Hours per week: 4 (2 Lect./2 Lab.)
Credit: 12

Learning Outcomes

Upon completion of this course, students will be able to:

1. Identify different soil chemical properties controlling the suitability of soil for satisfactory plant growth and to study their interrelationships;
2. Apply principles and mechanisms governing nutrient availability in soils to soil management;
3. Explain the implications of use of fertilizers on the soil chemical reactions;
4. Describe the role of soil chemical reactions on plant growth and nutrition;
5. Relate soil fertility to nutrient transformations within the soil.

Syllabus

Structural and colloidal chemistry of silicate clays, non-silicate clays and organic colloids Ion exchange theories and chemical equilibria, adsorption theories, cation and anion exchange processes, concepts of PZC, layer theories and sorption
Exchange phenomena between plant roots and soil matrices, nutrient cycles (major nutrients)
Soil acidity, potential and reserve acidity in soil, role of Al, liming, liming requirements, liming materials. Salt affected soils, their appraisals; SAR, ESP, estimation of GR; assessment of quality of irrigation water (pH, EC, Cl, CO^2 etc) and management of salt affected soils, HCO^-, soluble cations, RSC Fertilizers, classification of fertilizers, common fertilizer sources for N, P and K, manufacture of them, transformation and fates in soil, fertilizer analysis and calculations of fertilizer requirement, residual acidity/alkalinity for various commercial fertilizers (generic ones)
Transformation of major soil nutrients (nitrogen, phosphorous and potassium) including nutrient fixation. Study of organic manures, FYM, compost, oil cakes. Fertilizer recommendation based on soil tests.

References

- Basak, R. K. 2002. Fertilizers (A text book). Kalyani Publishers, India.
- Bohn, H. L., McNeal, B. L. and O'connor, G. A. 2001. Soil Chemistry (3rd Edn.), John Wiley and Sons, USA.
- Bolt G. H. and Bruggenwert, M. G. M. 1976. Soil Chemistry A. Basic elements, Elsevier Scientific Publishing Co., Netherlands
- Hall, A. and Smith, A. M. 2004. Fertilizers and Manures, Daya Publishing House, India.
- McBride, M. B. 1994. Environmental chemistry of soils. Oxford University Press, New York.
- Sparks, D. L. 2002. Environmental Soil Chemistry (2nd Edn.), Elsevier Science and Technology Books. Netherlands
- Sposito, G. 1989. The chemistry of soils. Oxford University Press, New York, NY.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 513: METHODS OF SOIL AND PLANT ANALYSIS

Hours per week: 4 (2 Lect./2 Lab.)
Credit: 12

Learning Outcomes

Upon completion of this course, students will be able to:

1. Learn and practice good laboratory practices required for soil and plant analysis laboratory;
2. Study the basic principles underlying the preparation of reagents and chemicals essential for estimation of soil and plant nutrients;
3. Gain practical experience in the estimations of soil and plant nutrients;
4. Compare and contrast available methods for a soil or plant analytical parameter;
5. Able to identify appropriate analytical methods for soil and plant analysis.

Syllabus

Basic concepts of quantitative analytical chemistry- %, normality, molarity, molality, ppm, ppt, meq weight, moles etc., which are commonly used in analysis. Preparation of standard solutions, standardization of acids and bases.

Sampling techniques for collecting soil and plants, sample preparation for lab analysis such as sieving, 2mm soil sample preparation, air drying Potentiometry and estimation of soil pH

Measurement of total soluble salts- gravimetric and conductometric methods
Analysis of soil water extracts for carbonates, bicarbonates and chlorides by titrimetric procedure
Concepts of colorimetry, emission spectrophotometry, absorption spectrophotometry, Beer- Lambert's law
Determination of OC content of the soil by wet oxidation method and combustion methods
Total N estimation by Kjeldahl method and combustion method
Digestion of plant materials and estimation of important nutrient elements by ICP-OES

References

- Chatwal, G. R. and Anand, S. K. 2004. Instrumental methods of chemical analysis, Himalaya Publishing House, India
- Page, A. L. 1982. Methods of Soil analysis Part 2: Soil chemical and Microbiological analysis. ASA, Madison, USA
- Peverill, K. I.., Sparrow, L. A. and Reuter, D. J. 1997. Soil Analysis an Interpretation Manual, CSIRO Publishing.
- Reuter, D. J. and Robinson, J. B. 1997. Plant Analysis an Interpretation Manual (2nd Edn.), CSIRO Publishing.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 514: SOIL MICROBIOLOGY

Hours per week: 4 (2 Lect./2 Lab.)
Credit: 12

Learning Outcomes

Upon completion of this course, students will be able to:

1. Discuss the role of microorganism in the vital soil functions;
2. Illustrate some of the important functions carried out by the soil microorganisms;
3. Assess the laboratory techniques followed in the study of soil microorganisms;
4. Use the microbes for the production of biofertilizers;
5. Predict the microbial population in the soil.

Syllabus

Micro-organisms in the soil environment, microbial ecology and soil micro flora microbial physiology, nutrition, growth and enzymatic activity in soils.
Factors influencing soil microbial populations; organic matter decomposition, carbon assimilation, anaerobic C mineralization, decomposition of cellulose, hemicelluloses, lignin and the polysaccharides, transformation of hydrocarbons
N cycle- mineralization, immobilization, protein decomposition, nitrification,
denitrification, nitrogen fixation; symbiotic and non-symbiotic, C/N ratio in soil- microorganisms and nutrient dynamics.
Microbial transformation of P, S and other micronutrients
Ecological interrelationships, associations, competition, amensalism, predation and Parasitism.
Microbiology of the rhizosphere- influence of the plant on microbes and influence of microorganisms on the plant, plant pathogens, mycorrhizae, microorganisms in soil aggregation

Biofertilizers, production and benefits
Isolation and enumeration of soil organisms, estimation of microbial biomass and enzyme activities

References

- Alexander, M., 1977.Introduction to Soil Microbiology (2nd Edn.)., John Wiley and Sons, USA
- Paul, E. A. and Clark, F. E. 2007. Soil Microbiology and Biochemistry (3rd Edn.), Academic Press, USA
- Rangaswamy, G. 1966. Agricultural Microbiology, Asia Publishing House, India
- Stevenson, F. J. 1986. Cycles of Soil, Wiley Inter science Publication, USA
- Sylvia, D. M., Fuhrmann, J., Hartel, P., and Zuberer, D. 2005. Principles and Applications of Soil Microbiology, Prentice Hall Inc., India

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 515: EPIDEMIOLOGY AND PLANT DISEASE MANAGEMENT

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Discuss the various components of plant diseases development;
2. Illustrate the principles of plant disease development in the population level;
3. Structure how to conduct epidemiological research;
4. Plan and conduct crop loss studies;
5. Forecast outbreak of plant diseases;
6. Manipulate epidemiological principles to develop the sustainable disease management strategies.

Syllabus

History and development of plant pathology, significance of plant diseases. Development of plant disease epidemiology, components of plant disease epidemic, disease development in natural and agricultural ecosystems, designing epidemiological studies and sampling, surveys and monitoring, disease forecasting, yield loss estimation, epidemiological and general principles of plant disease management, how the epidemiology set the strategy for disease management, various disease control methods including quarantine and pest risk analysis.

References

- Campbell, C. L. and Madden, L. V. 1989. Introduction to Plant Disease Epidemiology. John Willey and Sons, New York.
- Fry, W. E. 1982. Principles of Plant Disease Management. Academic Press. New York.
- Horsfall, J. G. and Cowling, E. B. (Eds.). 1978. Plant Disease: An Advanced Treatise (Vol. 2): How Disease Develops in Populations. Academic Press, New York.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 516: INTEGRATED PEST MANAGEMENT

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Recall the historical development of IPM;
2. Illustrates the principles and strategies of integrated pest management;
3. Compare the IPM with the conventional methods of pest management;
4. Manage the pest population below the economic injury level highly effectively with little damage to the environment;
5. Design the IPM for various important crops

Syllabus

History, principles and application of techniques for managing plant pests. Development of integrated pest management. Theory and practice of integrating pest control tactics to manage pests within economic, environmental, and sociological constrains. Ecological principles of damage control, Economic thresholds and EIL. Economic and environmental cost of control measures, cost benefit analysis, legal and public policy measures, risk assessment and management. Pest sampling, monitoring and forecasting, economic aesthetic thresholds, yield loss estimation, biological control, host-resistance, cultural control, quarantine, efficient pesticide use, biotechnology. The future of IPM.

References

- Benbrook, C. M., E. Groth III, J. M. Halloran, M. K. Hansen & S. Marquardt. 1996. Pest Management at the Crossroads. Consumers Union. Yonkers, NY.
- Ciancio, A. and Mukerji, K. G. (Ed) 2007. General Concepts in Integrated Pest and Disease Management. Springer, Berlin.
- Dent, D. 1993. Insect Pest Management. CAB International, UK.
- Radcliffe, E. B., Hutchinson, W. D. and Rafael, E. C. (Eds). 2009. Integrated Pest Management: Concepts, Tactics, Strategies and Case Studies. Cambridge University Press.
- Sharam, J. N. and Shamra, R. C. 2005. Integrated Plant Disease Management. Scientific Publishers, India.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 517: APPLIED INSECT ECOLOGY

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Describe insect associations within an agro-ecosystem and their responses to environmental change;
2. Relate different tri-tropic interactions within an agro-ecosystem;
3. Describe the influence of interactions on structure and dynamics of population;
4. Assess the effects of predator-prey and pathogen-host to pesticides;
5. Design and develop tools that are comparable to pesticide effects.

Syllabus

Ecological systems in Papua New Guinea, Population dynamics, Ecology and control of major insect and mite pests in PNG, herbivore-natural enemy interactions, consumer-resource dynamics (predator-prey), insect-insect interactions, insect chemical ecology, Pesticides and Environment, risk assessment, costs and benefits, Plant-derived pesticides (PDPs) and secondary plant metabolites, Ecologically-sound Pest Management, Urban entomology, Applications in Forensic Entomology, Insect Conservation/Insects as Indicators of Environmental Quality.

References

- Schneider, M. F. 1999. Entomology: A textbook for students, agriculturalists and foresters. Bulolo University College, PNG.
- Speight, M. R., Hunter, M. D and Watt, A. D. 2008. Ecology of Insects: Concepts and Applications. Wiley & Sons, London. 640pp.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 518: PRINCIPLES OF WEED SCIENCE

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Describe the biology and ecology of weedy species;
2. Apply the biological knowledge of the different types of invasive weeds in varying ecosystems and their control;
3. Differentiate available tactics and their effects on weed control;
4. Apply economics into weed management and the importance of IWM in Integrated Insect Pest and Disease Management;
5. Evaluate successes of IWM.

Syllabus

Evolution, Weeds and the ecosystem, Types and classification of weeds, Legislation and weeds, economics and integrated weed management (IWM), Modeling, weed ecology of native, pasture and cropping systems in Papua New Guinea (PNG), biological control of weeds, cultural control, physical control, chemical control, herbicide-resistance-environment, secondary plant metabolites, prospects of weed control in PNG, IWM in pastures, IWM in cropping and natural systems, IWM for floriculture, horticulture and viticulture.

References

- Henty, E. E and Pritchard G. H. 1975. PNG Weeds and their Controls. Botany Bulletin, no. 7. Department of Forest. Division of Botany, Lae.
- Van Rijn, P. J. 2001. Weed Management in the Humid and Sub-humid Tropics. P.J. Van Rijn and L.T. Mannetje (eds). Koninklijk Instituut Voor de Tropen, Netherlands.
- Zimdahl, R. L. 1993. Fundamentals of Weeds Science. Academic Press, New York.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 519: MONOGASTRIC ANIMAL PRODUCTION IN PAPUA NEW GUINEA

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Discuss the importance and distribution patterns of monogastric farm animals in PNG;
2. Explain the principles which underlie monogastric animal production.
3 Assess various systems of monogastric animal production;
4 Design husbandry programs and facilities for production of various monogastric farm animals in PNG.

Syllabus

Role and distribution of monogastric animals in the economy of PNG;
Classification and genetic resources of monogastric animals in PNG; Monogastric animal production systems including mixed farming;
Feed resources for monogastric animals including unconventional and locally available ingredients.
Management of pigs, poultry (chickens and ducks), rabbits and horses
Processing of farm animal products
Marketing of products (domestic and international trade);
Animal welfare and legislation in PNG;
Monogastric animal production and the environment

References

- Blood, D. C., Radostits, O. M. and Henderson, J. A. 1983. Veterinary Medicine Bailliere Tindall, London
- Ewer, T. K. 1982. Practical Animal Husbandry. Wright Scientechnica, London.
- Williamson, G., Payne, W. J. A. 1984. An Introduction to Animal Husbandry in the Tropics (3rd Edn.). Longman, London, and New York

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 520: RUMINANT ANIMAL PRODUCTION IN PAPUA NEW GUINEA

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Discuss the importance and distribution patterns of ruminant farm animals in PNG;
2. Explain the principles which underlie ruminant animal production;
3 Assess various systems of ruminant animal production;
4 Design husbandry programs and facilities for production of various ruminant farm animals in PNG.

Syllabus

Role of ruminant animals in the economy of PNG;
Classification and genetic resources of ruminant animals in PNG; Ruminant animal production systems including mixed farming;
Feed resources for ruminant animals including unconventional and locally available ingredients.
Management of beef cattle; dairy cattle; sheep; and goats
Marketing of products (domestic and international trade) and product quality; Animal welfare and legislation in PNG;
Ruminant animal production and the environment.

Reference

- Blood, D.C., Radostits, O.M. and Henderson, J.A. 1983. Veterinary Medicine Bailliere Tindall, London.
- Ewer, T.K. 1982. Practical Animal Husbandry. Wright Scientechnica, London.
- Williamson, G., Payne, W.J.A. 1984. An Introduction to Animal Husbandry in the Tropics (3rd Edn.). Longman, London and New York

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 521: NUTRIENT REQUIREMENT AND QUANTITATIVE NUTRITION

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Assess the quality of feed;
2. Plan and conduct metabolic trials for assessing quality of feeds;
3. Prepare rations for different classes of animals based on its performance;
4. Prepare mineral mixtures for farm animals.

Syllabus

Review of digestion, absorption and metabolism in animals. Microbial digestion and utilization of NPN by ruminants. Physiological importance of vitamins and minerals.
Classification of feeds, their composition and nutritive value. Schemes for describing energy values for feeds, TDN, NVI, GE, DE, ME, conversion of TDN to DE, etc., Direct and indirect calorimetric analyses, carbon and nitrogen balance techniques for measuring energy retention Feeding standards for maintenance and production in different classes of animals, feed formulations, cost effective rations, compounding mineral mixtures, feed additives.

Reference

- Fuller, M. F. (Ed) 2004. The Encyclopedia of Farm Animal Nutrition, CABI
- Lassiter,J. W., Hardy., M. and Edwards jr., 1982. Animal Nutrition. Reston Publishers. Virginia.
- Leeson, S. And Summers., J. D. 2001. Nutrition of chicken (4th Edn.), University books, Guelph, Onatrio
- Mcdonald, P., Edwards, R. A., Greenhalg, J. F. D. and Morgan., C. A. 2004. Animal Nutrition (6th Edn.), Prentice Hall.
- NRC 2001 Nutrient requirements of dairy cattle (7th Edn.), National Research. Council, National Academy Press, Washington.
- Pond, W. G., Church, D. C. Pond, K. R. and Schoknecht,P. A., 2005 Basic Animal. Nutrition and Feeding (5th Edn.), Wiley.
- Underwood, E. J. and Suttle, N. 1999. The mineral nutrition of Livestock (3rd Edn.), CABI.

Assessment

ContinuousAssessment	50%
Final Examination	50%

AG 522: FEED ANALYSIS AND FEED TECHNOLOGY

Hours per week: 4 (2 Lect./2 Lab.)
Credit: 12

Learning Outcomes

Upon completion of this course, students will be able to:

1. Estimate important minerals, different fractions of fiber;
2. Conduct *in vitro* digestion trials;
3. Use different feed process for proper utilization of nutrients;
4. Equipped with basic knowledge of running a feed mill.

Syllabus

Collection and storage of samples, proximate analysis of feed stuffs, determination of calcium, phosphorous in feed, detergent system of feed analysis, evaluation of feeds for proteins for ruminants and non-ruminants. Antinutritional factors. Reasons for feed processing, grinding, mixing, dry rolling, steam rolling, exploding, pelleting, cubing, etc., storage and conservation of feeds. Visit to feed mills.

References

- Fuller, M. F. (Ed) 2004. The Encyclopedia of Farm Animal Nutrition CABI
- Lassiter,J. W., Hardy., M. and Edwards jr., 1982. Animal Nutrition. Reston Publishers. Virginia.
- Leeson, S. And Summers., J. D. 2001. Nutrition of chicken (4th Edn.), University books, Guelph, Onatrio.
- Mcdonald, P., Edwards, R. A., Greenhalg, J. F. D. and Morgan., C. A. 2004. Animal Nutrition (6th Edn.), Prentice Hall.
- NRC 2001 Nutrient requirements of dairy cattle (7th Edn.), National Research Council, National Academy Press, Washington.
- Pond, W. G., Church, D. C. Pond, K. R. and Schoknecht,P. A., 2005 Basic Animal Nutrition and Feeding (5th Edn), Wiley.
- Underwood, E. J. and Suttle, N. 1999. The

mineral nutrition of Livestock (3rd Edn.), CABI.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 523: ADVANCED FARM MANAGEMENT

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Understand farm planning, control methods and their applications to achieve farmer goals;
2. Prepare budgets and evaluate farm performance using performance indicators;
3. Develop farm program, analyze risk and uncertain situations;
4. Valuate farm inventory and calculate depreciation of farm equipment and machineries;
5. Use statistical tools to analyse competitiveness and efficiency of the farm.

Syllabus

Functions of farm management, management objectives, types of decisions and the decision-making process in farming. Economic principles of farm management. Farm planning and control methods: Budgeting techniques (whole farm, partial, gross margin and cash flow), linear programming and sensitivity analysis introduction to other programming techniques. Farm records and accounts: production, financial and inventory records. Valuation of inventory and depreciation c alculations. Impact of uncertainty and dynamic nature of farming. Systems approach to farming and diversification. Measurement of farm competitiveness and efficiency

References

- Barnard C.S and Nix J.S. 1979. Farm Planning and Control, 2nd ed., Cambridge University Press, Cambridge.
- Dillon D. L. and Y-iardaker J. B. 1980. Farm Management Researoh for Small Farmer Development FAO, Rome.
- Sadoulet, E. and de Janvry, A. 1995. Quantitative Development Policy Analysis. The Johns Hopkins University Press, Baltimore.
- Yang, W. Y. 1965. Methods of Farm Management Investigation. FAQ Development Paper No.80, Rome.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 524: AGRICULTURAL PROJECT PLANNING

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Conceptualize the stages of project conception to project completion and the valuation of costs and benefits;
2. Discuss the concept and nature of planning, taking into account the importance of socio-economic aspects of the project;
3. Plan and assess the procedures for financial and economic analysis and causes of project failures;
4. Identify and use the appropriate tools for monitoring and evaluation of projects.

Syllabus

Stages of project planning, project preparation, checklist, logical framework for project designing and project concept paper, appraisal, implementation, monitoring, control and evaluation. Project planning, management and evaluation tools and techniques. Identification and valuation of costs and benefits and adjustments of financial prices to economic prices or values. Discounted and undiscounted measures of project worth. Causes of project failures in LDCs. The concept and nature of planning, socio-economic aspects of planning, macro plan and its sectoral disaggregation.

References

- Gitinger, J. P. 1982. Economic analysis of Agricultural Projects, Rev. Ed, Johns Hopkins University Press.
- Hopkins, J. 1990, Agricultural Projects (Revised Ed.), University Press, Baltimore.
- Rodney T., J. 1999. The Handbook of Project Based Management (second edition), McGraw-Hill, Berkshire
- Selvavinayagam, K. 1991. Financial Analysis in Agricultural Project Preparation, FAO, Rome.

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 525: STRUCTURE AND EFFICIENCY OF AGRICULTURAL MARKETS

Hours per week: 4
Credit: 18

Learning Outcomes
Upon completion of this course, students will be able to:

1. Perceive and interpret the nature and structure of agricultural markets;
2. Understand and apply the approaches of agricultural marketing;
3. Evaluate the effects of different market structures in agriculture;
4. Articulate and appreciate the policies that governments in non-communist countries undertake to improve the efficiency of agricultural markets.

Syllabus
Characteristics of supply, demand, price and elasticity of agricultural products; Marketing costs and margins; Modelling supply and demand relationships; Marketing institutions and policy intervention; Structure, conduct and performance of agricultural markets; Measures of market structure and performance and the barriers to entry.

References

- Acharaya, S. S. and Agarwal, N. I. 1994. Agricultural Prices – Analysis and Policy. Oxford and IBH Publishing, New Delhi.
- Tomek W.G. and Robinson, K. L. 1981. Agricultural Product Prices. Cornell Univ. Press.

Assessment
ContinuousAssessment 50%
Final Examination 50%

AG 526: CONTEMPORARY EXTENSION SYSTEMS IN SOUTH EAST ASIA

Hours per week: 4
Credit: 18
Learning Outcomes
Upon completion of this course, students will be able to:

1. Acquire a broad view of extension systems around the world particularly in South – East Asia in the context of past history, present status and future trend;
2. Discuss the importance of GOs and NGOS in provision of extension services around the world;
3. Develop independent thinking among the learners on how to design their own Extension System in the context of existing situation of any respective country;
4. Develop leadership among the learners regarding administration and management of extension organization and dissemination of technologies using the locally available recourses including women and youth;
5. Appreciate the role of extension in facilitating micro-credit in agribusiness.

Syllabus
Extension concepts, principles and scope, similarity and dissimilarly of Extension Service compared to Rural Development, Community Development, Social Welfare and Formal Education. Role of NGO's, Public Agencies, Agricultural Universities and Colleges, Industries, Research Institutions and Local level Institutions (churches, farmer's association etc) in Agricultural Extension. Communication methods and use of information technology in extension. Paradigm of diffusion in extension. Different approaches f extension around the world. The present status and future trend of extension in South East Asian counties particularly in Japan, Vietnam, Thailand, Philippines, Malaysia, Indonesia, Bangladesh, India and Papua New Guinea. Extension Administration and Management and associated problems in LDC., Role of women and youth in extension. The role of extension and micro – credit in agri – business and marketing.

References

- Halim A. and Kaida Y. 2001 Agricultural Extension in South East Asia – Historical Review, Centre for Farming System and Environmental Studies, Bangladesh Agricultural University, Mymensingh, Bangladesh

- Ray, G. L. 2003 Extension Communication and Management. Kalyani Publishers, New Delhi, India.
- Rogers E.M. 1983 Diffusion of Innovations, Free Press, New York, USA.
- Swanson, B.E. 1984 Agricultural Extension Manual, F.A.O, Rome.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 527: SOCIO–CULTURAL CHANGE

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Understand the contemporary theories of socio – culture change and relate them with development concept;
2. Learn how village societies are formed, grow and expand with reference to Papua New Guinea;
3. Identify the factors influencing social change, pattern of change and its stabilization;
4. Analyze problems and develop strategies to address them in rural societies.

Syllabus

The concept of sociology, psychology, society, culture, change and development.

Theories of change: Theories of Sorokin, Karl Marx, Max Weber and the recent theories of socio – cultural change.

Factors of social change, process of stabilization and change, pattern of change and development. The structure of rural society, characteristics of rural people, rural society, organization, ecological entities, groups and collectivities, social stratification, social interaction and processes, social problems and adjustment to solve the problems.

References

- Chitambar, J. B. 1973. Introductory Rural Sociology. Mahinder Singh Sejwal for Wiley Eastern, Ltd. Daryaganj, New Delhi 110002, India
- Hoton, J. R. and Bryan S. T. 1989. Max Weber on Economy and Society, Routledge, London and New York.
- Schuessler, F. K. 1982. Measuring Social Life Feelings; Jossey – Bass Publishers, London
- Singh, J. 1996. Society culture and Socio-cultural change. National Book Organization, India
- Talcott, P. (Ed) 1961, Theories of Society – Fundamentals of Modern Sociological Theory, The Free Press, New York.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 528: RURAL COMMUNITY DEVELOPMENT

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Explain the concepts of development and appreciate the components and structure of rural communities;
2. Discuss the processes involved in the development of rural communities;
3. Identify the drivers to development and the inputs required from various stakeholders to drive change in rural communities;
4. Provide practical skills and ability to use community development techniques for the improvement of community life.

Syllabus

Concept of community. Rural community development processes, understanding change in rural and regional communities, approaches to community development, methods of community development. Entrepreneurship and leadership, community leadership and entrepreneurship, role of community developer. Tools and techniques for rural development. Concepts of key community development approaches and insights from PNG and overseas. Current changes in rural PNG, and the fundamental components of community development.

References

- Blakeley, E. 1994 Planning Local Economic Development Theory and Practices (2nd Edn.), Sage Publications, London.
- Flora, C.B., Flora, J.L. Spears, J.D. and L.E.Swanson. 1992. Rural Communities: Legacy and Change. Boulder, Colorado: Westview Press.
- Hanson, L.W., Allen, B.J, Bourke R.M., and McCarthy. T.J. 2001 Papua New Guinea Rural
- Development Handbook, The Australian National University Press, Canberra.
- Vendeberg, L. and Sandmann, L 1994 Community Action Leadership Development. Michigan, State University Extension.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 529: CULTIVATION AND MECHANIZATION

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Discuss the principles of operation and selection criteria of cultivation equipment in order to optimize the performance of the equipment;
2. Test field machineries and equipment to propose best use of the same;
3. Use statistical model to optimize use of farm machineries;
4. Calculate depreciation costs and valuate farm machineries;
5. Manage the operations of agricultural machines to get the best out of a mechanized agricultural production system.

Syllabus

Performance of tillage tools, soil compaction, tillage requirements and implement selection, matching field equipment to available field power sources, linear programming model and optimization. Logistical and scheduling requirements of major field operations in agriculture. Field performance testing of equipment. Concept of fuel and fertilizer from agro-industrial by products. Rate of technical substitution and technological changes. Cost Analysis, calculation of depreciation costs and valuation of farm implements alternatives to equipment ownership.

References

- CIGR Handbook of Agricultural Engineering. 1999. Vol. III Plant Production Engineering. Published by ASAE. St. Joseph, Michigan, USA
- FAO, Agricultural Services Bulletin # 84. 1990. Agricultural Engineering in Development: Selection of mechanization inputs Rome, Italy.
- Gill, William, R. and Glen E. Vanden Berg. 1968.Soil Dynamics in Tillage and Traction. Agriculture Handbook No. 316, ARS. USDA Washington D.C.USA.
- Hillier, F.S. and G.J. Liberman. 1974. Operations Research, Holden Day Inc. San Francisco, USA.
- Hunt, D. 1989. Farm Power and Machinery Management. Iowa State University Press, USA. RNAM Test Codes & Procedures for Farm Machinery – Technical Series No. 12, 1983. Economics and Social Commission for Asia and the Pacific of the United Nation, Bangkok, Thailand.
- Whitney, W. 1989. Choosing and Using Farm Machines. Longman Press, UK.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 530: AGRICULTURAL PROCESSING AND STORAGE TECHNOLOGY

Hours per week: 4
Credit: 18

Learning Outcomes

Upon completion of this course, students will be able to:

1. Describe and apply the different aspects of processing method applied to common crops grown in the South Pacific region;
2. Maintain the quality of the crops and crop-products during the storage, transport and distribution system;
3. Identify and be able to use the right type of fumigants to store grain crops;
4. Follow proper techniques to extract juice and oils form certain crops.

Syllabus
Biological and rheological characteristics of common crops, cleaning, drying and milling,
Handling and conditioning equipment, environmental requirements for the storage of grain and non-grain crops, fumigation of stored grain products and fumigants. Mechanical damage to perishable crops, methods to preserve shelf life of perishable, grading, separation and packaging. Techniques for the extraction of juices and oils.

References

- Brooker, D. B., Bakker-Arkemma, F.W. and Hall, C. W. (1974). Drying Cereal Grain. AVI publication, West Port, Connecticut, USA.
- CIGR Handbook of Agricultural Engineering. (1999). Vol. IV. Agro-Processing Engineering. Published by ASAE. St. Joseph, Michigan, USA.
- Mohsenin, N.N. (1986). Physical Properties of Plants and Animal Materials, Gordon and Breach. New York, USA.
- Singh, R. P. and Heldman, D. R. (2001). Introduction to Food Engineering (3rd Edn.). Academic. Press 84 Theobald Rd, London, WC 1x 8RR, UK.

Assessment

Continuous Assessment	50 %
Final Examination	50%

AG 531: SOIL AND WATER CONSERVATION ENGINEERING

Hours per week: 4
Credit: 18

Learning Outcomes
Upon completion of this course, students will be able to:
1. Identify the different types of soil erosion;
2. Assess the soil erosion hazards in relation to the environment;
3. Use modeling software to model soil erosion;
4. Adopt suitable methods in order to reduce soil erosion and to conserve water;
5. Design and conserve water through different water harvesting systems.

Syllabus
Introduction to Climate in Papua New Guinea. Identification and classification of soil erosion due to water, surface run-off and prediction of run-off, modeling soil erosion, hydraulics of channel and design of water ways, water harvesting system, conservation structures, dam and its construction, land forming and surface drainage, installation and maintenance of subsurface drainage. Wind erosion and its control.

References

- CIGR Handbook of Agricultural Engineering. (1999). Vol I. Land and Water Engineering. Published by ASAE. St. Joseph, Michigan USA.
- Hudson, N. W. (1992). Soil Conservation Engineering. Cornell University Press. USA Morgan, R.P.C (1986). Soil Erosion and Conservation. Longman, UK.
- Schwab, G. O., Barnes K. K., Frevert, R. K. and Talcott, W. E. (1971). Elementary Soil and Water Engineering. John Wiley and Sons, Inc. New York, USA.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG 535: DIGESTION AND METABOLISM IN FARM ANIMALS

Hours Per week: 4 (4 Lect.)
Credits: 18

Learning Outcomes
Upon completion of the course, the student will be able to:
1. Explain the interconversion of nutrients i.e., non-carbohydrates to carbohydrates,
2. Recognize the energy utilization for maintenance and various production,
3. Calculate energy partition and growth/lactation,
4. Identify and correct the mineral and vitamin deficiency in animals,
5. Identify feeds with antinutritional factors and their effects on metabolism.
6. Formulate feed based on production.

Syllabus
Chemistry, digestion, absorption and metabolism of Nutrients in Farm Animals. Importance of rumen in metabolism. Utilization of NPN.

Energy partition and utilization. Metabolism and deficiency symptoms of minerals and vitamins. Feed supplements and additives. Antinutritional factors. Metabolic diseases.

References

- Bedford, M.R and Partridge, G.G. (2010). Enzymes in Farm animal nutrition. CAB international, UK.
- Chiba L.I. (2014). Animal Nutrition Handbook.
- FAO (2011). Rearing of young ruminants on milk replacers and starter feeds, FAO, Rome
- Greenfield, H and Southgate, D.A.T. (2003). Food composition data. FAO, Rome.
- McDonald, P., Edwards, R.A., Greenhalg, F.D., Morgan, C.A., Sinclair, L.A. and Wilkinson, R.G. (2013). Animal Nutrition: Seventh Edition Pearson, London.
- Reddy, D.V. (2011). Advanced Animal Nutrition. Oxford and IBH, New Delhi.

Assessment

Continuous Assessment	50%
Final Examination	50%

AG536: ADVANCED ANIMAL BREEDING

Hours per week: 4 (2 Lect./2 Lab.)
Credit: 12

Learning Outcomes:

Upon completion of this subject, students will be able to:

1. Outline the main components of a breeding program.
2. Apply statistical techniques to estimate genetic parameters useful to animal breeding.
3. Discuss the use of biotechnology to increase genetic gain and maintain genetic diversity in breeding programs.
4. Evaluate breeding programs in terms of response to selection and genetic diversity.
5. Formulate breeding programs for selected farm animals based on knowledge of quantitative and population genetics.

Syllabus

Components of an animal breeding program; Breeding objectives; Major traits for genetic improvement of farm animals; Quantitative and qualitative traits, DNA and eukaryotic gene structure; Infinitesimal model, Types of gene action; Normal distribution; Introductory matrix algebra; Sample statistics and population parameters, Linear models in animal breeding, Animal models; Variation and its causes, Partitioning of phenotypic variance, Heritability and repeatability, Genotype by environment interaction, Estimation of breeding values using different sources of information, Selection index theory, Genetic evaluation; Gene and genotype frequencies, Hardy Weinberg equilibrium and the factors influencing it, Types of selection and their consequences, Response to selection, Genetic correlation and correlated response, Genetic relationships and inbreeding, Multiple trait selection, Mating systems for the genetic improvement of farm animals; Applications of biotechnology in animal breeding; Conservation of farm animal genetic resources; Breeding programs for cattle, pigs, sheep and goats.

References

1. Lecture notes
2. Understanding Animal Breeding. Richard M. Bourdon. Prentice Hall. 1997
3. Introduction to Quantitative Genetics. Falconer, D. S. and T. F. C. MacKay. 4th Edition. Longman. 1996
4. Linear models for the prediction of animal breeding values. Mrode, R. A. 1st edition. CAB International, New York, USA.
5. Selection indices and prediction of genetic merit in animal breeding. Cameron, N. D, 1st edition. CAB International, New York, USA.
6. Principles of population genetics. Hartl, D and Clark, G C. 3rd Edition, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts, USA.
7. Molecular biology of the cell, 4th edition. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. New York: Garland Science; 2002. ISBN-10: 0-8153-3218-1ISBN-10: 0-8153-4072-9.

Assessment

Continuous Assessment	50%
Final Examination	50%

DEPARTMENT OF APPLIED PHYSICS

- MASTER OF SCIENCE (MSc) IN APPLIED PHYSICS
- MASTER OF TECHNOLOGY IN EXPLORATION GEOPHYSICS (MTech)

DEPARTMENT OF APPLIED PHYSICS

Head of Department
Anduwan, G.A. EdD and M.Sc (Ball State-USA), B.Eng(PNGUoT), Dip CERT(PNGUoT)

Deputy Head of Department
Kolkoma, D. Msc(Aust), B.Eng and Dip (PNGUoT)

Professor
Mukhopadhyay, Manoj, Ph.D. (Indian School of Mines, Dhanbad, India); M.Sc. (Applied Geophysics) (ISM); B.Sc. (Hons.) (Applied Geophysics) (ISM)

Jojo Panakal John M Phil & Ph D (Aligarh Muslim University, Aligarh, India) M Sc & B Sc (Mahatma Gandhi University, Kottayam, India)

Associate Professor
Pereira, Felix Ph.D, M.Phil, M.Sc B.Sc (Kerala, India)

Dapsy Olatona, PhD (UNSW, Aus), MSc (OAU), BSc (UNICAL).

Senior Lecturer
Anduwan, G.A. EdD and M.Sc (Ball State-USA), B.Eng(PNGUoT), Dip CERT(PNGUoT)

Senthilkumar, V.PhD (Gandhigram Rural Uni, India), MSc and BSc (Bharathiar Uni, India)

Thakur Ravindra, PhD (IFM, UMSNH), MA (Suny @ SB, USA), MSc and BSc (Uni Delhi), PGDBM/MBA (BIM Tech)

Ali, Muhammad, PhD (Indian Institute of Technology, Indian School of Mines), MSc (Tech) (Applied Geophysics (ISM), Dhanbad, India)

Lecturer
Ampana S. MSc (Nagoya Univ. Japan), BSc (PNGUoT) Study Leave

Kolkoma, D. Msc(Aust), B.Eng and Dip (PNGUoT)

Gaoma, M. MEd(Charles-Stuart-Aus), BSc(UPNG)

Principal Technical Officer
Kenny, M. BSc (PNGUoT)

Senior Technical Officer
Deckson, B. Cert. Lab. Tech. (Lae Tech.), Dip. Tech. Services (ICS)

Waimbo, N. Mathew BSc(PNGUoT)

Technical Officer
William Piel BSc (PNGUoT)

Bomi, K. Cert. Lab. Tech. (Lae Tech.)

Executive Secretary
Doe, F. SecCert. (Goroka Tech.)

Secretary II
Nasusu, C SecCert (Goroka Busines Col)

Janitor
Piwi, N (Grade 10 certificate)

MASTER OF SCIENCE (M.Sc.) IN APPLIED PHYSICS WITH ELECTRONICS AND INSTRUMENTATION

Introduction

In addition to the existing Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) in Applied Physics, the Department is proposing to introduce a program of post-graduate studies at Master's Level leading to M.Sc. degree in Applied Physics beginning in 2012 academic year. The program has been designed to provide the students with scope of advanced training in fundamental areas of Applied Physics through formal course-work and participation in original research work in one of a variety of projects directed by the faculty members.

Objective of the Program

The objective of the proposed M. Sc. Program is to create broad area-based graduate education opportunities for students interested in studies and basic research in applied physics with technological applications. It is, indeed, directed to prepare the students for continued professional and scholarly development as applied physicists with the expectation that the experience obtained by undertaking this course of studies and research work, at the intellectually stimulating interface of Applied Physics and its engineering applications, would be supportive for them to succeed in professional careers in this age of rapidly emerging new technologies.

Further to be stated that this program has been carefully designed keeping it at the back of the mind that it would become possible in course of time to embark on, from this modest beginning, a broader interdisciplinary Ph.D. program across the traditional lines of Natural Sciences and Engineering Disciplines which is currently going to be more and more demanding in the establishments of high-tech industries world-wide.

Program Outcomes

PO1: Ability to identify, analyze, formulate, simulate, design and/or build and test systems representing physical problems.

PO2: Ability to describe, explain, and communicate effectively to others, as well as ability to prepare formal technical plans and reports detailing solutions of problems in physical systems

PO3: Ability to understand and recognize the need for, to engage in life-long learning to continuously upgrade their knowledge to a higher learning via research activities, personal readings and by attending short seminars and workshops from time to time.

PO4: Ability to work on multidisciplinary teams and understand the scope of work and issues that allow the team to achieve their goal.

PO5: Ability to apply the knowledge of mathematics and Physics and science in general, in all aspects related to physical systems

PO6: Ability to design and conduct experiments, as well as to analyze and interpret obtained data

PO7: Ability to conduct and manage projects in multidisciplinary environments and apply appropriate techniques and skills, as well as project management concepts and tools necessary to complete those projects with success.

PO8: Demonstrate broad knowledge and understanding of contemporary issues due to the changing of global economy, environmental impact of those changes, and the social context involved.

PO9: Develop an understanding of professional, safety and ethical responsibility at all times

PO10: Ability to conduct experiments or lead researches especially in academia and analyze data to come up with useful conclusions and recommendations in relation to improve the academic environment in teaching and learning.

Entry Requirements

Those who have earned Bachelor's degree in Physics/Applied Physics or in a related discipline from a recognized universities/tertiary level institution, are eligible to submit application for admission and all applicant will be required to go through a "Selection Process" to be eligible for admission into programs. Details of the "Selection Criteria" will be available in the "Handbook of Graduate Programs".

Administration of the Program

The intake into this program would be kept limited to such a level so as to foster students' development through intense and close interaction with the faculty under the

expectation that such level of interaction with the faculty would provide the students opportunity for effective and in-depth learning of both theories and technical aspects of research works in respect of the proposed curriculum.

Under the perspectives as stated above, the program would be administered with an arrangements in the department being put in place so that this program can more effectively utilizes the faculty, library and laboratory resources in producing competent graduates with specialization in one or more core areas of applied physics who would be able to eventually undertake post-graduate studies at doctoral level as well as to undertake staff/research/consultative position in private or public sector organizations in the country overseas.

Program Duration and Credit Point Requirements

The proposed M.Sc. program in Applied Physics will normally be of two-year duration involving recommended taught courses and research work on a selected project and it is set that 32 credits points will be required for the award of Master of Science (M.Sc.) degree in Applied Physics.

Areas of Current Research in the Department

The current research activities in the department are confined to the studies of the: Dynamics of Environmental and Atmospheric Phenomena, Earthquake Source Mechanisms; Tsunami Generation and Tsunami Warning Systems; Volcano Formations and Eruption Styles Geophysical Techniques of Resource Exploration; Atomic and Molecular Spectroscopy; Solid State Physics; Semiconductor Devices; Modern Optics and Laser Physics; Radiation Physics; Nanostructures and Properties of Nanomaterials; Nanotechnology; Mathematical Modeling of Dynamical Systems; Electronics and Instrumentations; Microprocessor and Microcontroller; etc.

COURSE STRUCTURE

Semester: I, First Year

Subject Code	Subject Title	Hours/Week
APM501	Mathematics for Physicists and Engineers	4
APM503	Classical Mechanics	4
Two elective subjects		(4 x 2) = 8
APM549	Research Project	4
		Total = 20

Semester: II, First Year

APM509	Classical Electrodynamics	4
Two elective subjects		(4 x 2) = 8
APM 545	Lab	3
APM549	Research Project	6
		Total = 21

Semester: I, Second Year

Two elective subjects		(4 x 2) = 8
APM547	Lab	3
APM549	Research Project	8
		Total =19

Semester: II, Second Year

One elective subjects		4
APM549	Research Project	16
		Total = 20

MASTER OF SCIENCE (M.SC.) IN APPLIED PHYSICS

Subject Code	List of Subjects
APM501	Mathematics for Physicists and Engineers
APM503	Classical Mechanics
APM505	Quantum Mechanics
APM507	Statistical Mechanics
APM509	Classical Electrodynamics
APM511	Modern Physics
APM513	Condensed Matter Physics
APM515	Materials Science
APM517	Atomic & Molecular Spectroscopy
APM519	Fundamentals of Optics & Laser Physics
APM521	Nano Science and Nanotechnology
APM523	Environmental Physics
APM525	Physical Oceanography
APM527	Physics of Earthquakes & Tsunamis
APM529	Physics of Volcano Formation & Eruption Styles
APM531	Physics of Earth's Atmospheric

APM533 Geophysical Techniques for Resource Exploration
APM535 Non-Destructive Testing Techniques
APM537 Fibre Optics and Optical Communications
APM539 Physics of Semiconductor Devices
APM541 Digital Electronics & Microprocessor
APM543 Microcontrollers & Digital Signal Processing
APM545 Experimental Methods in Physics - I
APM547 Experimental Methods in Physics – II
APM549 Research Project
APM551 Robot Manipulators: Modeling& Control

STRUCTURE OF COURSES

MASTER OF SCIENCE IN APPLIED PHYSICS WITH ELECTRONICS AND INSTRUMENTATION

APM501: MATHEMATICS FOR PHYSICISTS AND ENGINEERS

Hours per week: 4 (4 lectures)

Credits: 18
Pre-requisite: MA334

Learning Outcomes
On completion of the subject the student should be able to:

LO1: Analyze complex mathematical functions being used in Physics and Engineering

LO2: Apply and interpret differential equations related to the physical problems and use hyper-geometric and special functions for the same.

LO3: Use Laplace transforms and their properties to boundary value problems.

LO4: Evaluate Fourier Transform integral formula for the transformation of trigonometric functions to change the domain of the relation for their applications in harmonic functions and problems.

Syllabus
Complex analysis, zeros and isolated singularities of analytic functions; Calculus of residues; Multivalued functions; Analytic continuation. meromorphic functions; The method of steepest descent.
Second order differential equations, Self adjoint operators, Green's functions; The Sturm-Liouville problem; Hypergeometric functions; Laguerre function, Bessel function, Beta function and gamma function.
Laplace Transform: Definition of Laplace Transform, Linearity property, condition for existence of Laplace Transform; First & Second Shifting properties, Laplace Transform of derivatives and integrals; Unit step functions, Dirac delta-function. Differentiation and Integration of transforms, Convolution Theorem, Inversion, Periodic functions. Evaluation of integrals by L.T., Solution of boundary value problems.
Fourier Transform: Fourier Integral formula, Fourier Transform, Fourier sine and cosine transforms. Linearity, Scaling, frequency shifting and time shifting properties. Self reciprocity of Fourier Transform. Convolution theorem. Application to boundary value problems. Z-Transform and Wavelet Transform.

Textbook
Kreyszig, E., (2001), *Advanced Engineering Mathematics*, John-Wiley & Sons, New Delhi.

Reference
Dass, H. K., (1998), *Advanced Engineering Mathematics*, S. Chand & Co., New Delhi

Pipes, L. A. & Harvil, L. R., (latest Ed.), *Applied Mathematics for Engineers and Physicists*, McGraw-Hill, Singapore.

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM503: CLASSICAL MECHANICS

Hours per week: 4(4 lectures)

Credits: 18
Pre-requisite: AP274

Learning Outcomes
On completion of this subject the student should be able to:

LO1: Discuss physical concepts and describe the mathematical methods of classical mechanics.

LO2: Explain clearly the notion of degrees of freedom, and identify them for a given mechanical system

LO3: Identify the existing symmetries and the corresponding integrals of motion; analyze the qualitative nature of dynamics (decoupling of certain degrees of freedom, periodicity, stability, integrability) on the basis of general principles without explicitly solving equations of motion

LO4: Explain and discuss the concept of phase space; recognizing how the nature of the dynamics is reflected in the properties of the phase space trajectories; understanding and using phase portraits to analyze the dynamics of a system

LO5: Compose the Lagrangian and the Hamiltonian, to set up and solve the equations of motion for any reasonable mechanical system, including two-body systems, rigid bodies, coupled linear and non-linear oscillators, and systems with time-dependent constraints.

LO6: Use approximate and numerical methods for solving equations of motion

Syllabus

Mechanics of a systems of particles; generalized coordinates, D'Alembert's principle and Lagrange's equation. Variational principles and Lagrange's equations, conservation theorems and symmetry properties. Central force motion, Kepler's laws, orbital dynamics, stability of circular orbits, precession of equinoxes and of satellite orbits. Rigid body motion, Euler angles, inertia tensor and moment of inertia, Euler's equations of motion, free motion of rigid bodies, motion of symmetric op. Hamiltonian's canonical equations of motion; Principle of least action; Small oscillations, normal coordinates and normal mode frequencies; Canonical transformations. Hamiltonian-Jacobi theory of linear oscillatory systems, Hamiltonian's principle and characteristic functions, separation of variables, action-angle variables.

Textbook

Goldstein, H., P. Poole, C. P. and John L. Safko, J. L., (2001), *Classical Mechanics*, Addidon-Wesley

Reference

Slater, J. C. & Frank, N. H., *Mechanics,* McGraw Hill, New York

Assessment

ontinuous Assessment - 50%
Written Examination -50% (1x3 hrs)

APM505: QUANTUM MECHANICS

Hours per week: 4 (4 lectures)

Credits: 18
Pre-requisite: AP 373, AP 352

Learning Outcomes

On completion of this subject the student should be able to:-

LO1: Formulate and solve problems in quantum mechanics using Dirac representation.

LO2: Discuss and illustrate the concepts of spin and angular momentum, as well as their quantization and addition rules.

LO3: Familiarize with various approximation methods applied to atomic, nuclear and solid-state physics.

Syllabus

Schrödinger equation for a free particle, Operator formalism, Expectation value, Eigen values and Eigen functions, Orthonormality, The uncertainty relation.
One dimensional problem: Particle in a central potential and particle in a periodic potential – Hydrogen atom, Reduction of two body Hamiltonian, Eigen functions and spectra, Normal Zeeman effect of Hydrogenic atoms.
Perturbation theory in non-degenerate cases, Application to ground state of a harmonic oscillator, Variation method, Application to ground state of Helium atom, WKB approximation.
Angular Momentum. Operators, Matrix representation of Angular Momentum, Wave functions Combination of two Angular Momenta, Clebsch – Gordon co-efficient.
Schrodinger wave equation, stationary states, Heisenberg picture: correspondence with classical mechanics, Representation theory, Basis in function space, momentum and configuration representations, Dirac's Ket and Bra Vector Notation, Matrix representation, Harmonic Oscillator.
Perturbation theory, First and Second order transitions under constant perturbation – conservation of energy – application to potential scattering and inelastic collisions

– Harmonic perturbations – Adiabatic and sudden approximations.

Textbooks
Kroemer, H., *Quantum Mechanics*, Prentice Hall
Mathews, P. M. &Venkatesan, *A Textbook of quantum Mechanics*, McGraw Hill (TX)

Reference
Shankar, R., *Principles of Quantum Mechanics*, (latest ed.).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM507: STATISTICAL MECHANICS

Hours per week: 4 (4 lectures)

Credits: 18
Pre-requisite: AP 271, AP 352

Learning Outcomes
On completion of this subject the student should be able to:
LO1: Discover and Outline the modern aspects of equilibrium and non-equilibrium statistical physics

LO2: Describe the features and examples of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics

LO3: Examine and manipulate equations of state and thermodynamic potentials for elementary systems of particles; and use and develop mean field theory for first and second order phase transitions.

Syllabus
Basic concepts, ensemble-microcanonical ensemble & thermodynamic connection, two state system and Einstein model of vibrating lattice, canonical ensemble, density matrix, partition function, thermodynamic function and equilibrium.
Ideal gas-translational, vibrational and rotational motion, Para-, ortho-hydrogen, equipartition of energy, negative temperature, Grand canonical ensemble.
Ideal, Fermi and Bose gas (both weakly and strongly degenerate), statistics of photon and phonon gas, Imperfect gases, Virial expansion and Van der Waal's equation of states.
Approximate method for free energy, Phase transition in model systems, transport equation, Langevin, Fokker-Planck equation, Linear response and correlation functions.

Textbook
Bowley, R. & Sanchez, M., (2000), *Introductory Statistical Mechanics,* Oxford Univ. Press

Reference
Finkel, R., (2011), *Concise Introduction to Statistical Mechanics and Thermodynamics*, Chaion Analytic.

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM509: CLASSICAL ELECTRODYNAMICS

Hours per week: 4(4 lectures)

Credits: 18
Pre-requisite: AP 274, AP 311

Learning Outcomes
On completion of this subject the student should be able to:
LO1: Evaluate fields and forces in Electrodynamics and Magneto dynamics using basic scientific method.

LO2. Prepare concepts of relativistic electrodynamics and its applications in branches of Physical Sciences.

LO3: Explain and solve advanced problems based on classical electrodynamics using Maxwell's equation.

LO4: Analyse radiation systems in which the electric dipole, magnetic dipole or electric quadruple dominate.

LO5: Understand the covariant formulation of electrodynamics and the concept of retarded time for charges undergoing acceleration.

Syllabus
Maxwell's equations, Poynting vector, wave equation; Propagation of electromagnetic waves in dielectric and conducting media, skin effect; Optical dispersion in materials, resonance absorption, anomalous dispersion; Reflection and refraction of electromagnetic waves at the

interface between dielectric media, Brewster's law, reflection from conducting surfaces
Transmission lines; Wave guides, elementary theory of rectangular and cylindrical wave guides, Rectangular and cylindrical resonant cavities; Potential formulation, scalar and vector potentials, gauge transformations; Field of a uniformly moving charge, Lienard-Wiechert potentials, retarded potentials; Radiation from oscillating electric and magnetic dipoles and antennas.

Maxwell field as a classical 4-vector field; Covariant formulation of the Hamiltonian principle; Action integral; Euler-Lagrange equations; Electromagnetic field tensor; Homogeneous Maxwell equations; Lorentz invariants of the Maxwell field; Wigner rotation and Thomas precession.
Radiation from accelerated charges, Polar plots and polarization charts; Radiation from relativistic charges; Linear accelerator and synchrotron radiation; Maser formulae for the radiation from bounded charge-current distributions; Time-harmonic and pulsed sources; Multipole expansion of the electromagnetic fields; Cherenkov radiation & Transition radiation.

Textbooks
Jackson, J. D., *Classical Electrodynamics*, Latest ed.
Griffith, D, J, Introduction to Electrodynamics, Latest ed., Prentice Hall

Panofsky, W K. H. & Phillip, M., Classical Electricity and magnetism, 2nd Ed., Dover Books

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM511: MODERN PHYSICS

Hours per week: 4(4 lectures)

Credits: 18
Pre-requisite: AP 262, AP 373

Learning Outcomes
On completion of this subject the student should be able to:

LO1: Assess the evolution of modern physics through classical physics.

LO2: Understand different classical theories that led to a well-developed quantum physics

LO3: Discuss and Explain wave theories that help understand modern physics.

Syllabus
Atomic theory and evolution of the atomic models, Black body radiation, Franck-Hertz experiment, The Galilean transformation. The Michelson-Morley experiment. Einstein's postulates. The Lorentz transformation. Relativistic mechanics, Relativistic momentum and energy. Radiation and the origin of quantum theory. Classical and quantum theories of the photoelectric effect. The Compton effect. Models and theories of atomic structure. Schroedinger's theory of quantum mechanics. Spin-orbit coupling, Perihelion precession of Mercury, The Stern-Gerlach experiment and electron spin, Rotational energy levels, Atomic nucleus, Nuclear force and binding energy. Nuclear transformations, Radioactivity and radioactive series, Alpha, beta & gamma decays. Elementary particles.

Textbooks
Beiser, A., (2003), *Concepts of Modern Physics*, McGraw Hill
Tipler, P. & Llewellyn, R., (2002), *Modern Physics,* W. H. freeman

Reference
Eisberg, R.M., *Fundamentals of Modern Physic*s, Wiley, 1961.

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM513: CONDENSED MATTER PHYSICS

Hours per week:4(4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:
LO1: Assemble an extended knowledge of principles and techniques of solid-state physics

LO2: Develop an understanding of structure, thermal and electrical properties of matter

LO3: Formulate basic models for electrons and lattice vibrations for describing the physics of crystalline materials; and develop an understanding of the relation between band structure and the electrical/optical properties of a material.

Syllabus

Structure of solids, lattice translation, symmetry, unit cell, simple crystal structures, diffraction - Bragg's law, structure factor, different methods for structure determination, point defects, dislocation.
Crystal binding - ionic, covalent, weak bonding. Cohesive energy and compressibility. Vibration of lattice, mono-, and di-atomic chains, periodic lattice, phonons, phonon spectrum, heat capacity. Thermal expansion and resistivity.
Semiconductor: intrinsic and extrinsic semiconductors, hole, effective mass, impurity band conduction, p-n junction, Shottky barrier, quantum Hall effect.
Free electron theory. Periodic potentials in one dimension, electrons in weak periodic potential, tight binding approximation, bands, Brillouin zone, motion in magnetic field.
Optical properties, dielectric, ferroelectric, displasive and soft mode, magnetism, dia-, para-magnetism, Curie-Weiss law, Van-Vleck and Pauli para-magnetism, ferro-, anti- and ferrimagnetism.
Exchange interaction, spin wave, resonance absorption, dilute magnetic alloys, superconductivity: phenomenology, GL theory and some ideas of microscopic origin.

Textbooks

Marder, P. M., *Condensed Matter Physics*, 2nd ed., Willey.
Chaikin, P. M. & Lubensky, *Principles of Condensed Matter Physics*, Cambridge.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM515: MATERIALS SCIENCE

Hours per week: 4(4 lectures)
Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:-

LO1: Discuss the properties of a material that are relevant to its use in engineering products.

LO2: Define the characteristic properties and calculate their values from appropriate data.

LO3: Discuss and illustrate how crystal structures are characterised and how they are determined experimentally.

LO4: Explain in terms of electron and ion interactions the various types of bonding and the crystal structures that typically result therefrom.

LO5: Explain how characteristic properties of metal semiconductors, polymers and ceramics depend on chemical composition and structure.

Syllabus

Crystal lattice and unit cell, seven crystal system, Symmetry elements of a crystalline solid- structure of SCC, BCC, FCC and HCP, Characteristics of cubic system, condition number, atomic radius, number of atoms per unit cell, density of packing, relation between Lattice constant and density of the crystal, Miller indices, miller indices of cubic crystal planes, relation between interplanar spacing and cube edge.
Origin of X-rays, X-Ray spectrum, Mosley's law, diffraction of X-rays by crystal method and powder photograph method, Compton scattering of X-rays. Points defects, lines, surface and volume- Freckle defect, dislocation and Burgers vector.
Types of magnetic materials, classical theory of diamagnetism, Langevin theory of para-magnetism, Weis theory of parra-magnetism, quantum theory of magnetism.
Dielectrics, Different types of electric polarization, Frequency and temperature effects on polarization, dielectric loss. Clausius-Mosottis relation, determination of dielectric constant, dielectric breakdown, properties of different types of insulating materials, Schotcky effect.
Polymers & ceramics, super strong materials, high temperature materials, thermoelectric materials, electrets, nuclear engineering material, plastics, metallic glasses, optical materials, materials for optical source and

detector, Fiber optics material and their application, Acoustic material and their application, Biomaterials, conductor.

Textbook
Kittle, C., (1983), *Solid State Physics,* Wiley & Sons, New York.

Reference
Callister, W. D., *Materials Science and Engineering: An Introduction*, Bentham Press.

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM517: ATOMIC & MOLECULAR SPECTROSCOPY

*Hours per week: 4 (*4 lectures)

Credits: 18

Learning Outcomes
On completion of this subject the student should be able to:

LO1: Explain in detail the structure of atoms and molecules.

LO2: Discuss and explain the spectral behavior of atoms and molecules at different states of energy levels.

LO3: Explain what it means to use spectroscopic methods for qualitative and quantitative analysis.

LO4: Identify the terms in and describe deviations to Beer's Law.

LO5: Describe the effect of changing the slit width and the impact it will have on qualitative and quantitative analyses.

LO6: Determine the relative error in absorbance measurements and estimate the optimal range for measurement purposes.

LO7: Formulate the desirable features of a radiation source.

LO8: Explain the advantages of a dual versus single-beam spectrophotometer.

LO9: Explain the difference between a -2 and 4 level laser and why it is not possible to have a 2-level laser.

LO10: Illustrate how a photomultiplier tube works and explain how an array detector works and describe the advantages of using an array detector.

Syllabus
Electronic spectra of molecules: Born openheim approximation, Intensity of vibrational electronic spectra, Frank – Condor Principle, Chemical analysis by electronic spectroscopy.
Spectra of alkali atoms, vector atom model, LS and jj couplings, normal and anomalous Zeeman effect, Stark effect.
Fine structure of spectral lines, nuclear spin and hyperfine structure, spectra of diatomic molecules, polyatomic molecules.
Raman Effect and Raman Spectroscopy, magnetic resonance, Characteristics of Raman lines, Calculation of normal modes for Raman and IR activity Czr and C3r point groups by group theoretical considerations - Calculation of F and G matrices – Normal co-ordinate analysis for H_2O and NH3 and molecules.
ESR and MNR spectra, Lasers, interaction of laser with Symmetric of poly molecules – Theory of NMR spectroscopy – Block equation – Relaxation process – Structural analysis – Single Coil & double coil spectrometers – NMR in liquids – ESR spectroscopy – Hyperfine structure – applications.
NQR spectroscopy –Hamiltonian Theory – Energy Levels for molecules of axial symmetry – experimental detection – super registrative oscillator – Continuous wave oscillator – Mossbauer spectroscopy.

Textbooks
Svanberg, S., *Atomic and Molecular Spectroscopy: Basic Aspects and Practical Applications*, 4th ed., Springer.
Michael Hollas, J., *Modern Spectroscopy*, 4th ed., Willey

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM519: FUNDAMENTALS OF MODERN OPTICS & LASER PHYSICS

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:

LO1: Discuss the fundamentals of modern optics;

LO2: Explain the theories of coherence, diffraction and interference;

LO3: Illustrate reflection, refraction and polarization of light using Fresnel's equations;

LO4: Discuss the processes of amplification of light;

LO5: Discuss the operation and performance of typical laser systems;

LO6: Describe the operation, performance and application of some optical devices.

Syllabus

Theories of optical refraction and diffraction; Diffraction of a Gaussian beam; Fresnel and Fraunhofer diffraction; Application to different apertures. Fourier optics; Fourier transforming property of a thin lens; Spatial frequency filtering and its applications.
Coherence theory; Partial coherence. Holography; Construction and reconstruction of hologram. Lasers; Two-level and three-level lasers.
Electromagnetic theory of optical fibres and wave guides; Scalar wave equation; Modes of a fibre and planar wave guides. Periodic media; Bragg diffraction and Bragg devices.
Nonlinear optics; Second harmonic generation; Optical phase conjugation; Optical bistability; Solitons; Self and cross phase modulations; Optical Bloch equation.
Electro-optic effects in different crystals; Acousto-optic effects; Raman-Nath diffraction and Acousto-optic devices.

Textbook

Noé, R, (2010), *Essentials of Modern Optical Fiber Communication*, Springer

Reference

Thyagarajan, K. & Ghatak, A., (2011), *Lasers: Fundamentals and Applications*, Springer.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM521: NANOSCIENCE AND NANOTECHNOLOGY

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:

LO1: Describe the crystal structure, vibration and energy levels that exist in materials.

LO2: Discuss the emergence of nanotechnology as things gets very small.

LO3: Classify the types of nano-crystal structures and the composition of materials.

LO4: Recognize the new field on which new technological approaches are possible.

Syllabus

Review of crystal structure, lattice vibration and energy bands; Emergence of nanotechnology and its challenges; Properties of individual nanoparticles; Nucleation, Types of nanocrystals and nanocrystals-defects; 1-D, 2-D and 3-D nanostructured materials, Carbon nanostructures, Carbon clusters & carbon nanotubes: metals, metal oxides, semiconductors, Ceramics and Composites; Dilute magnetic semiconductors, Biological system: DNA and RNA; Mechanical, Physical and Chemical properties; Bulk nanostructured materials; Nanostructured ferromagnetism; Optical and vibrational spectroscopy; Quantum wells, quantum wires and quantum dots; Self-assembly and catalysts; Organic compounds and Polymers; Biological materials; nanomachines and nanodevices.

Textbooks

Charles P. Poole, Jr. & Frank J. Owens, (2003), *Introduction to Nanotechnology*, John Wiley & Sons

G. Cao, (2004), *Nanostructures and Namomaterials: Synthesis, properties and applications*, Imperial College Press.

Kenneth J. Klabunde (Eds), (2001), *Nanoscale Materials Science*, John Wiley & Sons, Inc.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM523: ENVIRONMENTAL PHYSICS

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:

LO1: Describe basic physics of the atmosphere, atmospheric comosition, radiation in atmosphere & radiation transport, Atmospheric thermodynamics, hydrologic cycle, aerosols and cloud physics

LO2: Explain effectively hydrologic concepts, and demonstrate advanced understanding of hydrologic cycles, practical training in basic hydrological measurement techniques

LO3:Discuss fundamentals of soil physics, components of soils and their properties, Interaction matrix for soil-water, water transport in saturated and unsaturated soil, transport of pollutants

LO4:Understand core concepts & methods from ecological and physical sciences and their applications in environmental problem-solving

LO5:Understand the interactions among physical, biological, chemical and human components of the environment; to characterie the various soial drivers of environmental problems involving agriculture, mining, fishing, forestry

LO6:Outline global energy resources, thermodynamics, solar energy, renewable energy from wind, water and waves, nuclear power plants,ionizing radiation and environmental issues, the earth's heat balance, utlization and conversion of energy resources, energy conservation

LO7: Explain the nature of poluution of air, water & soils; explain the drivers, principles & methods of environmental analysis; explain some key methods and techniques for pollution measurement

LO8: Explain the origins of global effects on the environment cause by human activities, the physical basis for the exploitation of various energy sources, make assessments on different energy technologies

LO9: Outline natural and anthropogenic greenhouse effect, different reservoirs of carbon in the earth system, role of carbon in the chemistry of the ocean & in setting its pH, carbon isotopes as analytical tool.

Syllabus

(a). Earth's atmosphere: Composition; structure, weather and climate, atmospheric circulation and the Coriolis Effect, atmosphere-ocean interactions.
(b). Global Water Resources and Use: Freshwater and saltwater, ocean circulation, agricultural, industrial, and domestic use, surface and groundwater issues, global problems, conservation.
©. Soil and Soil Dynamics: Rock cycle, formation, composition, physical and chemical properties, main soil types, erosion and other soil problems; soil conservation.
(d). Ecosystem Structure: Energy flow, ecosystem diversity, natural ecosystem change, natural biogeochemical cycle.
(e). Land and Water Use: Agriculture, feeding a growing population, controlling pests, forestry, transportation infrastructure, mining and fishing.
(f). Energy Resources and Consumption: Energy concepts, energy consumption, nuclear energy, hydroelectric power, renewable energy, energy conservation.
(g). Pollution: Pollution types, air pollution, air pollution, noise pollution, water pollution, water quality, solid waste, impacts on the environment and human health, hazards to human health, chronic effect, air pollutants, Hazardous chemicals in the environment, Economic Impacts
(h). Global Change: Stratospheric zone, formation of stratospheric ozone, ultraviolet radiation causes of ozone depletion, effects of ozone depletion, strategies for reducing ozone depletion.

(i). Global Warming: Greenhouse gases and the greenhouse effect, impacts and consequences of global warming, reducing climate change.

Textbooks

Boeker, E. & van Grondelle, R. (1995), *Environmental Physics*, John Wiley
Monteith, J. L., &Unsworth, M. H., (1990), Principles of Environmental Physics, Chapman & Hall

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM525: PHYSICAL OCEANOGRAPHY

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:
LO1: Explain the important physical processes on both the conceptual physical principles and at the larger scale how these fit into the earth as a system

LO2: Discuss and formulate the basic equations describing the principles upon which physical oceanography is based. These principles guide a student to understand the waves, tides, currents as well as the large-scale ocean circulation

LO3: Describe the geological oceanography, how the tsunamis develop and travel, geology of the sea-floor and geophysical fluid dynamics

LO4: Outline the interaction of the oceans with other components, most importantly, the atmosphere

LO5: Illustrate and describe the hydrodynamics in coastal areas, current-flow pattern and coastal sediment dynamics.

Syllabus

1. Physical setting, physical conditions and physical processes within the oceans, ocean currents and interaction of ocean circulation.
2. Coriolis effect, tidal characteristics, tidal effect, advection-diffusion equation, transport equations, wind forcing and tidal elevation, tidal current, tidal choking, shoaling effect,
3. Tsunamis and surface waves,
4. temperature, salinity and density of ocean water,
5. Geophysical fluid dynamics,
6. Geology of the sea floor,
7. Atmosphere – ocean dynamics, fluxes of various chemical substances, physical properties within the oceans and across its boundaries, plants, animals and microbes (biota) of the oceans and their ecological interaction, chemistry of the ocean and its chemical interaction with the atmosphere,
8. Geology of the ocean floor including plate tectonics, *waves, internal waves, tides*—topics duplicated
9. Hydrodynamics of coastal sea areas and their estuaries and harbours, harbour dynamics, current and flow patterns, sediment dynamics and modeling mechanisms.

Textbook

Sverdrup, K. A., Duxbury and Alison, B. (2006). Fundamentals of Oceanography, McGraw-Hill

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM527: PHYSICS OF EARTHQUAKES AND TSUNAMIS

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:
LO1: Describe the physics of earthquakes, stress and strain, and follows the wave motion

LO2: Discuss the physics of tsunamis

LO3: Develop basic knowledge on the size of an earthquake, magnitude scale & felt intensity

LO4: Discuss the behavior of structures during earthquakes and think about what measures can be taken

LO5: Illustrate the relationship between ground structure and seismic motion, faults & their parameters

LO6: Discuss and evaluate any relevance of the Course from PNG perspectives for earthquakes, volcanism and tsunamis.

Syllabus

Behavior of Earth as an elastic medium, theory of elasticity, stress and strain, elastic displacement vector, equation of motion, elastic stress tensor and elastic strain tensor, symmetry of the stress tensor, stress-strain relation, displacement-strain relation, infinitesimal strain theory, cubical dilation, the elasto-dynamic wave equation, elastic waves, phase change, lithosphere-asthenosphere boundary, mantle-core boundary.
Seismic waves and effect of boundaries on seismic waves, seismic phases, ray geometry and the ray parameter, travel time of seismic waves, inversion of travel time, time distance curves.
Seismographs and seismographic networks, geophysical observatories, seismic source, observation of travel-time of seismic waves from source to observatories, estimation earthquake source parameters.
Estimation of the earthquake size, intensity scale and magnitude scales of earthquake size estimation, various magnitude scales, relation between intensity and magnitude of earthquakes.
Earthquake faults and fault parameters, fault-plane solution.
Geodynamics and plate tectonic theory, different plate boundaries, causes and mechanisms of earthquakes, seismicity, tsunamis, volcanoes.
Tectonic setting of Papua New Guinea.

Textbooks

Lay, T. & Wallace, T. C., (1995), Modern Global seismology, Academic press
Bullen, K. E., & Bolt, B. A., (1985), An introduction to the Theory of Seismology, Cambridge Univ. Press.
Aki, A. & Richards, P. G., (1980), Quantitative Seismology, 2 vols. Freeman, San Francisco.

References

Kennett, B. L. N., (1983), Seismic Wave propagation in Stratified Media, Cambridge Univ. Press.
Scholtz, C. H., (1990), The Mechanics of Earthquakes and Faulting, Cambridge Univ. Press.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM529: PHYSICS OF VOLCANO FORMATION & ERUPTION STYLES

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:
LO1: Develop knowledge on volcanic structures, physical geology of a volcano & volcanic eruption styles

LO2: Illustrate the impacts of volcanic eruptions on society, focusing on past notable eruptions

LO3: Develop skills in applying computational geophysics to modeling the magmatic process & plume dynamics

LO4: Acquire knowledge on advanced monitoring techniques as forecasting tools for volcanic eruption, such as: Satellite imagery, Digital Elevation Models & InSAR

LO5: Estimate Volcanic hazards for subduction-related volcano system, like Papua New Guinea.

Syllabus

Formation, distribution and classification of volcanoes, geological aspects of volcanic systems, volcano stratigraphy, structure and tectonic influence, eruptive history, evolution of volcanic landforms, volcano forms, volcanic eruption style and progress, kinds of materials ejected during an eruption, pyro9clastic flows, pyroclastic fallout, lahars, debris-flow avalanches, lava, dust, ash, volcanic gases, dispersal patterns of lava an dash, analysis of real-time eruption observations, volcanic hazards.
Geophysical aspects of volcanic systems, physical properties of volcanic rocks and magmas, heat flow studies; volcano seismology, geodesy and remote sensing, Geochemical and petrological aspects of volcanic rocks, magma genesis and evolution,

crystallization, volatile compositions, solubility and degassing, volcanic petrography and textural analysis, hydrology, geochemistry and measurement of volcanic and hydrothermal fluids, volcanic gas emissions, fumaroles and springs, crater lakes, hydrothermal mineralization.
Computational modeling and experimental simulation of magmatic and hydrothermal processes, eruption dynamics, magma transport and storage, plume dynamics and ash dispersal, lava flow dynamics, hydrothermal fluid flow, thermodynamics of aqueous fluids and melts. Volcano hazard and risk research, hazard zonation methodology, development of forecasting tools, assessment techniques for vulnerability and impact, Mechanisms of deformation monitoring, EDMs, Satellite and InSAR.

Textbooks
Jacques-Marie Bardintzeff, J.M. & McBirney, A., *Volcanology*
Sparks, R.S.J., Bursil, M.I., Carey, S.N. & Gilbert, J.S., (1997), *Volcanic Plumes*, John Wiley & Sons
Francis, P. & Oppenheimer, C., (2004), *Volcanoes*, Oxford University Press (2nd ed.)
Dobran, F., (2001) *Volcanic Processes: Mechanisms in Material Transport*; Springer

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM531: PHYSICS OF THE EARTH'S ATMOSPHERE

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes
On completion of this subject the student should be able to:
LO1: Describe and explain basic physics of atmospheric processes; learn the basics on physical & dynamic meteorology.

LO2: Analyze weather maps and develop basic weather forecasts; what are the severe weather and the tropical cyclones?

LO3: Apply the concept of feedback mechanisms to specific examples of climate change.

LO4: Develop an understanding on: Subjective & Objective Synoptic Meteorology, Structure of synoptic-scale weather systems, Jet Stream dynamics

LO5.Explain the role of each major influence on climate and examine the factors influencing temperature and precipitation patterns on Earth.

LO6: Examine Intra-seasonal & Inter-annual Climate variations, including El-Nino effect, aerosol, drizzle, rain, snow, freezing-rain, hailstorm etc.

LO7: Distinguish different Meteorological instruments.

Syllabus
Introduction to the Atmosphere, Heating Earth's Surface and Atmosphere, Moisture and Atmospheric Stability, Air Pressure and Winds, Circulation of the Atmosphere, Air Masses, Weather Patterns, Atmospheric dynamics, Thunderstorms, lightning, Tropical cyclones, Hurricanes, Tornadoes, Weather Analysis,
Meteorology: (a). Climate & climate change, weather forecasting, air-pollution, radiative transfer, remote sensing, (b). Synoptic meteorology, El Niño, cloud dynamics, collision-coalescence, Bergeron process, dynamic phase hypothesis, (c). Precipitation processes, aerosol, drizzle, rain, snow, graupel, freezing rain, ice pellets, hailstorm, (d). Atmospheric tide, atmospheric electricity, Aeronomy

Textbooks
Murray L. Salby, *Fundamentals of Atmospheric Physics,* Volume 61 (International Geophysics)
Frederick K. Lutgens, Edward J. Tarbuck and Dennis Tasa., (2010), *Atmosphere: An Introduction to Meteorology,* Prentice Hall, Inc

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM533: GEOPHYSICAL TECHNIQUES OF RESOURCES EXPLORATIONS

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:-

LO1: Explain and illustrate various geophysical exploration methods

LO2: Discuss and explain different methodologies, their field surveying procedures on land, over seas and from air, and the interpretation techniques for geologic bodies located from shallow to considerable depths.

LO3: Explain, illustrate and discuss different geophysical methods act on naturally available signal on the surface of the earth to estimate the physical properties, configuration of the body, depth of burial and other geologic conditions.

LO4: Interpret the geophysical signals for resource location in the subsurface. These are interpretation techniques based on computer methods

LO5: Formulate Interpretation of natural resources.

Syllabus

General introduction to geophysical exploration principles geological properties of crustal structure that are favorable for the formation of petroleum and mineral deposits;

Principles of gravity and magnetic methods, principles of field operations and data acquisition, data processing, interpretation and limitations; Field examples;

Different electrical methods of geophysical exploration; Resistivity method, Equipments, electrode layouts and field procedure of resistivity method. Interpretation of resistivity data; strength and limitations of resistivity method.

Induced polarization (IP) method, its principles, field operations, interpretation of IP data, Self-potential (SP) method; Mechanism of self-potential (SP) method, field procedure; interpretation of SP anomaly data,

Electromagnetic (EM) surveying depth of penetration and detection of EM fields tilt-angle-, VLF – and AFMAG methods; Airborne EM surveying; Interpretation of EM data; Limitations of EM method; Telluric and Magneto-telluric field surveying methods.

Sources and detectors used in Seismic exploration methods; Partitioning of seismic energy at an interface; Geometry of seismic wave paths; Characteristics of seismic events; characteristics of time distance graphs, Seismic refraction surveying; Computation, reduction and interpretation of seismic refraction data; Engineering applications of seismic refraction surveying.

Seismic reflection profiling; Geometry of reflected ray paths; Multi-channel reflection profiling; Detector designs; CDP shooting; Acquisition of data in multiplexed format on land and water covered areas; Seismic data processing; Convolution and deconvolution; Correlation; Frequency filtering.

Radiometric method; Principles of radioactivity and decay processes; Radioactive equilibrium; Age determination using radioisotopes; Instruments used for data acquisition, field operations and data interpretation.

Textbooks

Telford, W.M., Geldart, L.P. and Sheriff, R.E., *Applied Geophysics*, Cambridge University Press.
Robinson, E.A. & Trietal, S., *Geophysical Signal Analysis*, Prentice Hall.

Reference

Fitch, A.A. (ed), Developments in Geophysical Exploration Methods (v1-v6), App. Science Publishers

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM535: NON-DESTRUCTIVE TESTING TECHNIQUES

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:-

LO1: Explain the basic principles, techniques & limitations of Non Destructive Testing (NDT) methods

LO2: Develop capability for NDT such as: Visual, Penetrant, Magnetic particle, Ultrasonic, Radiography, Eddy current, Magnetic flux leakage methods

LO3: Develop an understanding on specialized NDT methods such as: Thermography, Acoustic emission, Stress/Strain measurements, Holography

LO4: Discuss and interpret the Codes, Specifications & Standards in NDT

LO5: Choose and adopt appropriate NDT method(s)?

LO6: Write Reports & Recommendations based on NDT findings

Syllabus

General introduction to nondestructive testing, VISUAL METHODS: Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection.
Penetrant Method of Flaw Detection: Principles, process, penetrant system, liquid penetrant materials, emulsifiers, cleaners developers, sensitivity, advantages, limitations and applications.
Radiographic Methods: Principles of radiography, sources of radiation, Ionising radiation - X-rays sources, gamma-rays sources, recording of radiation, radiographic sensitivity, fluoroscopic methods, special techniques, radiation safety, limitations,
Ultrasonic Testing of Materials: Generation of. Ultrasonic waves, general characteristics of ultrasonic waves, methods and instruments for ultrasonic materials testing, special techniques. advantages, disadvantages & applications,
Magnetic Methods: Methods of generating fields, magnetic particles and suspending liquids magnetography, field sensitive probes, applications. measurement of metal properties, advantages& limitations
Electrical Methods: Eddy current methods: potential-drop methods, applications.
Electromagnetic Testing: Magnetism, magnetic domains, magnetization curves, magnetic hysteresis, hysteresis-loop tests, comparator - bridge tests absolute single-coil system, applications.
Other Methods: Acoustic Emission Methods, Acoustic methods, Leak detection & Thermal inspection.

Textbooks

Prakash, R, (2009), *Nondestructive Testing Techniques*, New Age Science
Halmshaw, P. (2nd, ed.), *Non-Destructive Testing*, Edward Arnold.

Reference

Hillier, C., (2001), *Handbook of Nondestructive Evaluation*, McGraw Hill

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM537: FIBRE OPTICS & OPTICAL COMMUNICATIONS

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:

LO1: Outline the history and fundamentals of optical communication systems

LO2: Explain the wave theory, properties, phenomena related wave property of light including image formation.

LO3: Apply principles of optical fibres and their use in communication systems

LO4: Illustrate methods of ransmission of optical signals through optical fibres

LO5: Identify basic components of optical communication systems and do their characterisation

LO6: Develop practical optical communication system and its implementation for transmission and reception of infirmation.

Syllabus

Overview of optical communication systems: History of optical communications.
Review of optics: Wave theory of light, reflection and refraction of plane waves, Fresnel's formulas, Interference and interferometers, diffraction, optical coherence, polarization of light, image-forming systems.
Characteristics of optical fibers: Wave propagation in multimode and single-mode optical fibers, coupling into and out of fibers, attenuation, group-velocity dispersion, optical nonlinearities, polarization-mode dispersion, fiber manufacturing, air-core fibers, test equipment and techniques.
Optical waveguides: Planar conducting waveguides, planar dielectric waveguides, optical fiber waveguides.
Review of digital communications: Baseband transmission, broadband transmission, Shannon's coding theorem, bit signaling and bit-group signaling methods, bit error rate and bit-group error rate, time-division multiplexing, frequency-division multiplexing
Optical sources and transmitters: Physics of light emission and amplification in semiconductors, Light-emitting diodes, semiconductor lasers, edge-emitting lasers, vertical-cavity surface-emitting lasers, optical transmitters.
Optical detectors and receivers: Photoconductors, photodiodes, phototransistors: Optical receivers, optical amplifiers: Semiconductor laser amplifiers, Electronic Device Failure Analysis Society (EDFAs), planar amplifiers, Raman amplifiers, repeaters, noise sources, bit error rate.
Dispersion in optical communication systems: Dispersion in single-mode and multimode fibers, dispersion-induced pulse broadening in single-mode fiber, system implications and real-life examples, optical link design, power and noise budget, jitter and risetime budgets.
Manufacturing materials: silica, fluorides, phosphates, chalcogenides, practical issues: optical fibre cables, termination & splicing, free-space coupling, electric power transmission.

Textbook

Palais, J. C., (2004), *Fiber Optic Communication*, 5th ed. Wiley.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM539: PHYSICS OF SEMICONDUCTOR DEVICES

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:

LO1: Apply the fundamental properties of semiconductors for the fabrication of basic semiconductor devices

LO2: Illustrate fabrication and properties of Special semiconductor devices and their characteristics

LO3: Use the field effect semiconductor devices for various applications in electronics circuits.

LO4: Devise high frequency semiconductor switching devices and their applications in communication

LO5: Apply the principle, construction and applications of GUN Diodes at various operating modes

Syllabus

Properties of Semiconductors: Measurement of semiconductor properties; Junction Devices: Zener Diode, Varactor Diode: and Tunnel Diode and their principle of operation, structure and application; Bipolar junction Transistor and Power semiconductor Devices; Metal Semiconductor junction Diode.
Mos Devices: Energy band diagram, accumulation, depletion mode, inversion mode and C-V characteristics of MOS capacitor, constructional details IV-Characteristics, and principle of operation of depletion type and enhancement type MOSFET, equivalent circuit of MOSFET, short channel and narrow width effect, MOSFET scaling and hot electron effect, charged coupled devices (CCD) types of charged coupled device (SCCD and

BCCD) application of charged coupled devices.
High Frequency Solid-State Devices: Frequency dependence of power gain and noise in BJT, Transit time effects in BJT, Transit time effect in FET and Transit time effect in MESFET, Structure, Principle of operation and application of high electron mobility transistor (HEMT), Principle of operation and application of ballistic transistors.
Negative Conductance Microwave Devices:
Construction, Principle of operation and application of impact Avalanche Transit time (IMPATT) Diode, TRAPATT Diode, GUN Diode effect, the transferred electron mechanism, domain formation and various operating modes of GUN diode.

Textbooks

Sze, S. M., (1981), *Physics of Semiconductor Devices*, Wiley
Jaros, M., (1989), *Physics and Applications of Semiconductor Microstructures*, Clarenden

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM541: DIGITAL ELECTRONICS & MICROPROCESSOR

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:

LO1: Develop an understanding of fundamentals of electronics in order to deepen the understanding of electronic devices that are part of the technologies that surround us

LO2: Use techniques for analysing analogue and digital electronic circuits; and formulate the concepts of operational amplifier and Field Effect Transistors (FET); identify its major properties and main types of FET and op-amps circuits.

LO3: Apply the principles of digital electronics to practical circuits for memory devices, data handling systems and data processors.

LO4: Design and implement logical circuits involving digital clocks, counters, registers and programmable arrays

LO5: Perform arithmetic and logical operations using digital devices through various methods and to output the results through interface devices

LO6: Write and implement instructions and programs for microprocessors and micro-computers to perform simple computer programs

Syllabus

Electronic systems, Semiconductor diodes, BJT, FET, MOSFET, Rectifier and Filters, Transistor biasing. Small signal transistor amplifiers, Operational amplifiers, Feedback and Oscillators.
Fiber optics & networking. Design of Power Supply: Low Voltage, High Voltage, Low Current & High Current; High Frequency, Low Frequency Amplifiers and Oscillators; Phase Locked Circuits and Lock-In Amplifiers; Measurement of Low- Noise Signals; Linear and Non-Linear analog Circuits.

Digital circuit and combinational logic, Sequential logic and flip-flops, ADC & DAC, Data acquisition systems, Memory systems, Case studies of electronic systems like microprocessors.

Integrated circuits, TTL and MOS logic circuits, Gating Networks Logic design: Flip – Flops Transfer circuits, Clocks, shift registers, Counters, State diagrams and State tables, Magnitude comparator, Programmable Arrays of Logic cells.
Elements of ALU Design and implementation of Binary Address (Half and Full) and Subtractors, BCD Adder, Multiplexer, encoder, decoder, Floating point number systems, Arithmetic operations with Floating point numbers.

Input – output interface modules, I / O versus memory bus, isolated versus memory, mapped I / O, asynchronous data transfer, direct memory access (DMA), input-output processor (IOP): CPU, IOP communication, memory organization.

Microcomputers, microprocessor and assembly language, microprocessor architecture and microcomputer systems: microprocessor architecture and its operations, memory, input and output, 8085 MPL, 8085 based microcomputer, memory interfacing.

The 8085 programming model, addressing techniques, 8085 instructions, code conversion, BCD arithmetic operations.

Textbooks

Mathur, A. P., Introduction to Microprocessor, T.M.H. 1990.

Bartee, T. C., Digital Computer Fundamentals, T.M.H. 6th edition 1991.

Ramesh, A., & Goankar, S., Microprocessor Architecture, Programming and Applications with the 8085/8080 Wiley Eastern Ltd.

Reference

Hall, D. V., Microprocessors and interfacing – Programming and Hardware, TMH, 1997.

Mano, M. M., Computer System Architecture, 3rd ed., PHI.

Assessment

Continuous Assessment - 50%

Written Examination - 50% (1x3 hrs)

APM543: MICROCONTROLLER AND DIGITAL SIGNAL PROCESSING

Hours per week: 4 (4 lectures)

Credits: 18

Learning Outcomes

On completion of this subject the student should be able to:

LO1: Perform the classification signal systems and mathematical anlysis signals

LO2: Perform computational techniques for discrete and fast Fourier Transforms of various signals used in communication systems.

LO3: Design and characterize ilters through various modes and perform frequency transformation of signals.

LO4: Write programs for microcontrollers with special function registers and addressing modes.

LO5: Outline and explain the internal strucutre (architectre) of PIC Micro, its organisation and instruction sets

LO6: Familiarize with the instruction set, source codes, source formats, mnemonics, labels, file formats and extensions to PIC.

Syllabus

Classification of signals, singularity function, amplitude and phase spectra, classification of systems. Fourier transform, Properties of Fourier transform, Fourier transform of some important signals, Fourier transform for power and energy signals.

Linear Time Invarient System: Introduction, properties of a DSP systems, difference equation and its relationship with system function, impulse response and frequency response.

Discrete and fast Fourier Transforms (DFT AND FFT): Discrete convolution – DTFT – FFT computing an inverse DFT by doing a direct DFT – composite radix FFT – Fast convolution – Correlation – Z transform – Definition of the z transform – Properties of z transform – Evaluation of the inverse z transform.

FIR AND IIR: Magnitude and phase response of digital filter – Frequency response of linear phase FIR filter – Design techniques for FIR Filters – Design of optimal phase FIR filter.

IIR filter design by approximation of derivatives – IIR filter design by impulse invariant method and the bilinear transformation, Butterworth and Chebyshev filter, Elliptic filter, Frequency transformation.

Introduction of Microcontrollers-8051, Microcontroller-architecture-special function registers, addressing modes, instruction set.

Origin of PIC Micro: Introduction to PIC micro-Architecture and hardware, block diagram, working registers, program memory, data memory, file registers, program concepts of status register, stack file selection register, option register, indirect data addressing register, digital I/O port, clock oscillators, timer modules, pre-scalar, watch dog timer, reset circuitry, instruction cycle, long word instruction, power down mode sleep, configuration fuses

Instruction set and program development: Instruction set types, MPASM, source code formats, labels, mnemonics, operands, comments, files with default extension, lists file format, error file format (EPR), operators, procedure, text

strings, numeric constants and radix key to PIC 16/17 form instruction sets.

Textbooks
Salivahanan, S., Vallavaraj, A. & and Gnanapriya,C., Digital Signal processing, Tata McGraw Hill
Embedded control hand book, volume 1995/96
PIC 16/17 microcontroller data book, volume 1996/1997

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

APM545: EXPERIMENTAL METHODS IN PHYSICS I

Hours per week: 3(3 Lab)

Credits: 4

Learning Outcomes
On completion of this subject the student should be able to:

LO1: Carry out hands on experiments on the fundamental principles

LO2: Perform practical experiments to verify the important theories and derive related outcome

LO3: Develop an analytical capacity to arrive at statistically reliable results.

LO4: Perform error analysis of the experiment carried out.

LO5: Carry out advanced experiments

List of experiments will be provided at the beginning of the Semester

This course is in line with any elective subject students take in a semester. The laboratory component of the course work done for the elective subjects taken can be taken during the semester for the subjects taken.

Assessment
Continuous Assessment - 100%

APM547: EXPERIMENTAL METHODS IN PHYSICS II

Hours per week: 3(3 Lab)

Credits: 4

List of experiments will be provided at the beginning of the Semester

This course is in line with any elective subject students take in a semester. The laboratory component of the course work done for the electives subjects taken can be taken during the semester for the subjects taken.

Learning Outcomes
On completion of this subject the student should be able to:

LO1: Carry out hands on experiments on the fundamental principles

LO2: Perform practical experiments to verify the important theories and derive related outcome

LO3: Develop an analytical capacity to arrive at statistically reliable results.

LO4: Perform error analysis of the experiment carried out.

Assessment
Continuous Assessment - 100%

APM549: RESEARCH PROJECT

Hours per week: Contact Hours varies

Credits: Varies

Learning Outcomes
On completion of this subject the student should be able to:

Research work will be conducted on specific project as will be decided by the individual student in the area of his interest and in consultation with his supervisor.

LO1: Identify, select and develop small research

projects relevant to the subjects studied.

LO2: Carry out literature surveys related to the selected topics and identify gap areas.

LO3: Demonstrate the ability to plan a schedule of research activities to complete the project in time.

LO4: Present the report of the research in a systematic way, preferably in the format of research publication.

Assessment
Continuous Assessment - 100%

APM551: RESEARCH PROJECT

Hours per week: Contact Hours varies

Credits: Varies

Pre-requisite: Undergraduate degree

Research work will be conducted on specific project as will be decided by the individual student in the area of his interest and in consultation with his supervisor.

Learning Outcomes
On completion of this subject the student should be able to:

LO1: Identify, select and develop small research projects relevant to the subjects studied.

LO2: Carry out literature surveys related to the selected topics and identify gap areas.

LO3: Demonstrate the ability to plan a schedule of research activities to complete the project in time.

LO4: Should be able to present the report of the research in a systematic way, preferably in the format of research publication.

LO5: Publish the results / observations in a reputed journal as far as possible.

Assessment
Continuous Assessment - 100%

➢ MASTER OF TECHNOLOGY IN EXPLORATION GEOPHYSICS (MTech)

MASTER OF TECHNOLOGY IN EXPLORATION GEOPHYSICS

INTRODUCTION

No program on 'Exploration Geophysics' is offered at any University in PNG, although, there is a huge demand for such a specialist course in the Oil/Gas as well as Mining and Power industries, with the Geological Exploration Wings of the Mineral Resources Authority, PNG Chamber of Mines & Petroleum, PNG. In view of the above, the Master Program in Exploration Geophysics is planned in two fields of specialization – Hydrocarbon Exploration and Mineral & Geothermal Exploration. Details of the Course Curriculum are described below; the First Year of the Program (comprised of Two Teaching Semesters) is entirely devoted to Course Work where components of Field Reports are built into. The Second Year of the Program is exclusively devoted to independent Thesis work by the student in any of the chosen fields of specialization viz., Hydrocarbon or Mineral & Geothermal Exploration, under an Academic Supervisor. A written Thesis is to be submitted for Examination and Departmental Seminar is to be presented.

It is envisaged that graduates of MEG program will be employed as professional Field Geophysicists in Exploration by companies both in Public and Private Sectors, Data Interpreters and Seismic Modelers in Corporate Offices, Exploration Geophysics specialists employed by Multinational Consultant companies who will continue to excel and contribute towards the overall development of natural resources in PNG, & also as researchers and teachers in educational institutions. Geothermal Exploration using geophysical methodologies is gaining momentum in PNG in view of its huge potentiality in power production in the mainland as well as in remote islands. This is in line with the projected vision of power demand & supply in the coming decades. Moreover, the graduates with Masters can be easily promoted to higher position within the organization they are employed.

PROGRAM OUTCOMES

The aim of the MEG program is to train and develop highly skilled professionals in the areas of Oil-Gas, Mineral as well as Geothermal Exploration in PNG. There are almost two dozen of Oil-Gas Companies currently operating in PNG waters, several of them are engaged in massive geophysical exploration, like; CGG & TOTAL. There are many Mining Companies engaged in geophysical exploration, like Wafi-Golpu dealing with Copper-Gold exploration and exploitation. In fact, at the present state of affairs, no oil-gas production, mining or geothermal exploration is undertaken without the advanced geophysical exploration. Since the country is rich in hydrocarbon and mineral resources, there is a growing demand for exploration geophysicists in both the sectors. It is therefore envisaged that the University of Technology can contribute very significantly in meeting this demand for qualified geophysics professionals by offering a specialized program in Exploration Geophysics at the Masters level.

Upon completion of the course, it is expected that the graduates will have acquired the knowledge and skills relating to:

1. The typical locations of minerals, oil and gas deposits either on land or waters.
2. The identification of the minerals, oil, gas and other sister minerals that are present with the actual deposits and other symptoms.
3. Developing techniques needed to explore and locate the presence of Oil- Gas, Mineral and Geothermal resources.
4. Good communication skills – verbal, interpersonal and written to facilitate working in an industry having colleagues of multi-cultural background.
5. Academic expertise for undertaking field exploration using advanced methodology & equipment,
6. Developing adequate scientific knowledge for handling and interpreting field data to arrive at meaningful and geologically realistic conclusions,
7. Working in a time-bound frame, under varied field conditions, to achieve the set goal
8. Capability to learn and keep abreast with scientific methods that are continually developed.

RATIONALE

The Exploration Geophysics graduates are needed in the country that is specialized in thatfield. When specialized work such as seismic refractive or reflective survey, subsurface mapping techniques, potential field data interpreter is needed, all companies import skilled workers from overseas on contractual basis. This kind of work can be done by graduates who are trained indigenously in the area of exploration geophysics which will reduce employing overseas professionals through contractual agreements. When we have our own graduates, this will create employment for our nationals which can solve unemployment, poverty, less school leavers and other socio-economic benefits to our nation.

The proposed program will enhance the knowledge and skills of professionals working in exploration industries within the country, in the Pacific and other countries through the experiences gained. The subjects within this program will enable students to develop the practical knowledge and skills needed in research, problem solving, analyse, plan, implement and evaluate the mineral, oil and gas deposits within the community and other stakeholder engagement programs and activities to meet the local, provincial, national, and global challenges associated with exploration geophysics activities. It is an ideal program for professionals seeking to expand their career prospects into a wide range of government, commercial, or research roles in the broad area of mineral, oil and gas industry.

SUMMARY OF THE COURSE

The proposed Masters in Exploration Geophysics (MEG) degree program is a two-year normal mode program of study. It offers four compulsory core subjects and three elective subjects. The program thus entails one full year residential session at UNITECH and the other one year is a thesis work. The residential session is a full-time course work, whereas, the subject MEG571 is a thesis work that is to be undertaken in collaboration with industry or a regulatory body in PNG. This module involves an independent research project of 15 weeks duration in each Semester, intervened by a mid-Year assessment by the Supervisor. Thesis topic will be tailored to student's specific interest and ability, but will have an applied focus and well-defined objectives that the student will cultivate for an academic outcome. The students will be taking the subjects as per the following schedule along with the Thesis project component.

(i) Schedule

YEAR 1	Contact Hrs/Wk
Semester 1	
4 core subjects	16
Semester 2	
3 Elective subjects	12
Student Field Report	
1 subject (MEG 569)	4
Total Hrs/Wk	32
YEAR 2	
Semester 1	16
Thesis	
Semester 2	
Thesis	16

(ii) Subject Outline

Subject	Code	Semester
Core Subjects		
Gravity & Magnetic Exploration	MEG 551	I
Interpretation of Well logs	MEG 553	I
Seismic Prospecting	MEG 555	I
Research Project	MEG 557	I
Elective Subjects		
Airborne Geophysics	MEG 559	II
Subsurface Mapping Techniques in Petroleum Geology	MEG 561	II
Petrophysics & Reservoir Characterization	MEG 563	II
Geophysical Prospecting – I	MEG 565	II
Geophysical Prospecting – II	MEG 567	II
Industrial Training	MEG 569	II
Research Project		
Thesis	MEG 571	I & II

DETAILED SYLLABUS

MEG 551: GRAVITY & MAGNETIC EXPLORATION

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Explore Gravity & Magnetic Exploration methods.
2. Plan and execute exploration strategy for natural resources.
3. Learn various methodologies, their field surveying procedures on land, offshore and from air, and the interpretation techniques for geological bodies located from shallow to considerable depths.
4. Use naturally available potential field signals on the surface of the earth in locating exploration targets
5. Interpret the potential field anomaly for resource location on the subsurface.
6. Use advanced computational methodology for geological interpretation of natural resources.

Syllabus

(a). Gravity exploration: Figure of the Earth, Basic concepts, Relative gravitymeasurements, Gravimeters—working principle; Field survey procedures, Base ties, Gravity data reduction; Computer storage of gravity data; Free-air and Bouguer gravity anomalies; Contoured anomaly maps; Rock densities; Interpretation of gravity anomalies; Regional and residual separation; Gravity anomalies of simple-shaped bodies; Direct and Indirect interpretation; Application of gravity surveying for geologic interpretation; Case history.

(b). Magnetic exploration: Basic concepts, Magnetic field of the Earth, Geomagnetic Field components, Rock magnetism; Ground magnetic survey procedures; Magnetometers—Vertical and Total Field Magnetometers, working principle; Data reduction; Diurnal and Geomagnetic corrections; Magnetic susceptibility and its variation; Interpretation: Direct and Indirect interpretation; Depth rules; Application of magnetic surveying in the search of hydrocarbons and minerals; Case history.

Reference books

1. Dobrin, M.B. and Savit, C.H. 1988. Introduction to Geophysical Prospecting, 4th edition, McGrawHill, New York.
2. Kearey, P., Brooks, M. and Hill, I. 2002. An Introduction to Geophysical Exploration. 3rd edition, Blackwell Science.
3. Nettleton, L.L. 1971. Gravity and Magnetics for Geologists and Seismologists. Monograph Series 1, Society of Exploration Geophysicists, Tulsa.
4. Nettleton, L.L. 1976. Gravity and Magnetics in Oil Exploration. McGraw-Hill, New York.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

MEG 552: INTERPRETATION OF WELL LOGS

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Explore Borehole Wireline Log exploration methods.
2. Plan and execute exploration strategy in petroliferous basins.
3. Examine borehole logging techniques using geophysical methods through application of mathematical and physical principles.
4. Develop various logging procedures like: Spontaneous Log, Resistivity & Induction Logs, Neutron log, Focused Electrode logs.
5. Interpret various logs in terms of borehole lithology.
6. Evaluate standard well-log interpretation

techniques like Quick-look method, Tornado chart, Saturation cross-plot, Shaly-sand analysis.

7. Interpret the geophysical well logs using computer-based software for locating the promising horizons.

Syllabus

Principles of Well Logging: Borehole Environment, Log Data Acquisition, Invasion & Resistivity Profiles, Fundamentals of Quantitative Log Interpretation: Porosity, Saturation, Permeability, Archie's equation, Temperature & Pressure, Invasion Process, Resistivity, Spontaneous Potential Log, Origin of SPs, Shale Baseline, Formation Water Resistivity determination, Shale Volume calculation, Porosity Logs: Density Log, Neutron Log and their Interpretations, estimation of Formation Lithology using Neutron- Density combination, Resistivity Logs: Physical principles for Resistivity & Induction Logging, Conventional Logs, Focused Electrode Logs – LL3, LL7 & LL8, Dual Laterologs, SFL, MSFL, Induction Logs, Flushed Zone Resistivity, Log Interpretation: Archie's Water Saturation, Quick-Look Method, Tornado Chart, Saturation Crossplot, Permeability from Logs, Shaly-sand analysis, Interpretation Case Studies for promising horizons for production: Sandstone & Limestone Formations in oil fields.

Reference books

1. Asquith, G. and Krygowski, D. 2004. Basic Well Log Analysis. American Association of Petroleum Geologists Methods in Exploration Series, No. 16, 2nd edition.
2. Hilchie, D.W. 1982. Advanced Well Log Interpretation. D.W. Hilchie Inc., Colorado.
3. Schlumberger, 1989. Log Interpretation, Principles/Applications. Schlumberger Educational Services, SMP-7017, Texas.
4. Western Atlas International Inc., 1995. Log Interpretation Charts, Texas, Western Atlas.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

MEG 553: SEISMIC PROSPECTING

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Study Seismic prospective in both petroleum and mineral prospecting.
2. Develop the seismic prospecting methods in geophysical exploration.
3. Develop the theoretical aspects of seismic prospecting and Data Processing Techniques.
4. Use advanced software for computer processing and seismic data interpretation.
5. Recognize 3D- modelling and visualization of geological and geophysical data.

Syllabus

(i). Elements of seismic prospecting and their importance in Oil-Gas exploration. (ii). Stress and strain, seismic waves, Ray-paths in layered media, Seismic velocities, (iii). Reflection and refraction surveying, (iv). Seismic instrumentation, Field procedures, Seismic sources, Seismic Recording system; (v). Seismic Reflection surveys: Time-distance relations for reflected and refracted seismic waves in layered media, (vi). Time correction to seismic traces, Static correction, Velocity analysis, (vii). Filtering of seismic data, (viii). Multichannel reflection, Common Mid-Point (CMP) surveys, (ix). Seismic migration, Seismic Data processing, (x). 3D Seismic Reflection; (xi). Vertical Seismic Profiling, (xii). Structural and Stratigraphical Analysis of seismic reflection data, (xiii). Seismic attributes, (xiv). Seismic refraction surveying, Geometry of refracted ray paths, (xv) 2-Layer, 3-Layer, Multi-Layer & Dipping-layer cases, Irregular interfaces, Construction of wavefronts and Ray-tracing, Hidden-&-Blind-layer problems, (xvi) Methodology of refraction profiling, Field survey & Recording scheme, (xvii). Weathering and elevation corrections; (xviii). Two-ship seismic surveying--combined reflection and refraction surveys; (xix). Scope of seismic surveys in ore prospecting, (xx). Seismic tomography, (xxi) Seismic Stratigraphy, (xxii). Case history.

Reference books

1. Dobrin, M.B. and Savit, C.H. 1988. Introduction to Geophysical Prospecting, 4th edition, McGrawHill, New York.
2. Kearey, P., Brooks, M. and Hill, I. 2002. An Introduction to Geophysical Exploration. 3rd edition, Blackwell Science.
3. Kleyn, A.H. 1983. Seismic Reflection Interpretation, Applied Science Publishers, London.
4. Lavergne, M. 1989. Seismic Methods, Paris.
5. Robinson, E.S. and Courah, C. 1988. Basic Exploration Geophysics, Wiley, New York.
6. Sheriff, R.E. and Geldart, L.P. 1983. Exploration Seismology, Vol. 2, Data Processing and Interpretation. Cambridge University Press.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

MEG 554: RESEARCH PROJECT

Hours per week: 4 (Project) Credits: 6

Learning Outcomes

On completion of this subject the student should be able to:

1. Develop the Geophysical Strategy for Mapping Natural Resources in PNG.
2. Examine the distribution of the Hydrocarbon, Mineral & Geothermal resources in PNG.
3. Assess the distribution of Petroleum-bearing basins in PNG
4. Comprehend the oilfield structures prevalent in PNG
5. Evaluate the Mineral Prospecting scenario for PNG
6. Evaluate Resource mapping techniques in geophysical exploration for Geothermal prospects in PNG.

Syllabus

This subject constitutes part of the Masters program. This is an independent research conducted by each student on a chosen subject in consultation with and supervised by the Lecturing Staff. It can be Laboratory-based or Field-oriented or desk-top Project. Planning & Management of the study is jointly with industry if support is forthcoming. This involves network- familiarity in the field of resource exploration, in particular for energy, geophysical data acquisition, data processing with industry-standard software, and developing interpretation skills. At UNITECH, the student will be encouraged by the Project Supervisor, to look for and subscribe for a Geosoftware, what the Research Committee usually supports, subject to a fixed funding- limit. In return, the student will be expected to demonstrate the use of the software (so subscribed) for his/her thesis work in the Second Year of the Masters program. Since the Research project lasts only one Semester in the First Year, it should be planned to include the following final deliverables:

i) Ability to write a Scientific & Research Report, on a research topic that must necessarily be in the field of Exploration Geophysics,
ii) Present a summary on the latest development in the chosen research field both in the scientific world as well as in its industrial applications in the energy sector,
iii) Ability to present and discuss one's own work to a wide audience. The Applied Physics Department/UNITECH will organize a Departmental Seminar for presentation by the student.

Assessment

Continuous Assessment - 100%

MEG 555: AIRBORNE GEOPHYSICS FOR RESPOURCE EXPLORATION

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Develop the Airborne Geophysics for data acquisition, processing and interpretation for resource mapping in PNG.
2. Evaluate the advanced instrumentation and applications in Airborne Geophysics for on-land & offshore exploration.
3. Use airborne geophysical data for further follow-up and ground- checks in exploration

strategy.

4. Evaluate the principles and concepts for interrelationship for interpreting the airborne geophysical data in reference to geological and environmental problems in PNG.

Syllabus

a) Aero-radioactive Surveys: Scope of radioactivity surveys in mineral exploration; Radioactive decay & radioactive equilibrium; Radioactivity of rocks; Instrumentation; Field procedures; Aero-radioactive prospecting; Case history.

b) Aeromagnetic Surveys: Total Field Magnetometers—Proton, Flux- gate & Optically-pumped; Aeromagnetic survey procedures— Flight height, pattern; Instrument mounting; Sensor ' Bird & Fish'; Signal recording system; Data reduction & corrections; Contoured anomaly maps; Qualitative Interpretation techniques; Quantitative Interpretation – Direct & Indirect Interpretations, Limiting Depth; Upward & Downward continuation of magnetic anomalies, Filtering techniques; Source-body modelling using aeromagnetic anomalies; Aeromagnetic anomaly over selective geologic bodies— Shield areas, Continental Margin, Dikes, Mafic bodies, Iron Ore (Haematite composition); Advantages & disadvantages of aeromagnetic surveys.

c) Airborne-Electromagnetic (EM) Surveys: Surveying systems, Fixed Separation system, Phase measuring (Quadrature) system; Depth- penetration and Efficiency of Airborne EM systems; AFMAG; Airborne Time- Domain EM Input Pulse (TDEM-INPUT) for enhanced signal; Interpretation of Airborne EM anomalies; Real-component Airborne EM anomaly over ore bodies.

Reference books

1. Kearey, P., Brooks, M. and Hill, I. 2002. An Introduction to Geophysical Exploration. 3rd edition, Blackwell Science.
2. Reynolds, J.M. 1997. An Introduction to Applied and Environmental Geophysics. Wiley.
3. Robinson, E.S. and Coruh, C. 1988. Basic Exploration Geophysics, Wiley, New York.
4. Sheriff, R.E. and Geldart, L.P. 1983. Exploration Seismology, Vol. 2: Data Processing and Interpretation. Cambridge Univ. Press.
5. Telford, W.M., Geldart, L.P. and Sheriff, R.E. 1990. Applied Geophysics, 2nd edition, Cambridge Univ. Press.
6. Wait, J. R. 1982. Geo- Electromagnetism. Academic Press, New York.

Assessment

Continuous Assessment - 50%
Written Examination - 50%

MEG 556: SUBSURFACE MAPPING TECHNIQUES IN PETROLEUM EXPLORATION

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Generate contour maps from discrete data points and the practicalities behind computer generated contour mapping.
2. Evaluate structural interpretation involving both 2D & 3D seismic data interpretation on a workstation.
3. Interpretation of horizons and faults by working on grids or volumes of data, rather than interpreting single lines.
4. Recognize the structural Geology to study Fault mechanics (fault/fracture meshes, and classification of faults).
5. Use basic principles of structural geology with a focus on the main structural geometries seen on seismic data and in outcrop oil industry.
6. Comprehend the structural styles associated with extension, compression, inversion and strike- slip or salt tectonics.

Syllabus

(i) Objectives of sub-surface mapping (ii). Subsurface Maps & Directional Surveys, (v). Correlation Techniques, (vi). Integration of Well Log and Seismic Data in Subsurface Mapping, (vii). Cross Sections, (viii). Fault Maps, (ix). Structure Maps, (x). Interpretation of Three-Dimensional Seismic Data, (xi). Compressional Structures: Balancing and Interpretation, (xii). Extensional Structures: Balancing and

Interpretation, (xiii). Strike-Slip Faults and Associated Structures, (xiv). GrowthStructures, (xv). Isochore and Isopach Maps: Thickness/Facies/Trend Surface/Trend Surface Residual Maps, (xvi). Formation Fluid Interpretation.

Reference books

1. Evenick, J. C. 2008, Introduction to Well Logs and Subsurface Maps, ISBN10 1-59370-138-1
2. Hyne, N.J. 2012. Nontechnical Guide to Petroleum Geology, Exploration, Drilling, and Production (3rd Edition), ISBN-13: 978-1593702694
3. Tearpock, D. J. and Bischke, R. E. 2005. Applied Subsurface Geological Mapping with Structural Methods (2nd edition), ISBN-13: 9780132441681

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

MEG 557: PETROPHYSICS & CARBONATE RESERVOIR CHARACTERIZATION

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Analyse advanced borehole geophysics tools and rock classification methods for both petroleum and groundwater exploration.
2. Evaluate the carbonate reservoirs from clastic sandstone reservoirs.
3. Analyse the geology and the petrophysics of the rocks that contain boreholes.
4. Develop data types and different aspects of carbonate for potential reservoirs.
5. Develop techniques to obtain data from carbonate reservoirs.
6. Analyse systematize data and interpret to build a geological reservoir model for carbonate reservoirs.

Syllabus

This course covers the major rock physics methods used in geophysical data interpretation; it has the following main components:
(a). Relations between rock properties, fluid type and distribution & seismic waves. A review of rocks (sedimentary, igneous and metamorphic), Physical properties of rocks and fluids that affect the distribution and movement of fluids such as oil, gas, water or contaminants in porous media. (b). Porosity of Reservoir rocks: Constitution of Sandstone, Pores within reservoir rocks, Compressibility of reservoir rocks, Fluid saturation in reservoir rocks. (c). Permeability of Reservoir Rocks: Darcy's Law for anisotropic porous media, Gas Permeability and Slippage Effect, Influencing Factors for Rock Permeability, Permeability of Fractured and Vuggy Rocks, Relative Permeability, Applications of Relative Permeability Curve, Surface and interfacial tension, Wettability and Viscosity, Sensibility of Sandstone Reservoir Rocks. (d). Concept of Capillary Pressure, calculating Capillary Pressure Curves, & their Applications. (e). Other Petrophysical Properties of Reservoir Rocks: Electrical Conductivity of Fluids-Bearing Rocks, Thermal Properties of Reservoir Rocks, Acoustic Characteristics of Reservoir Rocks. (f). Carbonate Reservoir Characterization: covers carbonate depositional textures, diagenesis, permeability and porosity, reservoir compartmentalization

Reference books

1. Hu, X., Hu, S., Jin, F. and Huang, S. 2017. Physics of Petroleum Reservoirs, Springer.
2. Tiab, D. and Donaldson, E. C. 2015. Petrophysics: Theory & Practice of Measuring Reservoir Rock and Fluid Transport Properties. 4th edition, Elsevier.
3. Yang, Senglai. 2017. Fundamentals of Petrophysics, Springer.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

MEG558: GEOPHYSICAL PROSPECTING – I

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Use potential field methods for Mineral and Geothermal exploration and their related physical properties of rocks.
2. Apply Gravity and Magnetic data acquisition techniques for high- precision surveys.
3. Appraise Gravity and Magnetic data modeling & interpretation using commercially available software; like GEOSOFT.
4. Comprehend and analyze potential field data for integrated modeling in order to explore natural resources like; Hydrocarbons, Minerals & Geothermal Reserves.
5. Value the physical properties of rocks for use in different exploration techniques.
6. Evaluate and include gravity, magnetic & SP data and maps into broader exploration, or geological projects.

Syllabus

(a). Role of geophysics in ore prospecting; General aspects on collection and presentation of geophysical data for mining districts; Preliminary geologic information; Trial Surveys; Staking an area; Selecting the geophysical methodology.

(b). Magnetic method: Fundamental concepts, Permanent magnetization of rocks, Measuring susceptibility & remanence, Geomagnetic Field components; Magnetometers; Field surveys; The Zero-level; An ore body as a magnet; Interpretation of magnetic anomalies; Vertical field anomaly over sulphide ores; Geometric construction for determining the position of an ore- sheet; Depth estimates; Vector measurements.

©. Gravity method: Scope of gravity method in ore prospecting; Gravimeters; Field Procedure; Corrections to gravity data; Boguer anomalies; Density determination; Interpretation of gravity anomalies; Key variables in gravity interpretation; Bouguer anomaly pattern due to simple structures; Regional-Local anomalies; Effect of overburden on gravity anomalies; 2D- and 3D-gravity modelling; Estimation of ore mass using Gauss's theorem; Second Vertical derivative of gravity anomalies; Depth estimates; Underground and shaft- gravity measurements.

(d). Self-Potential (SP) method; Measuring SP; Field procedures; Example of SP surveys.

Reference books

1. Dobrin, M.B. and Savit, C.H. 1988. Introduction to Geophysical Prospecting, 4th edition, McGrawHill, New York.
2. Kearey, P., Brooks, M. and Hill, I. 2002. An Introduction to Geophysical Exploration. 3rd edition, Blackwell Science.
3. Nettleton, L.L., 1971. Gravity and Magnetics for Geologists and Seismologists. Monograph Series 1, Society of Exploration Geophysicists, Tulsa.
4. Nettleton, L.L. 1976. Gravity and Magnetics in Oil Exploration. McGraw-Hill, New York.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

MEG 559: GEOPHYSICAL PROSPECTING – II

Hours per week: 4 (3 Lectures + 1 Practical)

Credits: 15

Learning Outcomes

On completion of this subject the student should be able to:

1. Use multiple geophysical techniques, mainly, Electromagnetic (EM) and Seismic.
2. Develop a comprehensive understanding on EM and Seismic to search for hydrocarbons and mineral deposits at greater depths.
3. Operate the relevant techniques to perform sound survey design adoptable to variable geologic environment: basins, undulating topography, fold & thrust belts, volcanic fields etc. which are common to PNG.
4. Interpret and analyze the Electrical, EM & Seismic data in natural resource mapping.

Syllabus

(a). Electrical method: Resistivity; Resistivity of rocks and minerals; Resistivitymeters; Field measurements—Electrical sounding, Line-Electrode mapping; Mis-A'-La- Masse method; Data Interpretation. (b). Induced Polarization method: Origin of I.P., Time- and Frequency- domain I.P. methods; Measuring the I. P. effect; Polarizability of minerals and rocks, Case history; Interpretation of I.P. results. (c). Electromagnetic (EM) method: Geometry of EM field; Tilt-angle method; Amplitude & Phase; Phase angle & Vector diagram; Real

and Imaginary components; Classification of EM methods – Loop layouts, Moving Source-Receiver methods; Use of two frequencies in EM prospecting; Depth penetration; AFMAG; Distortion of anomalies due to magnetic permeability. (d). Seismic method: Elastic waves; Scope of seismic surveys in ore prospecting; Seismic source; Reflection and Refraction methods; Seismic interpretation, Case history of seismic surveys in different geologic settings.

Reference books

1. Eppelbaum, L. and Khasin, B. 2012. Mining Geophysics. In: Geophysical studies in the Caucausus, Lecture Notes in Earth System Science, p. 219-274.
2. Kaufman, A. and Hansen, R. 2007. Principles of Gravitational Method, Series: Methods in Geochemistry and Geophysics, Vol. 41.
3. Kaufman, A. Hansen, R. and Kleinberg, R. 2008. Principles of the Magnetic Methods in Geophysics. Series: Methods in Geochemistry and Geophysics, Vol. 42.
4. Kaufman, A. Aleekseev, D. and Oristaglio, M. 2014. Principles of Electromagnetic Surveys in Surface Geophysics. Series: Methods in Geochemistry & Geophysics, Vol. 45.
5. Parasnis, D. S. 1984. Mining Geophysics, 2nd edition, Elseveier.
6. Sumner, J. S. 1976. Principles of Induced Polarization for Geophysical Exploration. Elsevier, Amsterdam.
7. Ward, S.H. 1987. Electrical Methods in Geophysical Prospecting. In: Methods of Experimental Physics, Vol. 24, Part B – Field Measurements, 265-375. Academic Press, Orlando.

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

MEG 560: INDUSTRIAL TRAINING

Hours per week: 4 (Industrial Training)

Credits: 6

Learning Outcomes

On completion of this subject the student should be able to:

1. Operate various geophysical exploration methods used in a selected industry – Oil/Mineral/Geothermal Power- production.
2. Use exploration techniques for both planning and execution of exploration strategy.
3. Interpret the geophysical signal for resource location in the subsurface.
4. Appraise computer-based software modelling and data interpretation.
5. Develop hands-on experience through the field work, preparing project reports.

Syllabus

Geophysics is the remote study of the Earth's interior through physical techniques – principally analyzing seismic data, but also applying gravity, magnetic, electrical and electromagnetic methods. It is a key element of oil-gas and mineral exploration investigations. This course prepares a student to embark on a career in resource exploration. While the Classroom teaching at UNITECH can firmly establish the theoretical basis in different disciplines of Exploration Geophysics, strong links to industry are essential for a student to complete the scope of learning. This is possible only by Industrial Training, where, the student gains hands-on experience with a broad range of practical skills, underpinned by a theoretical understanding to prepare him/her to become a professional in the chosen field.

The MEG Course Curriculum illustrates that such chosen field can truly be versatile: Airborne Geophysical Surveys, Seismic & Gravity-Magnetic mapping, to Well Log in the drilled holes in oil-gas fields. Such industry training knowledge therefore can be gathered by a student from an actual operation in Oil-Gas Fields, or from the Processing & Interpretation Units of the Oil Companies, or from Geophysical Mapping Agencies, like Mineral Resources Authority.

The Post-Graduate Course Coordinator in Applied Physics Department together with the Applied Physics department will organize the Industrial Training for students. On completion of the Industrial Training, the student will be submitting a written Project Report to the PG Coordinator for evaluation by the Thesis Supervisor.

Assessment

Continuous Assessment - 100%

MEG 561: THESIS (DISSERTATION)

Hours per week: 16 (Thesis) Credits: 24

Learning Outcomes

On completion of this subject the student should be able to:

1. Identify, select and develop a research topic that i s relevant to the area of specialization.
2. Carry out literature surveys related to the selected topics and identify the knowledge gaps.
3. Undertake the research to complete the thesis on time.
4. Present the report of the research in the form of a written dissertation

Syllabus

The student, under the supervision of the Graduate Supervisor, undertakes and completes a research topic that comprises an in-depth investigation of a specific problem relating to any exploration-oriented problem in Petroleum/Mineral/Geothermal Exploration. It is highly recommended that the Thesis work is undertaken in collaboration with industry or a regulatory body in PNG but must be carried out rather independently by a student.

Though the Thesis work will be overseen by the Supervisor but the onus will be on the student to develop and execute the work program and to liaise with the Petroleum/Mineral/Geothermal Power Production industry, as appropriate.

The final written thesis will be assessed by two external Examiners while the oral presentation is done at the PG seminar.

Assessment

Continuous Assessment - 100%

LIST OF EXPERIMENTS FOR SOME OF THE SUBJECTS TO BE TAUGHT

MEG 551: GRAVITY-MAGNETIC EXPLORATION

1. Base Tie procedures in Gravity Field Surveys to estimate Gravimeter Drift correction
2. Computing Free-air and Bouguer corrections at a field station
3. Preparing the Contoured Bouguer anomaly map & profile interpretation
4. Regional-residual separation of Bouguer anomalies
5. Depth interpretation for a Salt Dome using gravity anomalies
6. Geomagnetic Field Components and their variations
7. To study the Magnetic Total Intensity and Inclination Angle for Papua New Guinea
8. Estimating the Diurnal Correction from Ground Magnetic data
9. Computing the Second Vertical Derivatives from observed magnetic anomalies
10. Downward continuation of magnetic anomalies
11. Studying magnetic susceptibility for common rocks Depth interpretation using magnetic anomalies

MEG 552: INTERPRETATION OF WELL LOGS

1. Borehole environment correction to Resistivity log for finding True Resistivity (R_t) by using Tornado/Butterfly chart.
2. Determination of a, m and n parameters. a (Archie's factor), m (cementation factor) and n (saturation index)
3. Determination of Formation factor (Rw) from SP log, 100% water bearing reservoir and directly from water sample collected by Logging tool
4. Shale Volume calculation from SP, Gamma Ray, sonic and density etc.
5. Porosity determination from density and sonic log
6. Determination of effective porosity from Cross-plot of bulk density and neutron porosity
7. Water Saturation by using: Archie, Waxman – Smits-Thomas (WST), Dual water (DW), Indonesia
8. Residual water saturation from Rxo log and finding movable hydrocarbon
9. Determination of permeability from porosity log
10. Locate the Hydrocarbon pay and gas bearing reservoir from Logs.

MEG 553: SEISMIC PROSPECTING

1. Animation of Body and Surface waves
2. Time-distance curve plotting from reflection and refraction data

3. Elevation and weathering correction on the basis of given model
4. CDP (common depth point) stack data acquisition using Signal enhancement seismograph.
5. Study of field reflection seismic records acquired for various spread configuration.
6. Study the noise test records
7. Construction of CDP stacking chart
8. Study of zero offset VSP records and identification of down going, up going and multiple events.

MEG 555: AIRBORNE GEOPHYSICS FOR RESOURCE EXPLORATION

1. Field Instrumentation in Aeroradioactivity surveying
2. To study & interpret Aeroradioactivity anomalies in mineral prospecting
3. Qualitative interpretation of Aeromagnetic anomalies
4. Downward continuation of Aeromagnetic anomalies & their application
5. Source-body modelling using Aeromagnetic anomalies
6. Interpreting Aeromagnetic anomalies for selective continental margins in PNG
7. Phase-measuring Quadrature system in airborne EM surveys
8. AFMAG
9. Studying Depth-penetration of airborne EM anomalies
10. Real-component Airborne EM anomalies for ore bodies

MEG 556: SUBSURFACE MAPPING TECHNIQUES IN PETROLEUM EXPLORATION

Techniques for producing subsurface maps:

1. Methods for preparing Contoured maps with subsurface data
2. Correlation techniques between the wells
3. Steps to integrate well log and seismic data
4. How to prepare a Cross-section for the subsurface
5. Fault mapping techniques
6. Compressional structures: Balancing & Interpretation – I

MEG 557: PETROPHYSICS & CARBONATE RESERVOIR CHARACTERIZATION

1. Relation between rock properties
2. Determining Porosity of reservoir rocks
3. Determining Permeability of reservoir rocks
4. Relative Permeability curve & its significance
5. Reservoir Characterization Techniques & Case History
6. Reservoir Compartmentalization Techniques & Case History

MEG 558: GEOPHYSICAL PROSPECTING – I

1. Methods for collection & presentation of geophysical data for a Mining District
2. Magnetic susceptibility for common rocks
3. Ground Magnetic survey Field Procedures in Mineral Exploration
4. Depth determination for sulphide ore body using magnetic anomaly
5. Geometric construction of an ore- sheet in the subsurface
6. Exploration Gravity survey—field procedures
7. Preparing Residual Bouguer anomaly map for an ore body
8. 2D-gravity modeling for a simple geologic body
9. Estimation of Ore Mass from Residual gravity by using Gauss's theorem
10. SP-anomaly over sulphide ore body.

MEG 559: GEOPHYSICAL PROSPECTING – II

1. Electrical resistivity sounding – field Array
2. Interpreting Sounding data
3. Mis-A'-La-Masse Field method & Data Interpretation
4. Lop Layout in EM field surveys
5. Tilt-angle EM – Field arrangement
6. Interpreting Tilt-angle data & Case history
7. Seismic survey field arrangement in mineral exploration
8. Studying case history for Ore prospecting by seismic surveys.

DEPARTMENT OF BUSINESS STUDIES

- MASTER OF EXECUTIVE BUSINESS ADMINISTRATION (EMBA)

- MASTER OF BUSINESS ADMINISTRATION (MBA)

DEPARTMENT OF BUSINESS STUDIES

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Kupil Kenzak
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Mr Tombe Neherts
Lecturer
LLB (UPNG)

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IT SECTION

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Professor
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Study Leave - NZ

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Mphil Student (PNGUoT)

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THE EXECUTIVE MASTER OF BUSINESS ADMINISTRATION (EMBA)

Introduction

Department of Business Studies (DBS) has successfully offered the Executive Master of Business Administration (EMBA) degree program from 2013 onwards. By the beginning of 2020, the program will enroll the 8th batch of students, The EMBA degree program is specifically designed to groom, up-skill, mentor and prepare employees in middle-management positions in both the public and private sectors to be competent and avid managers, as they progress upwards in any hierarchical structure of the organizations' human resource pool. The program is the University's flagship in executive business education. It is in this sense the pinnacle of all degree programs from the perspective of job-oriented training offered within the DBS. The EMBA program is quite unique in the sense that it blends the best of world's renowned universities' executive business education with local and regional business settings and practice. Whilst its main focus is on the mentoring of those who will be in the forefront of government business and private enterprise, the program is also able to play a inductive role in those who will be charged with more social and community development oriented organizations such as non-governmental organizations, faith-based organizations, community-based organizations, multi-lateral development organizations, etc., This EMBA program is also geared to empower upcoming entrepreneurs to be more board-minded and vigilant in their approach to brokering deals, managing relationships, scheduling commitments, etc. in view of globalization, the advent of technology and rapid proliferation of the development and the availability of innovations in communication and technology. This program is offered more from a pragmatic perspective rather than from a theoretical perspective. That is why; there is great care in the deliberation of actual cases study and fostering a conducive atmosphere to elicit experiences of students to test various business case studies, models, paradigms and invigorated mindsets. The DBS is continuing to review the EMBA degree program by seeking experiences, practices of leading universities around the world to add luster, credence and meaning to executive business education by PNG's leading technology University. In particular, the review is considering both the relevance and appeal of some of the leading American Business School's MBA degree programs, the Australian Graduate School of Management's MBA degree program, and other leading Australian and New Zealand Universities' MBA degree programs. PNG is described as a country with vast contrasts, and so is the business environment, the interplay of politics and culture, where the British legal system is deemed universally inadequate thus allowing for the recognition of customary law, where the enforcement of legal contracts is not purely straightforward as the textbooks seem to assume. Conducting business in PNG is complex, then the EMBA degree program allows for the blending of these peculiarities in modern business education. This makes this EMBA degree program more unique and is very relevant for those intending to work and conduct business in more complex environments where there are conceivable limitations to the application of standard text book principles and British Common Law.

The EMBA program can be completed in 14 months if two Subjects are studied per session. Alternatively, it can be completed in 28 months if one subject is studied per session. The academic year is partitioned into seven (7) Sessions; and it starts in February. There are 14 subjects to be studied in the EMBA Degree Program (9 Core, 4 Electives and 1 Capstone). As the program is geared towards accommodating the needs of the stressed and time-conscious workplace, the program has been sequenced to allow for employees to take evening classes after normal work hours during week days. Each session constitutes four weeks, and for each Subject there are two evening classes (5.30 p.m. - 9.00 p.m.) each week (e.g. Subject M1: Monday/Wednesday: 5.30 p.m. – 9.00 pm; and Subject M2: Tuesday/Thursday: 5.30 p.m. – 9.00 p.m.). Each student is allowed to study a maximum of two subjects per session.

Program Objectives

To develop EMBA degree program graduates with diverse managerial skill sets and perspectives needed to work effectively in a variety of situations and contexts.

- To enhance EMBA graduates' strategic, innovative and critical thinking capabilities required to address organizational challenges in today's highly competitive and dynamic environment.
- To provide rigorous and comprehensive professional development that combines knowledge of the state-of-the-art strategic frameworks, global outlook, and extensive experience, which are needed to take advantages of opportunities in an increasingly complex and global environment.
- To develop resourceful professional managers with competent leadership and ethical skills required for organizations to achieve a competitive advantage in the marketplace.
- To enhance collaborative and networking opportunities with other experienced professionals.
- Analyze multi-dimensional, complex business challenges, and develop innovative strategies/solutions through integration of various disciplinary fields in the context of relevant work places.

Program Learning Outcomes

On successful completion of this EMBA program, students should be able to

- Describe the dynamic nature of business and the role of strategy in generating and sustaining competitive advantage.
- Gain a comparative world-class management education without leaving a great job.
- Apply the relevant knowledge and skills to the workplace for the benefit of the organization and/or employer.
- Enhance self-confidence to develop a strategic perspective and firm grounding in advanced corporate management and leadership.
- Analyze the work and business limitations to manage issues and situations that are likely to significantly impact the core businesses
- Competently mentor those around in the organization and/or in the team
- Support both the management and governance levels the insightful added advantage of having to subject proposals and plans through a barrage of tests.

Admission Requirements

Because this is the University's Special Post-Graduate Program, (as the phrase "Flagship Program") the entry requirement differs from the Rules of the course-based Master degree programs of the University. The requirements are as follows: (a) The student must have a minimum Bachelor degree in any field of study, and (b) the student must have held a senior/middle management position for a minimum 3 years; or have had five years of cumulative work experience in any established employer (recognized by law), or (c) if self-employed they must have had three years of owner-management experience and produce their companies' both the Certificate of Incorporation and/or Registration of Business Name from the Investment Promotion Authority and a transcript of their companies'' main bank account for the previous month.

To complete the EMBA program, 14 Subjects are taken amounting to a total of 126 credit points. Its break-up is as follows:

- Core subjects (9 subjects) 81 credit points
- Elective subjects (4 subjects) 36 credit points
- Capstone subject (Strategic Management) 9 credits points

Structure of the EMBA Program

The core, electives and capstone subjects are shown below.

Core & Capstone (in Italics) Subjects	Contact Hrs. Per Week	Credit Points
EMBA504: Marketing Management	8	9
EMBA505: Financial Management	8	9
EMBA506: Managing People & Organizations	8	9
EMBA514 Operations Management	8	9
EMBA523: Business Ethics & Corporate Governance	8	9
EMBA526: Human Resource Management	8	9
EMBA528: Quantitative Methods	8	9
EMBA537 Economics for Managers	8	9
EMBA542: Managing ICT-Enable Transformation	8	9
All Core Subjects: 9	8x 9 = 72	9 x 9 = 81
Capstone Subject		
EMBA544 Strategic Management	8	9
Capstone Subject	1x8 = 8	1 x 9 = 9
Core + Capstone Subjects	72 + 8 = 80	81+ 9 = 90

Electives by Stream of Concentration	Contact Hrs. per Week	Credit Points
EMBA515: Project Management	8	9
EMBA516: International Management	8	9
EMBA517: Global Strategy & Competitiveness	8	9
EMBA518: Change Management	8	9
EMBA520 Investment Analysis & Portfolio Management	8	9
EMBA541 Public Policy Management	8	9
Required for Stream: 4 Subjects	4 x 8 = 32	4 x 9 = 36
Subjects for satisfactory Completion	Contact Hrs. Per Week	Credit Points
Core + Capstone Subjects	(8 x 9) + (8x1) = 80	(9x9) + (1x9) = 90
Required for Stream: 4 Subjects	4 x 8 = 32	4 x 9 = 36
ALL REQUIRED	80 + 32 = 112	90 +36= 126

SUBJECT DETAILS

EMBA504: Marketing Management

Hours per week: 8 *Credit points: 9*

Learning Outcome

On completion of this subject, the student will be able to:

- Demonstrate an understanding of the critical role of Marketing Management to business competitiveness;
- Apply the basic tools and techniques for Marketing Management;

- Articulate the contribution of marketing activities in delivering value to the consumer and to stakeholders;
- Conduct a market analysis and appreciate the 'science' behind marketing decisions; and develop and appreciate the challenges in the implementation of marketing plans;
- Analyze, evaluate and design customer–oriented, completive marketing mix strategies on product, price, promotion and distribution in an organization; and
- Synthesize through a group project, an in-depth examination of a selected topic related to Marketing Management showing mastering of knowledge acquired during the Session.

Syllabus

This subject provides an understanding of the application of marketing theories, concepts, and practices as they relate to the management of the marketing function in a complex organization. Emphasis will be on the managerial aspects of marketing plans, including analysis of the external environment. A key element of the subject will include the relationship of the "marketing mix" to strategic planning. A clear understanding of the importance of marketing, as well as a grasp of effective marketing practices, will be examined. Students will gain a working knowledge of both marketing theory and the practical application of innovative marketing strategies. They will also come to understand how product, price, place, and promotion contribute to the marketing mix as they explore research-based insights into consumer behavior.

Textbook(s)

[1]. Kotler, P.T. and Keller, K.L. (2016). *Marketing Management*. Prentice Hall (15th Edition). Australia.

Assessments

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA505: Financial Management

Hours per week: 8 *Credit points: 9*

Leaning Outcomes

On completion of this subject, the student will be able to:

- Employ the current practical methods used in making financial management decisions;
- Assess the relevance of developments in financial management theory to an enterprise; and employ theoretical models to make appropriate financial management decisions;
- Select the techniques most appropriate to optimize the employment of resources including the most effective method of financing the acquisition of fixed assets;
- Explain the operation of the financial systems, with reference to Papua New Guinea, and evaluate alternative sources of finance and assess investment opportunities; and
- Communicate the consequences of financial management decisions to accountants or non-accountants.

Syllabus

The aim of this subject is to introduce the fundamentals of financial management. It focuses on the financial objectives, which deal with investments, financing and other decisions. It also covers working capital management and capital budgeting techniques employed by finance managers to assist them in making short term financing and long-term investing decisions respectively. This subject introduces critical understanding of the theories and models developed to facilitate the financial management of organizations.

Textbook(s)

[1]. Titman, S., Martin, T., Keown, A.J., and Martin, J.D. (2018). *Financial Management: Principles and Applications* (12th Edition). Pearson, ISBN: 0134417216, 9780134417219.

Assessment

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA506: Managing People & Organizations

Hours per week: 8 *Credit points: 9*

Learning Outcomes

Upon completion of this subject the student will be able to:

- Assess the managerial context of organizational behavior;
- Analyze the individual processes, interpersonal aspects of the groups and the macro/system-wide aspects of organizational behavior in organizations;
- Predict the influence of individuals' and groups' psychology on the forms and functions of organizations;
- Apply theory to dilemmas and issues likely to confront managers today and in the future;
- Apply interpersonal skills necessary to operate as an effective manager for competitive advantage; and
- Write a case project on a topic related to managing people and organizations to show mastering of knowledge acquired during the subject's study.

Syllabus

The main contents may include Introduction to Organizational Behavior; the Individual Processes and Behavior; The Interpersonal Processes and Group Behavior; the Organizational Systems, Processes and Characteristics.

Textbook(s)

[1]. Colquitt, J., LePine, J., and Wesson, M., (2015). Organizational Behavior: Improving Performance and Commitment in the Workplace (4th Edition). McGraw-Hill Education [ISBN: 10-1259545091; 13- 978-1259545092]

[2]. Griffin, R.W. and Moorhead, G. (2014). Organizational Behavior: Managing People and Organisations (11th Edition). Cengage Learning [ISBN: 1111525595, 9781111525590]

[3]. Robbins, S.P., and Judge, T.A. (2019). Organizational Behavior (18th Edition). Pearson Education Ltd [ISBN: 0273719440, 9780273719441]

In addition, the instructor will make references and provide additional reading materials to students as deemed necessary.

Assessment

Continuous Assessment:	60%
Final Examination:	40%
Total:	100%

EMBA514 Operations Management

Hours per week: 8 *Credit points: 9*

Learning Outcomes

On completion of this, the student will be able to:

- Analyze critical role of Operations Management (OM) to sustain business competitiveness;
- Apply the basic tools and techniques for OM;
- Evaluate critically any organization's approaches to the design of its products, processes and services in PNG;
- Appraise the various capacity and production planning control problems facing any organization in PNG;
- Explain a systematic view of key aspects of Supply Chain Management, JIT/LEAN and Total Quality Management philosophies;
- Apply concepts and processes into practice through case studies, exercises, Internet exercises and discussion questions; and
- Synthesize through a group project, an in-depth examination of a selected topic related to production and operations management, to show mastering of knowledge acquired during the semester.

Syllabus

The main topics may include, but not limited: Competitiveness, Strategy and Productivity; Forecasting; Aggregate Planning; Operations

Scheduling; Inventory Management; Total Quality Management; Supply Chain Management; MRP/ERP; JIT/LEAN systems; and future trends in production and operations management. This subject will emphasize the importance of properly managed manufacturing or service operations as a competitive weapon.

Textbook(s)

[1]. Heizer, J. and Render, B. (2016). *Operations Management*. Operations Management: Sustainability and Supply Chain Management (12th Edition). Pearson Education Ltd

Assessment

Continuous Assessment:	60%
Examination or Project:	40%
Total	100%

EMBA523: Business Ethics & Corporate Governance

Hours per week: 8 *Credit points: 9*

Learning Outcomes

On completion of the subject, the student will be able to:

- Compare and analyze the corporate governance issues involved in business and the workplace;
- Compare and analyze the role of stakeholders and corporate managers' moral obligations in business decision making;
- Apply regulatory requirements to develop appropriate board and committee functions and structures;
- Apply corporate governance best practice principles and recommendations to achieve appropriate business practice;
- Analyze and explain economic, social and environmental sustainability issues relating to business practice.

Syllabus

The course aims to develop an understanding of the underlying concepts of Corporate Governance, business ethics and corporate social responsibility (CSR) which are relevant to the contemporary business environment. It is designed to foster students' understanding of the ethical influences on economic, financial, managerial, and environmental aspects of business. The course further aims to develop a student's ability to critically analyze ethical issues in business. This course reviews different regulatory processes essential to the understanding of the principles of corporate governance in Australia.

The main contents include the concepts, essential principles and stakeholders of corporate governance; CSR, citizenship and performance; board and committee functions and structures and company officers' training, induction, and behavior; corporate governance in Australia: background and regulations principles of good corporate governance and corporate disclosure requirements; corporate governance disclosure in practice; future directions for corporate governance and considerations in corporate decision-making

Textbook(s)

The lecturer will announce it before class.

Assessments

Continuous Assessment:	50%
Final Examination:	50%
Total:	100%

EMBA526: Human Resource Management

Hours per week: 8 *Credit points: 9*

Learning Outcomes

Upon completion of this subject the student will be able to:

- Play the critical and strategic role of Human Resource Management (HRM) in business competitiveness;
- Implement the various HRM best practices in compliance with legal requirements;
- Link HRM to company/institutional performance and strategies for organizational effectiveness;

- Analyze critically an organization's approaches to the design of its HRM policies and practices;
- Apply basic HR planning, staffing, training and development, performance management, compensation, health and safety, and employee and labour relations strategies to achieve overall business objectives; and
- Write a case project on a topic related to HRM to show mastering of knowledge acquired during the subject.

Syllabus

It is becoming increasingly important for both managers and employees on every level of the organization to espouse the core HRM elements/functions and linking HRM to the organization's strategic business objectives in view (a) turbulent business climate, caused by increased global competition, changing technologies, changing employment legislation and (b) changing workforce composition, which is posing a challenge to managers to manage their employees more effectively in the search for sustainable competitive advantage. Furthermore, studying the subject also will give students an in-depth understanding of important contemporary developments in various areas of HR Management. Students will critically analyze the relationship between strategy and core HRM activities in attracting, maintaining and retaining the organization's human capital.

The main topics may include, but not limited: HRM Overview, Strategic HRM HR Planning, Recruitment and Selection, Appraising and Managing performance Training, Employee Development, Employee Compensation and Benefits, Employee Health and Safety, Employment Relations, Managing HR Globally, Evaluation of HRM Effectiveness.

Textbook(s)

[1] Mondy, R.W. and Martocchio, J. J. (2016). *Human Resource Management*. Pearson Education (14th Edition). [ISBN: 13-9780133848809]

[2] Noe, R.A. (2015). *Human Resource Management*: *Gaining a Competitive Advantage* (9th Edition). Irwin/McGraw-Hill. [ISBN: 0072285184, 9780072285185]

Assessment

Continuous Assessment:	60%
Examination or Project:	40%
Total:	100%

MBA528: Quantitative Methods

Hours per week: 8 Credit points: 9

Learning Outcomes

On completion of this subject, the student will be able to:

- Demonstrate the understanding of how to formulate real-world problems as a mathematical programming model;
- Develop skills in structuring and analyzing business decision problem in quantitative analysis;
- Formulate answers to common business decision problems;
- Analyze critically and apply tools of quantitative analysis to improve business decision-making; and
- Implement and solve the models using computer applications.

Syllabus

The Subject introduces the student to the various techniques used in quantitative methods by applying mathematical models that represent real-world business problem using deterministic models (i.e. model without uncertainty- which mainly includes topics: linear programming, simplex methods, transportation models, network, integer, and non-linear models) and probabilistic models (i.e. introduces uncertainty or randomness- which includes topics such as game theory, PERT-CPM, Inventory model, Markovian decision process, queuing models and simulation) in application of these techniques in areas such as production, marketing, finance and services.

Textbook(s)

[1]. Render, Stair, R.M., Hanna, M.E., Hale, T.S. (2017) *Quantitative Analysis for Management* (13th Edition). Pearson Education Ltd [ISBN: 0134543459, 9780134543451]

Assessments

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA537 Economics for Managers

Hours per week: 8 Credit points: 9

Learning Outcomes

On completion of this subject, the student will be able to:

- Explain the application of economic theories that are relevant to many facets of modern business and not-for-profit decision-making;
- Evaluate the nature of debates that permeate the political, economic, and industry leaders, including the efficacy of monetary and fiscal policies;
- Assess the emerging globalization of production, investments, and trade in the world economy;
- Analyze the current problems of development, underdevelopment, and poverty; and
- Demonstrate the use of information technology in researching, analyzing, and presenting economic data in class.

Syllabus

The main topics may include managers and economics; demand-supply and equilibrium prices; demand elasticities; consumer demand and behavior; production and cost analysis; market structure; pricing strategies of firms; measuring macroeconomic activity; spending by individuals, firms and governments; role of money in the macro-economy; international trade and balance of payment issues in the macro economy. The subject also deals with the application of economic methodologies and principles needed to optimize the utilization of scarce resources.

Textbook(s)

[1]. Farnham, P. G. (2013). *Economics for Managers* (3rd Edition). Pearson Education Ltd [ISBN: 1292077786, 9781292077789].

Assessments

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA542: Managing ICT-Enabled Transformation

Hours per week: 8 Credit points: 9

Leaning Outcomes

On completion of this subject, the student will be able to:

- Use ICT effectively and appropriately to access, create and communicate information and ideas;
- Solve problems and work collaboratively in all learning areas;
- Apply most digital technologies studied to the organization where working,
- Adapt to new ways of doing things as technologies evolve and limit the risks to themselves and others in a digital environment.
- Develop capability in using ICT for tasks associated with information access and management, information creation and presentation, problem-solving, decision-making, communication, creative expression and empirical reasoning.

Syllabus

The topics may include ICT in the 21's Century; Business Intelligence and Decision Support Systems (Including AI); E-Commerce and Management; Managing Knowledge; Securing Information Systems and Cyber security; Web Services and

Management; Managing ICT-Enabled Transformation of Tertiary Education; Open Source Software and MOOC for PNG Universities; Social Computing and Mobile Computing; Big data, Analytics and Intelligence; Digital Transformation, Emerging Science and Technology.

Textbook(s)

[1]. Laudon, K. and Laudon, J. (2017). (15th Edition). *Management Information Systems- Managing Digital Firm*. Published by Pearson Education. [ISBN: 0134639952, 9780134639956]

Additional Resources

[1]. Bounfour, A. (2016). *Digital Futures, Digital Transformation, Progress in IS*. Springer International Publishing. [ISBN: 978-3-319-23278-2]

[2]. Dr. Zhaohao Sun's Lecture notes and other teaching materials

[3]. World Economic Forum Digital Transformation Initiative (DTI) website. http://reports.weforum.org/digital transformation. Accessed September 12, 2019.

Assessment

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA544: Strategic Management

Hours per week: 8 *Credit points: 9*

Learning Outcomes

On completion of this subject, the student will be able to:

- Play the critical role of strategic management in the long-term sustainability of any organization;
- Relate the conceptual knowledge of strategic management concepts to formulate and implement various strategic choices;
- Analyze critically an organization's strategic mix, its policies and practices;
- Apply various strategic frameworks and tools when conducting a situational analysis of external and internal factors facing a particular organization, and available alternative business strategies; and
- Write a Business Plan on a real-life PNG organization's intent to enter a particular foreign market(s), as a means to demonstrate mastery of knowledge acquired during the semester.

Syllabus

The main topics may include Introduction to Strategic Management; evaluating a Firm's External Environment; Internal Environment Analysis; Business Level Strategy; Corporate Level Strategy; Strategies for Diversified Organizations; International Strategy; Strategic Leadership; Corporate Governance; Organizational Support for Strategy Execution, and Strategy Evaluation.

The subject is designed to give students a thorough understanding of the complexities surrounding strategic formulation, market positioning, implementation, and evaluation processes, with special attention to capabilities and competencies required to be developed by organizations in particular competitive environments.

Textbook(s)

[1]. Johnson, G., Whittington, R., Angwin, D., Regner, P., and Scholes, K., (2017). Exploring Strategy: Text and Cases. (11th Edition). Financial Times Prentice Hall. [ISBN: 0273731564, 9780273731566]

Assessment

Continuous Assessment:	60%
Examination or Project:	40%
Total	100%

ELECTIVE SUBJECTS

EMBA515: Project Management

Hours per week: 8 *Credit points: 9*

Learning Outcomes

On completion of this subject, the student will be able to:

- Apply the various elements of effective project management to improve real world projects;
- Apply conceptual knowledge of project management concepts to formulate and implement various strategic project choices;
- Demonstrate project management tool PERT-CPM and its application through MS Project;
- Apply various strategic frameworks and tools when conducting a situational analysis of external and internal factors facing a particular organization, and available alternative business strategies; and
- Apply the principles and concepts to a real-life project within their respective organizations.

Syllabus

The subject is designed to allow the students to think, assess and articulate about how projects are done in their own environments, how new ideas can change the way projects are managed and how organizational shared values or cultures, strategies, systems, structures, staff, skills, and management styles influence the development, implementation, and outcomes of projects. The main topics may include: Introduction to project management. Models of project management. Tools and techniques for project management. Organising a project. Defining project scope, objectives and purpose. Defining the work breakdown structure. Communicating the aims of the project. Structuring a project plan. Managing a project. Controlling quality, cost, time and risk. Monitoring a project. Team dynamics. Introduction to computer tools for project management. Understanding GANNT and PERT charts. Monitoring and marking off progress.

Textbook(s)

[1]. Gray, C., and Larson, E. (2014). Project management – The managerial process (6th Edition). NY: McGraw-Hill

Assessments

Continuous Assessment:	60%
Examination or Project:	40%
Total:	100%

EMBA516: International Management

Hours per week: 8 *Credit points: 9*

Leaning Outcomes

On completion of the subject, the student will be able to:

- Describe the basis for the internationalization of business and its frameworks of analysis;
- Recognize the differences in the economic, political-legal, social, and cultural environments of doing business internationally vis-à-vis domestically;
- Assess the opportunities and threats created by the internationalization of business and the appropriate strategic responses, including the organizational structures and systems needed to implement them;
- Select alternative ways of entering and operating in international markets;
- Identify the key factors for functional area excellence when operating internationally;
- Describe the use of technology to gain international competitive advantage; and
- Integrate the ethical dimension and social and environmental responsibility in the discussion of various international management concepts.

Syllabus

This subject provides an understanding of how the economic, geopolitical and cultural dimensions of the international business environment shape international business investment and transacting, and how international firms are managed in this

environment. It provides students with an appreciation of the increased complexities and opportunities that international markets provide operations exclusively in a home market.

As international management requires an advanced way of thinking and managing in different contexts, learning about the challenges and opportunities that are presented in this complex international business environment is fundamental to this subject. The main topics may include market selection, modes of entry and operations, strategy choices on where abroad to operate and by what means, capability building for international advantage, structuring firms for organizational form advantage, consideration of alternative systems of exchange abroad, decision taking in risky and uncertain international contexts and managing under adverse conditions. Both smaller and large firm internationalization is a feature of this subject.

Textbook(s)

[1]. Helen, D. (2016). *International Management: Managing Against Cultures and Boarders* (9th Edition). Pearson Education Australia [ISBN-13: 978-0134376042]

Assessment

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA517: Global Strategy & Competitiveness

Hours per week: 8 *Credit points: 9*

Leaning Outcomes

On completion of this subject, the student will be able to:

- Assess the 'forces' of globalization, and the opportunities and challenges they create for global organizations and managers;
- Analyze deep cross-country differences that affects strategy formulation, implementation and performance of global firms;
- Analyze critically the complexities of national institutions and the dynamics of global industries;
- Apply various global strategic frameworks and tools needed to address business opportunities and challenges, in the context of global stakeholders;
- Write a Project/Business Plan on a real-life PNG organization's intent to go global. What will it take for the company to succeed in the global markets? Alternatively, focus on one which has already gone global. How did it make the transition happen?

Syllabus

This subject is geared towards understanding globalization and how it impacts global firms; and analysis of global industries and crafting and development of organizational competencies required to sustain global competitive advantage; global strategies adopted by Multi-National Corporations, international entry strategies; selective global supply chains); and strategic control of global business that creates an organizational culture that has responsive structures and processes.

Case studies are used to development students' conceptual, analytical and decision-making skills; They highlight the reality of environmental uncertainties influencing decision-making when operating in the global context. Case studies will also seek to develop a student's' ability to identify issues raised in each case, reason through the various possible options that may be feasible, and understand how to manage organizational processes by which decisions are formed and executed.

Textbook(s)

[1]. Cornelis de Kluyver, (2010). *Fundamentals of Global Strategy*, Saylor Academy. [ISBN: 1453332871, 9781453332870]

[2]. Daniel F. S. (2011). *Global Competitive Strategy*. Cambridge University Press. [ISBN: 0521367980, 9780521367981]

[3]. Lasserre, P. (2018). *Global Strategic Management* (4th Edition). Palgrave MacMillan. [ISBN-13: 978-1137584588]

EMBA518: Change Management

Hours per week: 8 *Credit points: 9*

Leaning Outcomes

On completion of this subject, the student will be able to:

- Demonstrate an understanding of the impact of globalization on organizational change and the significance change management;
- Identify and evaluate the various forces influencing the organizational change;
- Assess the need for change and types of organizational changes as well as the role of change agents;
- Explain the sources of resistance to change and how this resistance can be overcome;
- Evaluate critically the change types such as technology, new-product, structural and culture/people;
- Identify and understand critical success factors of change management; and
- Apply the practical implication of renowned models for change management such as Lewin model, McKinsey 7-S model and John Kotter's Eight-Point Strategy Model.

Syllabus

Change is all around us. We are continually asked to manage change in our own lives and organizations. Yet, change unfolds through personal and organizational resistance. This subject focuses on planning and managing change and provides frameworks and tools to implement it. Students examine personal and organizational approaches to dealing with change through case studies and extensive group activity. Teaching is experiential and involves simulation of the change process. The world is rapidly changing, with the rate of change accelerating. This change is primarily due to globalization, the increasing integration and interdependence of economies all over the world. This is driven by powerful economic, political, and technological forces.

Uncertainty, complexity and rapidly changing organizational environments create the necessity for organizations to respond to and effectively deal with turbulence and instability. The capability of an organization's human resources to adapt to such conditions, adopt and successfully use new practices, technologies and develop ways of performing organizational tasks is vital to proactive and sustainable human service organizations. Managing change and organizational development are essential to these processes.

In modern business, successful adaptation to environmental changes is the key to survival and growth. Current size, market share, financial strength, and reputation do not assure survival if the environment shifts, and the organization is not able to adapt appropriately. Since change is radical and continuous, internal organization change must also be radical and continuous.

Textbook(s)

[1]. Senior, B. and Swailes, S. (2016). *Organizational Change* (5th Edition). Pearson Education, United Kingdom. [ISBN: 9781292063836, ISBN-10: 1292063831]

Assessment

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA520 Investment Analysis & Portfolio Management

Hours per week: 8 *Credit points: 9*

Leaning Outcomes

On completion of this subject, students should be able to:

- Assess the consumption and investment decisions under certainty and uncertainty;
- Analyze why return and risk are the two critical components of all investing decisions;
- Identify money market and capital market securities and understand the important features of these securities;
- Recognize the various stock market indices typically encountered by investors;
- Calculate important return and risk measures for financial assets, using the formulation appropriate for the task;
- Recognize what it means to talk about modern portfolio theory;
- Appreciate the significance of the efficient frontier and understand how an optimal portfolio of risky assets is determined;
- Compare capital market theory with an extension of portfolio theory;
- Use the dividend discount model to estimate the intrinsic value of a stock;
- Use sector/industry analysis as an investor; and
- Discuss why portfolio management should be considered and implemented as a process.

Syllabus

The subject covers the definition of investment, espouses the (Fisher) Separation Theorem between consumption and savings on the one side and Investment on the other side. The latter covers both direct and indirect investments. The subject also covers Close End and Open End Funds, the money and capital markets, investment companies, returns and risks from investment. Trading in the modern markets involves the use of indices. This requires an analysis on the various measurement concepts of price indices and the capitalization weighted indices- Dow Jones and S&P 500 index.

Furthermore, in investments Markowitz's Portfolio theory under uncertainty and James Tobin's ideas of the introduction of risk-free asset and the portfolio efficient set as straight line is discussed. The subject also covers William Sharp's Capital Asset Pricing Model, Arbitrage Pricing Theory, and discounted cash flow analysis, company analysis, fixed Income and bond pricing and risk management.

Textbook(s)

[1]. Jones, C.P., (2012). *Investment: Analysis and Management* (12th Edition). John Wiley & Sons. [ISBN-13: 978-1118363294]

Additional Resources

[1]. Lumby, S. and Jones, C. (2015). *Corporate Finance: Theory & Practice* (9th Edition). CENGAGE Learning. [ISBN: 1408079895, 9781408079898]

[2]. Vernimmen, P., Quiry, P., Dallocchio, M., Fur, Y., Salvi, A. (2014). *Corporate Finance: Theory and Practice*. (4th Edition). Published by John Wiley & Sons. [ISBN: 1118849329, 9781118849323]

Assessment

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

EMBA541 Public Policy Management

Hours per week: 8 *Credit points: 9*

Leaning Outcomes

On completion of this subject, the student will be able to:

- Describe the nature of policy, its formulation and implementation process;
- Develop some basic formulation of policy;
- Participate in any policy formulation and implementation work;
- Determine how policy information and data is acquired and employ tools of logic to formulate and determine complex policy issues; and
- Discuss with other academics, supervisors and students matters that concern policy or general matters of interest with a higher degree of critical and analytical attitude.

Syllabus

This subject introduces students to both a basic and an advanced understanding of formulation and implementation of Public Policy. Students will

examine various National Government policies since independence and determine their benefits to PNG. In addition, students will learn and examine the basic systems/mechanics of policy formulation and the sophisticated processes for scrutiny and implementation. This subject essentially lays the foundation to developing skills in policy research, diagnosing issues with clarity to improve policy content and its application to meet government objectives.

Further, students will examine the challenges of implementing public policy and how to overcome policy implementation hurdles especially where political will and funding is lacking. Participants will learn the fundamental theories in public policy and the processes required to formulate policy.

Students will be required to participate in actual policy formulation by engaging on a Major Research project related to a Government Policy. The major focus will be on development techniques and methodology of policy formulation to address a need or developmental issue. Finally, the subject will examine International Law and Treaties and how, once ratified by a government have impact on local level government laws and public policy implementation.

Textbook(s)

[1]. Max, W. M. (2012) *Public Policy Development and Administration* (8th Edition). London School of Economics Press, London.

Assessment

Continuous Assessment:	50%
Examination or Project:	50%
Total:	100%

➢ MASTER OF BUSINESS ADMINISTRATION (MBA)

MASTER OF BUSINESS ADMINISTRATION (MBA)

Department of Business Studies offers the proposed MBA program. This program will serve public and private business sectors, NGOs and the Society at large. The development of this MBA program takes guidance from practices and programs running at other international and local universities. MBA Programs of other universities in Australia, USA and the South Pacific are consulted. More detailed review is conducted of the MBA programs offered by Business Schools at the University of Sydney, the University of Adelaide, the University of Queensland, Boston University, the University of the South Pacific, the Divine Word University, and our existing EMBA program. In the end, our final selection of the courses and program design has been contextualized to PNG to meet the growing demand for executive education programs.

The MBA program is a three-semester full-time program, each with 15 weeks of teaching. The program will have a total of 12 courses. The entry requirement is as per Rules of the Course based Master Degree Programs of the University of Technology.

Program Outcomes (POs)

The main objectives of MBA program are to prepare the younger breed of highly knowledgeable and skilled business management professionals with greater human values and right kind of attitudes. Such graduates will be fully equipped to meet the growing requirements of business organizations, and help them face the challenges of globalization. Upon completion of the MBA program, graduates are expected to become proficient in the following aspects:

PO1: Develop inter-linkages between their undergraduate study program and MBA courses.

PO2: Demonstrate knowledge of theoretical concepts from diverse fields of business management, accounting, finance, banking, statistical data analysis, marketing, economics, strategic management, human resources, operations management, and ICT.

PO3: Analyze multi-dimensional, complex business challenges, and develop innovative strategies/solutions through integration of various disciplinary fields.

PO4: Demonstrate a global perspective necessary to analyze environmental issues posed by globalization, and how to develop strategies that take advantages of global opportunities while minimizing associated risks.

PO5: Demonstrate high level leadership skills needed to work corroboratively and communicate effectively in diverse work teams.

PO6: Enhanced awareness of ethical, social and environmental responsibilities of business organizations.

Overall Structure of the MBA Program

Year 1	Contact Hrs /Week	Credit Points
Semester 1		
MBA511: Managerial Economics	4*	15
MBA512: Organizational Behaviour	4	15
MBA513: Quantitative Business Analysis	4	15
MBA514: Marketing Management	4	15
Semester total	4*4*15 = 240	60
Semester 2		
MBA521: Accounting and Decision Making	4	15
MBA522: Operations Management	4	15
MBA523: Human Resource Management	4	15
MBA524: Research Methodology	4	15
MBA525: Public Policy Management	4	15
Semester total	4*5*15 = 300	75

Year 2		
Semester 3		
MBA531: Management Information System (MIS)	4	15
MBA532: Major Project		4
MBA533: Strategic Management	4	15
1 elective	4	15
Semester total	4*4*15 = 240	60
Program totals	780	195

List of 13 Electives

Elective Name	Contact Hrs/Week	Credit Points
MBA534: International Management	4	15
MBA535: Management of Change	4	15
MBA536: Project Management	4	15
MBA537: Strategic Human Resource Management	4	15
MBA538: International Human Resource Management	4	15
MBA539: Strategic Marketing	4	15
MBA540: Quality Management	4	15
MBA542: Logistics & Supply Chain Management	4	15
MBA543: Financial Institutions & Markets	4	15
MBA544: Global Marketing	4	15
MBA545: Innovation & Entrepreneurship	4	15
MBA546: Financial Management	4	15
MBA547: International Finance	4	15

SUBJECT DETAILS

MBA511: MANAGERIAL ECONOMICS

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Explain the application of economic theories relevant to many facets of modern business and not-for-profit decision-making.
2. Evaluate the nature of debates that permeate the political, economic, and industry leaders, including the efficacy of monetary and fiscal policies.
3. Assess the emerging globalization of production, investments, and trade in the world economy.
4. Analyze the current problems of development, underdevelopment, and poverty.
5. Demonstrate the use of information technology in researching, analyzing, and presenting economic data in class.

Syllabus

Managers and economics; demand analysis and equilibrium prices; demand elasticity; consumer demand and behavior; production and cost analysis; market structure; pricing strategies of firms; measuring macroeconomic activity; spending by individuals, firms and governments; role of money in the macro-economy; international and balance of payment issues in the macro economy. Managerial economics deals with the application of economic methodologies and principles needed to optimize the utilization of scarce resources.

Textbook

Farnham, P. G. (2014) Economics for Managers, 3rd Edition. Pearson Prentice.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA512: ORGANIZATIONAL BEHAVIOUR

Hours per week: 4
Credit points: 15

Learning Outcomes
On completion of the subject, the student will be able to:

1. Demonstrate team leadership and interpersonal skills required to lead and work effectively in diverse teams.
2. Explain and define key concepts and terms used in organizational behavior.
3. Evaluate organizational behavior issues faced by managers.
4. Apply various theoretical frameworks and principles needed to analyze workplace behavior.
5. Understand how organizational structures affect human behavior at the workplace.
6. Analyze how organizational systems, policies and practices can influence and affect organizational effectiveness.

Syllabus
Organizational behavior; attitudes and job satisfaction; perceptions and individual decision making; motivation; foundations for group behavior; understanding work teams; leadership; power and politics; conflict and negotiation; foundations of organization structure; organization culture; human resource policies and practices; organizational change and stress management.

Textbook
Robbins, S.P. & Judge, T.A. (2016) Organizational Behaviour (17th Edition). Pearson.

Assessments
Continuous Assessment: 50%
Final Examination: 50%

MBA513: QUANTITATIVE BUSINESS ANALYSIS

Hours per week: 4
Credit points: 15

Learning Outcomes
On completion of the subject, the student will be able to:

1. Analyze data using scatter diagrams, histograms, and summary statistics.
2. Calculate sample data using statistics such as confidence interval estimation, hypothesis testing, and regression analysis.
3. Build statistical decision analysis models, required to aid effective business decision making.
4. Compute optimal solutions using decision analysis models for management.
5. Develop analytical thinking skills necessary to analyze spreadsheet simulation models and decisions with uncertain outcomes.

Syllabus
Exploring data; probability and decision-making under uncertainty; sampling and sampling distribution; confidence interval estimation; hypothesis testing & statistical significance; simple linear regression models; multiple linear regression models; time series analysis & forecasting; optimization and simulation; advanced data analysis; new technologies and statistical information necessary to make informed decisions for businesses and organizations.

Textbook
Albright, S.C. & Winston, W.L. (2016) Business Analytics: Data Analysis and Decision Making. South-Western College Publication/Cengage.

Assessments
Continuous Assessment: 50%
Final Examination: 50%

MBA514: MARKETING MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes
On completion of the subject, the student will be able to:

1. Demonstrate an understanding of the critical role of Marketing Management to business competitiveness
2. Understand the basic tools and techniques of Marketing Management.
3. Articulate the contribution of marketing activities in delivering value to the consumer and to stakeholders.
4. Conduct a market analysis and appreciate the 'science' behind marketing decisions. Develop and appreciate the challenges in the implementation of marketing plans.
5. Analyze, evaluate and design customer – oriented, completive marketing mix strategies on product, price, promotion and distribution in an organization
6. Synthesize, through a group project, an in-depth examination of a selected topic related to marketing management and show mastering of knowledge acquired during the semester.

Syllabus

Marketing for the 21st Century; marketing strategies and plans; marketing Research; creating long-term loyalty relationships; analyzing consumer markets & business markets; identifying market segments and targets; creating brand equity and crafting the rand positioning; setting product strategy; designing and managing services; developing pricing strategies and programs; designing and managing integrated marketing channels; designing and managing integrated marketing communications; managing personal communications: direct and interactive; marketing, word of mouth, and personal selling.

Textbook

Kotler, P. & Keller, K.L. (2016) Marketing Management (15th edition). Prentice Hall.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA521: ACCOUNTING AND DECISION MAKING

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Make informed judgments, and take effective, ethical and timely actions regarding the current and future allocation of resources in the context of a complex global business environment.
2. Demonstrate quantitative skills; evaluate the assumptions, behavioral implications and qualitative factors in decision-making.
3. Identify a problem, list uncertainties and develop strategies from accounting and financial statements.
4. Apply decision making processes including interpreting bias, evaluating alternatives, organizing information and clearly stating assumptions.

Syllabus

Accounting Information for managers and other stakeholders: private, non-profit, statutory authorities, performance metrics, economic indices, management perspective of financial statements, maintaining capital, returns to suppliers of funds: accounting systems-cash vs. accrual accounting, cash flow management, analysis of operating performance, cost concepts, relevant costs for decisions, cost objects and measurement, costs of products, services, divisions, business performance reporting – controllable costs, short run decisions – opportunity evaluation, strategic planning and budgeting uncertainty, financial planning – commercialization of opportunities.

Textbook

Collier. P.M. (2015) Accounting for Managers: Interpreting Accounting Information for Decision-Making, 5th Edition. John Wiley & Sons

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA522: OPERATIONS MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Demonstrate an understanding of the critical role of Operations Management (OM) to business competitiveness
2. Understand the basic tools and techniques of Operations Management (OM).
3. Evaluate critically any organization's approaches to the design of its products, processes and services in PNG.
4. Appraise the various capacity and production planning control problems facing any particular organization in PNG.
5. Explain a systematic view of key aspects of Supply Chain Management, JIT/LEAN and Total Quality Management philosophies.
6. Apply concepts and processes into practice through case studies, exercises, Internet exercises and discussion questions.
7. Synthesize through a group project, an in-depth examination of a selected topic related to production and operations management, to show mastering of knowledge acquired during the semester.

Syllabus

Competitiveness, strategy and productivity; forecasting; aggregate planning; operations scheduling; inventory management; total quality management; supply chain management; MRP/ERP; JIT/LEAN systems; and future trends in production and operations management. This course will emphasize the importance of properly managed manufacturing or service operations as a competitive weapon.

Textbook

Heizer, J. and Render, B. (2016) Operations Management (12e). Pearson: New Jersey.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA523: HUMAN RESOURCE MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand the critical and strategic role of Human Resource Management (HRM) to business competitiveness.
2. Implement the various HRM best practices in compliance with legal requirements to contribute to organizational effectiveness and link HRM to company performance and strategies,
3. Critically analyze an organization's approaches to the design of its HRM policies and practices.
4. Apply basic HR planning, staffing, training and development, performance management, compensation, health and safety, and employee and labor relations strategies to achieve overall business objectives.
5. Develop a case project on a topic related to HRM using the knowledge acquired.

Syllabus

Human Resource Management (HRM) overview, strategic HRM, HR planning, recruitment and selection, appraising and managing performance training, employee development, employee compensation & benefits, employee health & safety, employment relations, managing HR globally, evaluation of HRM effectiveness.

Textbooks

1. Mondy, R. W. & Joseph J. Martocchio, J.J. (2016) Human Resource Management, (14th edition). Pearson Education
2. Noe, R.A. (2015) Human Resource Management: Gaining a competitive advantage. 9th edition. New York: McGraw-Hill.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA524: RESEARCH METHODOLOGY

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Demonstrate an understanding of the various steps and processes needed to design and undertake independent research in various business management fields.
2. Identify and develop research problem(s), research questions, and/or research hypotheses guiding a particular research topic(s).
3. Develop a research proposal and thesis.
4. Evaluate critically the relevant literature guiding the research, and appropriate research method(ologies) to apply.
5. Collect data, organize data, analyze data using any appropriate statistical software, and make correct interpretation of results.
6. Apply the concepts and principles of ethics in research and publication.

Syllabus

Business and management research; formulating and clarifying the research topic; critically reviewing the literature; understanding research philosophies and approaches; formulating the research design; negotiating access and research ethics; selecting samples; using secondary data; collecting primary data; quantitative data analysis; qualitative data analysis; writing the thesis.

Textbook

Suanders, M., Lewis, P. & Thornhill, A. (2015) Research Methods for Business Students (7th edition). Pearson Education.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA532: MAJOR PROJECT

Hours per week: 4
Credit points: 15

Learning Outcomes

On successful completion of this course, students will be able to:

1. Understand the publications of international visibility.
2. Understand research as a search through researching and organizing research materials.
3. Identify the steps in the dissertation process and describe the primary components of the dissertation manuscript.
4. Compile a literature review binder with articles on a topic related to your dissertation interest.
5. Develop a research plan that addresses a “gap” in the business and management as well as information systems literature.
6. Embody a substantial amount of research on primary sources, or on scholarly and critical studies of such sources, or on both.
7. Locate and critically evaluate existing primary and secondary textual materials.
8. Edit, annotate, and/or analyze research materials, or engage in any other appropriate scholarly project.
9. Describe the procedures for submitting a research article to a professional journal.
10. Report an original piece of research, grounded in knowledge of the theories and previous studies in

the field, presented in a manner consistent with research reporting in that field.

11. Create new knowledge in the related field through publications.

Syllabus

Steps in the research process, components of research design, publications with international visibility, writing of a proposal for a research project, research as a search, components of the manuscript, design of project title, abstract, and literature review, design of a research plan. An oral presentation is required at the end of the semester before the project report is officially submitted.

Textbooks

1. Suanders, M., Lewis, P. & Thornhill, A. (2015) Research Methods for Business Students (7th edition). Pearson Education.

2. Publication Manual of the American Psychological Association (6th Ed). (2001). Washington, DC: American Psychological Association.

Assessments

Major Project: 100%

MBA531: MANAGEMENT INFORMATION SYSTEMS (MIS)

Hours per week: 4
Credit points: 15

Learning Outcomes

Upon successful completion of this subject, the students will be able to:

1. Apply analysis and application of technology to business problems/goals/strategies;
2. Understand IS technology and how it can be used by managers and professionals to improve organizational performance, teamwork, and personal productivity;
3. Design and implement processes and best practices for successfully managing an IS change effort;
4. Apply MIS concepts and technology to the identification of opportunities for information systems;
5. Identify and acquire the information technology capability that is needed for an organization to keep it efficient and effective;
6. Apply collaboration, decision support, database query, and Web searching software to support classroom assignments and future work activities; and
7. Understand current and future MIS management issues.

Syllabus

Management Information systems (MIS) in the 21st Century; information technology and intelligent infrastructure; business intelligence and decision support systems (Including AI); e-commerce and management; managing knowledge; securing information systems and cybersecurity; Web services and management; acquiring information systems, building Information systems, managing the Information resource; managing global Systems; social computing and mobile computing; big data, analytics and intelligence.

Textbooks

1. Laudon, K. & Laudon, J. (2016) Management Information Systems - Managing Digital Firm, 14th edition. Pearson

2. Zhaohao Sun's Lecture notes and other teaching materials.

3. Rainer, R.K., Prince, B. & Watson, H.J. (2015) Management Information Systems, 4th Edition. Wiley.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA525: PUBLIC POLICY MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Describe the nature of policy, its formulation and implementation process;
2. Determine how policy information and data is acquired and employ tools of logic to formulate and determine complex policy issues;
3. Discuss with other academics, supervisors and stakeholders on policy or general matters of interest with a higher degree of critical and analytical attitude.
4. Organize policy formulation and implementation;
5. Formulate policy.

Syllabus

Fundamental theories in public policy and the processes required to formulate policy, advanced understanding of formulation and implementation of public policy, basic systems/mechanics of policy formulation, processes for scrutiny and implementation, skills for policy research and diagnosis of policy content and its application to meet government objectives, challenges of implementing public policy, national government policies since independence and their benefits to PNG, international law and treaties, impact on municipal laws and public policy implementation.

Textbook

Weber, M. (2012) Public Policy Development and Administration (8th Edition). London: London School of Economics Press.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA533: STRATEGIC MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand the critical role Strategic Management plays in the long-term sustainability of any organization.
2. Familiarize with conceptual knowledge of strategic management concepts needed to formulate and implement various strategic choices.
3. Critically analyze an organization's strategic mix, its policies and practices.
4. Apply various strategic frameworks and tools to conducting a situational analysis of external and internal factors facing a particular organization, and available alternative business strategies.
5. Develop a Business Plan on a particular real-life PNG organization's intent to enter a particular foreign market(s), as a means to demonstrate mastery of knowledge acquired during the semester.

Syllabus

Introduction to Strategic Management; evaluating a firm's external environment; internal environment analysis; business level strategy; corporate level strategy; strategies for diversified organizations; international strategy; strategic leadership; corporate governance; organizational support for strategy execution, and strategy evaluation. The course is designed to give students a thorough understanding of the complexities surrounding strategic formulation, market positioning, implementation, and evaluation processes, with special attention to capabilities and competencies required to be developed by organizations in particular competitive environments.

Textbook

Johnson, G., Whittington, R., and Scholes, K. (2017) Exploring Strategy: Text & Cases (11th Edition). Prentice Hall.

Assessments
Continuous Assessment: 50%
Final Examination: 50%

MBA534: INTERNATIONAL MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes
On completion of the subject, the student will be able to:

1. Describe the basis for the internationalization of business and its frameworks of analysis;
2. Understand the differences in the economic, political-legal, social, and cultural environments of doing business internationally vis-à-vis domestically;
3. Assess the opportunities and threats created by the internationalization of business and the appropriate strategic responses, including the organizational structures and systems needed to implement them;
4. Understand alternative ways of entering and operating in international markets;
5. Identify the key factors for functional area excellence when operating internationally;
6. Describe the use of technology to gain international competitive advantage.
7. Integrate the ethical dimension and social and environmental responsibility in the discussion of various international management concepts.

Syllabus
Market selection, modes of entry and operations, strategy choices on where abroad to operate and by what means, capability building for international advantage, structuring firms for organizational form advantage, consideration of alternative systems of exchange abroad, decision taking in risky and uncertain international contexts and managing under adverse conditions. Both smaller and large firm internationalization is a feature of this course.

Textbook
Deresky, H. (2016) International Management, 9th Edition. Pearson

Assessments
Continuous Assessment: 50%
Final Examination: 50%

MBA535: MANAGEMENT OF CHANGE

Hours per week: 4
Credit points: 15

Learning Outcomes
On completion of the subject, the student will be able to:

1. Demonstrate an understanding the impact of globalization on organizational change and the significance change management.
2. Identify and evaluate the various forces influencing the organizational change.
3. Understand the need for change and types of organizational changes as well as the role of change agents.
4. Explain the sources of resistance to change and how this resistance can be overcome.
5. Evaluate critically the change types such as technology, new-product, structural and culture/people
6. Identify and understand critical success factors of change management
7. Understand and apply the practical implication of renowned models for change management such as Lewin model, Mc Kinsey 7-S model and John Kotter's 8 points strategy model.

Syllabus
Introduction to change management; understanding the impact of globalization on organizational change; internal and external forces influence the organizational change; types of organizational change and role of change agents; sources of resistance to organizational change and strategy to overcome the resistance of change; critical success factors of

change management; change management Strategies; renowned models for change management, such as Lewin model, McKinsey 7-S model and John Kotter's 8 point strategy model.

Textbook

Senior, B. & Swailes, S. (2016) Organizational Change, Fifth Edition. Pearson Education: UK

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA536: PROJECT MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand the various elements of effective project management.
2. Apply various project management concepts, tools & techniques to initiate, plan, execute, control, and lose projects.
3. Demonstrate competence of using project management tool such as PERT-CPM and its application through MS Project.
4. Identify and manage various project management stakeholders.
5. Calculate Earned Value Management parameters needed for project control.
6. Assess the real-life project management issues and risk management of projects being undertaken in their respective organizations.

Syllabus

Project management concepts; project initiation; project planning; project scheduling; project implementation and control; project closeouts; stakeholders management and conflict management; project risk management; earned value management and project cost control; quality management; MS Project.

Textbook

Pinto, J. K. (2013) Project Management: Achieving Competitive Advantage, 3rd Edition. Pearson.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA537: STRATEGIC HUMAN RESOURCE MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand and appreciate the critical role strategic human resource management plays to the long-term sustainability of any organization through effective acquisition and management of human assets.
2. Familiarize with conceptual models for the practice of strategic HR and also acquaint with trends that are affecting human resource management practice in the modern business organization.
3. Critically analyze the impact of various approaches to managing human resources, and explore how the effective management of human resources can be a source of sustained competitive advantage by sustaining the knowledge base of the organization.
4. Apply various frameworks and tools to design strategic human resource systems that facilitate the achievement of its strategic objectives.
5. Synthesize, through a group project, an in-depth examination of a selected topic related to strategic human resource management show mastering of knowledge acquired during the semester.

Syllabus

Context of strategic human resource management; an investment perspective of human resource management; social responsibility and human

resource management; strategic management; the evolving/strategic role of human resource management; strategic workforce planning; design and redesign of work systems; Employment law; implementation of strategic human resource management staffing; training and development; performance management and feedback; compensation; labour relations; employee separation and retention management; global human resource management.

Textbook

Mello, J. A. (2015). Strategic Human Resource Management (4th Edition). South Western Cengage Learning: Mason, Oh.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA540: QUALITY MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand the various elements of effective quality management.
2. Apply various quality management concepts, tools & techniques needed to deliver quality products and services.
3. Demonstrate competence of using quality management statistical tools.
4. Calculate various quality parameters needed for management and control production processes.
5. Assess the real-life quality control issues in their respective organizations.

Syllabus

Understanding quality concepts; dimensions of quality; different perspectives on quality; quality theory; global supply chain quality; international quality standards; strategic quality planning; customer driven quality; cost of quality; quality improvement tools; quality management systems; quality management tools; bench marking; TQM implementation in manufacturing and services.

Textbook

Foster, S.T. (2016) Managing quality: Integrating the Supply Chain (6th Edition). Pearson.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA542: LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand the various elements of an effective logistics and supply chain distribution management system.
2. Describe the key drivers of supply chain performance and sourcing decisions when managing the supply chain.
3. Identify, analyze, and develop appropriate supply chain solutions for a particular firm.
4. Demonstrate competence in the ability to develop appropriate procurement, inventory, revenue, pricing and distribution strategies.
5. Explain the importance of lean supply chain management to an organization's competitive advantage.
6. Apply appropriate techniques and metrics in evaluating the performance of the logistics and supply chain system.

Syllabus

Strategic importance of good logistics and supply chain design; material and physical distribution

management; demand forecasting and aggregate planning in the supply chain network; inventories planning within the supply chain network; managing variability within a supply chain network; sourcing, transportation and pricing decisions in the supply chain network; external and internal supply chain risks; supply chain mapping and value stream-mapping tools; reverse logistics; strategic role of information technology in coordinating the logistics & supply chain network.

Textbook

Coyle, J.J. and Langley, C.J. (2016) Supply Chain Management: A Logistics Perspective. South-Western College Pub.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA543: FINANCIAL INSTITUTIONS AND MARKETS

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand how the concepts of macroeconomics and finance are applied in financial institutions and markets and appreciate how the asymmetric information is prevalent in the financial markets and the role of financial institutions in mitigating it.
2. Appreciate the positive role played by the financial institutions and markets in the economy, and analyze the risks inherent in the working of the financial institutions and markets.
3. Analyze the capital markets, the bond and fixed income markets, and use the duration analysis for bond and fixed income markets, Similarly for capital markets especially stock markets.
4. Apply the efficient market hypothesis to real world problem.
5. Analyze various risks of the financial institutions: liquidity risks, interest rate risks, market risks, foreign exchange rate risks, and operational risks and their management.

Syllabus

Asymmetric information, moral hazard, risk reduction: actuarial and portfolio risk reduction, maturity transformation and role of financial intermediaries; money, Interest rates, monetary policy, and The reserve bank's role in monetary policy; various classification of financial markets: money markets, capital markets, bond markets, stock markets, primary, secondary markets, domestic and international markets; bond markets: concepts of yield, yield to maturity, duration, convexity , calculations and immunization of interest and price change risks; theory of interest rates, bond trading strategies; stock markets and efficient market hypothesis; thrift institutions and finance companies, insurance companies and pension funds, investing banking and investment companies; banking and financial institutions risks and management: liquidity risks, interest rate risks, market risks, and foreign exchange rate risks and their management.

Textbooks

1. Saunders, A. & Cornett, M.M. (2015) Financial Markets and Institutions (6th Edition). Irvin McGraw Hill.
2. Pilbeam, K. (2008) Finance & Financial Markets, 3rd edition. Palgrave Macmillan, UK.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA544: GLOBAL MARKETING

Hours per week: 4

Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Understand and explain the principles and practices of the organization in terms of global marketing.
2. Identify and critically analyze opportunities within international marketing environments.
3. Apply various tools and methods and conduct a market analysis as well as market research to develop and design the segmentation and entry strategies for a new product in the international market.
4. Conceive, develop, and implement an effective global marketing strategy.
5. Analyze, evaluate and design customer – oriented, completive marketing mix strategies on product, price, promotion and distribution for the international market.
6. Design and develop the export and import management strategy for the global market.

Syllabus

Globalization imperative; economic environment; financial environment; global cultural environment and buying behavior; political & legal environment; global marketing research; global segmentation and positioning; global marketing strategies; global market entry strategies; new product development for global market; global product policy decisions; global pricing strategies; global communication strategies; sales management; global logistics and distribution; export and import management; planning organization, and control of global marketing operations.

Textbook

Kotabe, M.M. and Helsen, K. (2017) Global Marketing Management (7th Edition). John Wiley & Sons, Inc.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA545: INNOVATION & ENTREPRENEURSHIP

Hours per week: 4
Credit points: 15

Learning Outcomes

Upon successful completion of the subject, students will be able to:

1. Discuss the attitudes, values, characteristics, behavior, and processes associated with possessing an entrepreneurial mindset and engaging in successful appropriate entrepreneurial behavior.
2. Describe entrepreneurship and explain how business concepts are developed into plans.
3. Create a financial plan and a marketing approach.
4. Describe the ways in which entrepreneurs perceive opportunity, manage risk, organize resources and add value.
5. Develop a plan for implementing entrepreneurial activities in a globalized and competitive environment being responsible for the social, ethical and culture issues.
6. Critique a plan for implementing entrepreneurial activities in a globalized and competitive environment being mindful of the social, ethical and culture issues.
7. Engage in a continuing learning process through the interaction with peers in related topics, as individuals and as team members.

Syllabus

Nature of enterprise and entrepreneurship, the role of the entrepreneur, innovation and technology in the entrepreneurial process, the development of growth-oriented businesses - whether for-profit or not-for-profit, Entrepreneurship as a thinking and doing. The course content is relevant to those individuals thinking about starting a business or who are already in business - large or small, those who are interested in commercializing their own innovations or of others, and those who advise entrepreneurs or engage in policy making in the entrepreneurship area.

Textbooks

1. Timmons, Jeffry A., Gillin, L. M., Burshtein, S., and Spinelli, Stephen Jr. (2011). New Venture Creation: Entrepreneurship for the 21st Century – A Pacific Rim Perspective, 1st Edition. McGraw-Hill Irwin.
2. Drucker, P. (1999) Innovation and Entrepreneurship, Butterworth Heinemann, Oxford.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA546: FINANCIAL MANAGEMENT

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. Employ the current practical methods used in making financial management decisions;
2. Assess the relevance of developments in financial management theory to an enterprise; and employ theoretical models to make appropriate financial management decisions;
3. Select the techniques most appropriate to optimize the employment of resources including the most effective method of financing the acquisition of fixed assets;
4. Explain the operation of the financial systems, with particular reference to Papua New Guinea, and evaluate alternative sources of finance and assess investment opportunities;
5. Communicate the consequences of financial management decisions to accountants or non-accountants.

Syllabus

Working capital management and capital budgeting techniques employed by finance managers, short term financing and long-term investing decisions, theories and models developed to facilitate the financial management of organizations.

Textbook

Titman, S., Keown, A. & Martin, J. (2011) Financial Management: Principles and Applications, 11th edition. Pearson/Prentice Hall.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

MBA547: INTERNATIONAL FINANCE

Hours per week: 4
Credit points: 15

Learning Outcomes

On completion of the subject, the student will be able to:

1. understand the International monetary and financial system.
2. Appreciate the exchange rates theories
3. Analyze exchange rates risks.
4. Manage exchange Rate risk for Banks and Business.
5. Analyze international financial markets.
6. Explain the basics of financial derivatives in international finance.
7. Have an exposure to international trade finance of banking.

Syllabus

International monetary system, dold standard, and Bretton woods systems; European Union, currency boards, currency crises; exchange rates theories, purchasing power parity, interest rate parity; trading in currencies, foreign exchange markets; currency swaps; exchange rates risk management for Banks; exchange risk management for business; international trade, Finance of banking.

Textbook

Mehta, D. & Fung, H-G. (2010) International Bank Management, 5th Edition. Blackwell Publishing.

Assessments

Continuous Assessment: 50%
Final Examination: 50%

DEPARTMENT OF CIVIL ENGINEERING

- MASTER IN ENGINEERING CIVIL ENGINEERING (ME_{ng})

- MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT PROGRAM (MScSWRM)

DEPARTMENT OF CIVIL ENGINEERING

Head of Department

Dr. Revanuru Subramanyam Ph.D. (IIT-Roorkee, India), M.Tech. (Environmental Engineering), B.Tech. (Civil Engineering), MISTE, AMIE

Deputy Head of Department

Mr. Konzang, M, MPhil (Civil Eng) BEng (Civil)

Senior Lecturers

Dr. Betasolo, M., Ph.D. (Technology Management, Philippines), M.Eng (Civil Eng, Philippines), BSGE, BSCE, CE, GE, PICE, GEP, SWE Ambassador PNG

Mr. Kobal, C.A., ME (Cantab., NZ), MS (Iowa, USA), BEng (Cantab., NZ), BEng (PNGUoT), MIEPNG; Reg. Eng.

Lecturers

Ms. Wantepe, G., BEng. (Civil)

Mr. Roboam, P.

Ms. Stephanie, K.

Lab Managers

Mr. Isan, P., CertCEng

Mr. Liuliu, D., CertCEng

Senior Technical Officer

Mr. Doaemo, W., BSc (PNGUoT)

Ms. Jesmah, K., DipCEng (Lae Tech)

Mr. Sebron, H., CertCEng

Tep, J., CertCEng

Silip M., B. Sc. (PNGUoT)

Technical Assistant

Mr. Wilson, E

Tradesman MFM

Mr. Telly, B. (On study leave)

Section supervisor MFW

Mr. Kairi, K.,

Semi-Skilled Welder MFW

Mr. Kules, K.

Mr. Thomas, G.

Section supervisor CC

Mr. Pinda, S.

Mr. Yang, H.

Storeman

Mr. Ben, G.

Snr. Administrative Assistant II

Koreng, N.

Administrative Assistant

Ms. Mary, B.

Janitors

Mrs. Nago, T.

Ms. Siling, M.

Mr. Ezekiel

MASTER PROGRAMS IN CIVIL ENGINEERING

BACKGROUND

The department has a Bachelor of Engineering in Civil Engineering recognized by the Institution of Engineers PNG (IEPNG) as fulfilling the educational requirement towards the Registration as a Professional Engineer. It also has its refreshed Program Bachelor of Engineering in Civil Engineering (Honours) that is in provisionally accredited by Engineers Australia under the Washington Accord Accreditation. The Department also currently is offering postgraduate Programs by Research (MPhil and Ph.D.). To complement research with the needed theoretical knowledge to advance the civil engineering field of specialization (Master in Engineering in Civil Engineering, MEng) and science in solid waste and resource management (Master of Science in Solid Waste and Resource Management, MSc SWRM) to a higher level of critical thinking skills, to cope with the 21stcentury needed skills, coursework is incorporated in the 2016 master's degree curriculum offering.

The offering of the master's program is an answer to the department Vision to be the premier Civil Engineering provider in PNG and the South Pacific that grow a world class Civil Engineers ot technocrats for the real world. And, to attain the department's mission as:

- To provide an opportunity to grow world-class Civil Engineers or technocrats through high quality experiential Teaching & Learning, Research & Development, External Collaboration & Partnerships, Commercial Testing and Active Community Services with the ardent application of scientific and technological knowledge and innovation in Civil Engineering.
- To live a culture of a world-class Civil Engineers or technocrats who are honest and with accountability of what they do, who are aware and with inclusiveness in a culturally diverse world, who are resourceful, works innovatively and creatively to meet the fast pace of
- development with sustainability, and who can work as a team to achieve the vision and mission.

Civil Engineers who graduated in a Master's Program are widely taking higher responsibility in the community and involvement in government associated employers such as:

- Department of Works & Transport
- Department of Mining & Petroleum
- Department of Rural Development
- Electricity Commission (PNG Pawa)
- National Housing Corporation
- Civil Aviation Authority
- Environment & Conservation
- National Institute of Standards & Industrial Technology (NISIT)
- PNG Ports Authority
- Water Board
- Provincial & Local Level Governments
- Universities and Technical Colleges

Also, their employment in the private sector in engineering consultancy, construction and contracting organisations, mining and petroleum industries and manufacturing also goes to a higher ranking and giving them more responsibility to take part in the shaping of the company they are in and the community they are serving. Such as to name a few:

- Mining Industries
- Business Industries
- Construction Industries

Master in Engineering in Civil Engineering (M.Eng, CE) aims to enable the candidate (graduate and current practitioners) to undertake a full-time or part-time course and research work. The study is leading to a formal qualification in civil engineering at the Masters level. The program also aims to advance their level of knowledge and skills in a range of areas relevant to the construction, structural, water, construction, and transport and geotechnical sectors of Civil Engineering.

The Master's Programs in the Civil Engineering Department are revised in 2020 as part of the university's Key Performance Indicators (KPI) which stipulates that 25% of the curricula will be reviewed each year across all Departments. In-line with the consultation with stakeholders and directive from the Academic Board of the University, through the Postgraduate Committee, the Department of Civil Engineering has revised the curriculum of the Master

of Science in Solid Waste & Resource Management course at the Department of Civil Engineering.

This revision eliminates overlapping topics in existing curricula, consult with expected employers of the graduates and other stakeholders, and to bring the refreshed curricula to a level comparable to South Pacific countries and the world. Moreover, the importance of this review could not be over-emphasized, given that the Department produces highly qualified manpower to service the Civil, Construction, Energy, and Mining sectors of Papua New Guinea, the Pacific Island Countries, and the world generally. The Master's Programs curricula are now properly aligned with all stakeholders including industries, institutions, government policies, accreditation bodies, and the University's graduate attributes, to mention a few. The revised/updated programs will be implemented in 2021

MASTER IN ENGINEERING (CIVIL ENGINEERING) PROGRAM (MEng)

Civil Engineering is an engineering profession under one name. These various professional disciplines include Water and Wastewater Engineering, Environment Engineering, Geotechnical Engineering, Pavement and Traffic Engineering, Structural Engineering and Construction Management. As such, a Civil engineer is trained to perform a broad range of tasks, which include the following:

- Design, plan and construct bridges, roads, buildings, aerodromes, wharves, jetties, water treatment and supply systems, sewage treatment and disposal systems.
- Carry out feasibility studies and ground investigations for engineering structures, design of foundations systems for bridges, buildings, wharves, roads, water and sewage treatment facilities.
- Plan, control, monitor construction operations and their effects on the environment, and management of assets and resources

Since it is broad as its name, and to intensify its study, a Master's Degree in Engineering and Science Programs were offered to start the year 2016, at the Department of Civil Engineering at the PNG University of Technology. The aim is to have mastery or high-order overview of a specific field of study or area of professional practice.

PROGRAM OUTCOMESS (POs) FOR MASTER IN ENGINEERING (CIVIL ENGINEERING)

PO1: An ability to apply a body of knowledge that includes the understanding of current developments in a specialized practice.

PO2: An ability to apply knowledge of research principles and methods according to specialized practice.

PO3: A cognitive skills that demonstrates mastery of theoretical knowledge which is reflected in the way the learner thinks critically and scholarly according to chosen specialized practice.

PO4: A cognitive, technical, and creative skills able to investigate critically, analyze and synthesize complex information, problems, concepts and theories or to apply established theories to different bodies of knowledge in the learner's specialized practice.

PO5: A cognitive, technical, and creative skills that can generate and evaluate complex ideas and concepts at an abstract level.

PO6: Possess a communication and technical research skills to justify and interpret theoretical propositions, methodologies, conclusions, and professional decisions that are according to chosen field of specialized practice.

PO7: Will have a technical and communication skills that is able to evaluate, analyze, design, implement, and theorize about developments that contributes to professional practice or body of knowledge.

PO8: Recognize the need for engaging in life-long learning to upgrade to higher learning and research activities and specialization.

PO9: Comprehensive knowledge of contemporary issues due to changing technical scenario and be able to plan and execute a substantial research or project-based capstone.

PO10: Apply knowledge and skills that demonstrate autonomy, expert judgment, adaptability, and responsibility as a learner.

ADMISSION REQUIREMENT & PROCEDURE, MEng

Entry is open to students with a four (4) year Bachelor of Engineering degree or equivalent or related field with experience in Civil Engineering works. The rules about admission, registration, supervision and administration of postgraduate programs shall be those of the PNG University of Technology Master in Engineering Programs.

CONTENT AND STRUCTURE

The candidate must complete a total of 96 credit points. There has to be 24 credit points for core units, 36 credit points of specialization, 36 credit points of Research. The candidate should undertake no more than 12 credit points on Specialist units. A completion of 48 credit points and a Pass mark is a pre-requisite in taking CEME 515: MEng Thesis.

All subjects can be taken at any semester except if there is a pre-requisite.

DELIVERY

In class, blended learning.

RESEARCH FACILITIES

The Civil Engineering Department is housed in four main buildings containing research laboratories, a separate workshop and a field laboratory. These research laboratories are:

- Structural Laboratory
- Hydraulics Laboratory
- Geotechnical Laboratory
- Concrete Laboratory, and
- General Workshops:
  - Welding
  - Carpentry
  - Fabrication
- Field Laboratory (CRI-Yalu Site):
  - Asphalt Laboratory
  - Cement Testing Laboratory
  - Concrete Test Laboratory

With the Memorandum of Understanding finalized in the year 2014 with the China Railway International (CRI), contracting the four-lane road project from Nadzab Airport to Lae, extended the Department's laboratory research facilities.

The department also operates a laboratory to serve industry. The laboratory calibrates mechanical equipment such as testing machines, pressure and force measuring devices and torque wrenches. It also offers a comprehensive range of material testing for soils, concrete and metals.

The research subjects being investigated in the Department include Concrete innovations, Material Resources, Cable Stayed Bridges, Steel Structures, Timber Structures, Sewage Lagoons, Roads Pavement Materials, Earthquake Resistant Structures, Soil Properties, Disaster Research, Accident Analysis, Pavement Design, Cost-Benefit Criteria for Developing countries, Rural Water Supply and Sanitation and Waste Management.

MASTER IN ENGINEERING (CIVIL ENGINEERING), M.Eng with majors

STRUCTURE OF COURSES

Code	Subject	Credit Points
Year 1	**First Semester**	
CEME 511	Method of Research	6
CEME 512	Entrepreneurship for Engineers	6
	Select from Specialist Unit	6
	Select from Specialist Unit	6
		24
Year 1	**Second Semester**	
CEME 513	Sustainable Technology & Engineering	6
CEME 514	Solid Waste & Resource Management	6
	Select from Specialist Unit	6
	Select from Specialist Unit	6
		24
Year 2	**First Semester**	
CEME 515	Thesis	12
	Select from Specialist Unit	6
	Select from Specialist Unit	6
		24
Year 2	**Second Semester**	
CEME 515	Thesis	24
		24

SPECIALIST UNITS

Environmental Engineering

CEME 535 Final Disposal/Land Filling in Developing Countries 6
CEME 536 International Environmental Policy 6
CEME 537 Environmental Economics 6
CEME 538 Mining Waste Management 6
CEME 539 Sustainable Production Technologies 6
CEME 541 Special Waste Management 6

Structural Engineering

CEME 519 Steel & Concrete Composite Designs 6
CEME 520 Advance Material Technology 6
CEME 546 Advance Earthquake & Wind Engineering 6
CEME 547 Finite Element Method 6
CEME 548 Fracture & Fatigue, Failure Analysis 6
CEME 549 Structural Forensic, Evaluation & Retrofitting 6

Construction & Management Engineering

CEME 517 Advance Project Planning & Control 6
CEME 518 Design of Construction Operation 6
CEME 542 Construction & Maintenance Management 6
CEME 543 Building & Material Performance 6
CEME 544 Sustainable Construction 6
CEME 545 Building Information Modelling And Project Management 6

Geotechnical Engineering

CEME 521 Geotechnical Modeling 6
CEME 522 Foundation Engineering 6
CEME 550 Geotechnical Investigation & Monitoring 6
CEME 551 Underground Space 6
CEME 552 Excavation Support System 6
CEME 553 Earth Retaining Structures 6

Water Resources Engineering

CEME 523 Advanced Hydrology 6
CEME 524 Urban Drainage 6
CEME 554 River Mechanics 6
CEME 555 Coastal Process & Sediment Transport 6
CEME 556 Wave Hydrodynamics 6
CEME 557 Numerical Methods in Mechanics & Environmental Flow 6

Transportation Engineering

CEME 525 Asphalt Technologies 6
CEME 526 Road Engineering 6
CEME 558 Pavement Design & Rehabilitation 6
CEME 559 Pavement Network & Management System 6
CEME 560 Operation & Management Infrastructure 6
CEME 561 Intelligent Transportation System 6

CORE SUBJECTS

CEME 511 Method of Research

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes

Upon completion of the subject, students should be able to:

1. Prepare their (Masters) dissertation proposals.
2. Determine best experimental design appropriate to his/her study.
3. Critically analyze and interpret results from their experimental designs.
4. Analyze various types of qualitative and quantitative data from all sources including manipulation of software in the analysis.
5. Conduct and present research results to research committee.

Syllabus

The subject covers classic and contemporary research strategies, research designs and writing a research proposal, format and presentation, data management, research ethics, plagiarism and information sources, qualitative and quantitative research methodology, interviews and participant observations, organizing and analyzing qualitative data, quantitative research methodology using statistical software.

Textbook
John Creswell. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Fourth Edition. SAGE Publications, Inc. NY. 2013

Assessment
Continuous: 50% (Test - 20%, Assignment- 30%)
Project Based: 25% Paper write up and 25% oral presentation

CEME 512 Entrepreneurship for Engineers

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Create a full business plan, a virtual company website.
2. Give several product presentations.
3. Compete in both the end-of-semester competitions in campus and off campus.
4. Present and discuss the critical importance of entrepreneurship to the world's economy (employment, technology advancement, societal development, etc).
5. Interact with, entrepreneurs from various sectors of the economy: software, telephony, energy, light, water, bio- and medical sciences, social networks and enterprises, entrepreneurship, and finance.

Syllabus
The course focuses on business sectors that derive from disciplines and areas of study. Engineering Entrepreneurship is a full-immersion, multidisciplinary, engineering experience holistically designed to integrate the skills and knowledge of the students in a more in-depth exposure to new product and business development to the engineering profession. The subject covers: Entrepreneurial engineer's readiness in 21st century, innovation, money, work, time, human behavior, ethics, organization and leadership, and assessment of technology opportunities.

Textbook
Goldberg, David. *The Entrepreneurial Engineer*. Wiley, USA, 2006.

Assessment
Continuous: 50% (Individual reporting-20%, Assignment- 30%)
Project Based: 50% Business Strategy

CEME 513: Sustainable Technology & Engineering

Hours per week: 6 (3 lectures + 3 Project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Address sustainable development in built environment during any civil engineering activities
2. Prepare a life cycle assessment strategies and analysis
3. Discuss environmental ethics and create an eco-label application paper in his workplace
4. Identify renewable energy and conservation strategy in PNG
5. Discuss concepts in new urbanism, bioclimatic design, and ecological.

Syllabus
This course addresses the application and fundamental concepts of the sustainable development paradigm to the built environment in application to evolving technologies and engineering possibilities; the environmental / resources issues and industrial / construction metabolism. The course will discuss environmental ethics and environmental justice; ecological / environmental economics including Life Cycle Costing; building assessment (frameworks) and Eco labels. Additionally, this course develops basic knowledge about energy systems, entropy, energy conservation and renewable energy; Life Cycle Assessment, embodied energy, and materials. Concepts such as New Urbanism, bioclimatic design principles, ecological concepts, and passive design strategies will be discussed.

Textbooks
Kauffman, Joanne, LEE, Kun Mo (eds.) *Handbook of Sustainable Engineering*
Wiley & Sons Boston, 2001
Herriott, Scott R. *Feasibility Analysis for Sustainable Technologies: An Engineering-Economic*

Perspective. Wiley & Sons. 1999.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Design & Technologies)
Final Examination: 20%

CEME 514: Recycling & Resource Management

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Assess on recycling and resource management possibilities
2. Estimate cost analysis on recycling and resource management
3. Deliver case study on best practice of recycling and resource management
4. Identify threats, hazards of as is practices and with recycling
5. Deliver a project on PNG's recycling and resource management portfolio

Syllabus
Topics in recycling covers material and energy flow management and analysis, influences of production and consumption, ecological and economically valuation of substances, assessment of sustainability of material flows, optimization of material, energy and information flows, treatment technologies, design of material flows, treatment technologies, design for recycling, upgrading and repair, recycling and reuse, engineering cost estimation, regulatory aspects of waste management, waste minimization, basic unit process, application and utilization or reclaimed products. In Resource management covers are people, facilities, communications and warning technologies, fire protection and life safety systems, pollution control systems, equipment, materials and supplies, funding, special expertise and information about threats and hazards.

Textbooks
Hung, Yung Tse . *Handbook of Environment and Waste Management - Volume 2* ISBN: 9789814449168 (ebook). 2013
Steffen Lehmann (Editor) and Robert Crocker (eds.) *Designing for Zero Waste* ISBN: 9780203146057. 2012.

Assessment
Continuous: 70% (Test -20%, Case Work- 30%) 30% Project Paper)
Final Examination: 20%

CEME 515: Thesis

Hours per week: 6 (Thesis)
Credit Hours: 6
PNG Credit: 19
Pre-requisite:
CEME 511 Method of Research

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify solid waste and resource management project involving investigation, research and/or field laboratory execution.
2. Plan and perform a detailed schedule of activities (from start to finish) of the project.
3. Apply skills and knowledge in the execution of the project.
4. Present the thesis and objectives in an organized research seminar.
5. Create and produce a written thesis and preliminary discussions

Syllabus
Topics of the research project will be chosen in consultation with the supervisor in the area of interest or specialization. Students are expected to prepare objectives, carry out a literature review on the topic, use appropriate reference and citation protocols (APA or AMA) and propose a methodology of research. Full discussion of topics selected for the research project in consultation with the supervisor in the area of interest or specialization. Students are expected to follow prepared objectives, carried out a complete literature review on the topic, used appropriate reference and citation protocols (APA or AMA) and follow proposed methodology of research. The student shall do exhaustive research to seek answers on his/her thesis either in experimental, scientific, qualitative and quantitative analysis as deemed appropriate in consultation with supervisor. This will form the basis of seminar presentation by

the student during the semester. The thesis will be examined by two external examiners approved by Higher Degree Committee.

Textbooks

Experimentation: Design and Analysis. John Wiley and Sons, New York. 2001

John Creswell. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Fourth Edition SAGE Publications, Inc. USA. 2013

Assessment

Continuous: 20% Research paper (Title, Objectives, Introduction and Literature Review), 10% Supervisor's rating, 40% External Examiner's (2 examiners, 20% each), 30% Research Oral Presentation

SPECIALIZATION

CEME 517: Advance Project Planning & Control

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes

Upon completion of the subject, students should be able to:

1. Plan and control small scale project portfolio
2. Plan and control large scale project portfolio
3. Perform Analysis in both small- and large-scale projects
4. Perform a computer- based Project Management
5. Discuss human behavior in the project setting

Syllabus

Students taking this course should already have a comprehensive understanding of the basics of planning, monitoring and controlling in a construction project using Critical Path Method (CPM) and other related techniques. This course intends to developing expertise in dealing with problems such as uncertainty in the performance of resources, modeling repetitive construction work, and simulating construction processes. It will also provide understanding of the tools and methods necessary to be leading construction managers in the new century.

Textbooks

Harris, Frank & Ronal McCaffer. *Modern Construction Management*. Sixth Edition. Blackwell Publishing. USA. 2010.

Chatfield, Carl and Timothy Johnson. *Microsoft Office Project 2007*. Microsoft Press. NY. 2007

Project Management Reference Guide. Department of Main Roads

Assessment

Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Advance Project Planning & Control Strategies)
Final Examination: 20%

CEME 518: Design of Construction Operation

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes

Upon completion of the subject, students should be able to:

1. Design theory as applied to construction,
2. Design a queuing and simulation model
3. Create and apply an axiomatic design
4. Create and apply a robust design
5. Develop a measurement and procedures for productivity

Syllabus

Design theory as applied to construction processes in the construction industry; building construction; queuing and simulation models; methodology on measurement procedures for productivity; job planning, layout planning, planning and design of production systems (construction oriented); reliability, availability, applications, axiomatic design, and robust design.

Textbook

Cooper, Rachel. *Process Management in Design & Construction*. Blackwell Publishing Ltd. USA 2005.

Assessment

Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Construction Operation Design)
Final Examination: 20%

CEME 519: Steel & Concrete Composite Designs

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify different trends and development in structural steel and concrete design including high rise building.
2. Design a composite structure
3. Design a pre-stressed structure
4. Design a pre-cast structure
5. Design and Analysis of steel and concrete composite structure in advance way

Syllabus
Topics include trends and developments in structural steel and concrete design. It will discuss framing systems, floor systems; Plate girders; Composite construction; Design of braced frames; Connections and P-Delta effects. The course includes steel bridge design, design of long columns and columns subjected to biaxial bending, two-way slabs, flat plates, girders, and shells. Design of prefabricated structures, pre-stressed, pre-casts, post-tensions concrete, short- and long-term deflections; strength loss and design requirements for shear, flexure, bond, and anchorage

Textbooks
Johnson, R. P. *Composite Structures* of *Steel and Concrete: Beams, Slabs, Columns, and Frames for Buildings*. 3rd Edition. Wiley. USA. 1990.
Gilbert R.I and N.C. Mickleborough. *Design of Prestressed Concrete*. Chapman & Hall. NY. 2000

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Composite Materials Design)
Final Examination: 20%

CEME 520: Advance Material Technology

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Calculate and analyze properties of materials
2. Create an advance material innovation
3. Perform a non-destructive testing analysis on created innovative materials
4. Comparative study of different advance materials
5. Discuss advances in Rapid Prototyping and Manufacturing Using Laser-Based Solid Free-Form Fabrication on the created advance innovated material.

Syllabus
Engineering properties of building materials such as: plastics, synthetic fibres, adhesives, sealants, caulking compounds, foams, sandwich panels, composites, polymer concrete systems, fibre-reinforced concretes, plastic mortars, polymers for flooring, roofing, synthetic wall papers. Moisture properties of modern building materials. Their structural, thermal, and acoustical properties. Consideration of corrosion, bio- and thermal-degradation, stability to ultraviolet and solar radiation. Advances in Rapid Prototyping and Manufacturing Using Laser-Based Solid Free-Form Fabrication.

Textbook
Wessel, James. *Handbook of Advance Materials, Enabling New Designs*. Wiley-Interscience. NY. 2004

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Advances in Material Technology)
Final Examination: 20%

CEME 521: Geotechnical Modelling

Hours per week: 6(3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Perform a geotechnical modelling of subsoil in any part of PNG
2. Analyze the geotechnical data of subsoil collected
3. Demonstrate the technical issues of the subsoil model

4. Apply knowledge of modelling techniques in the area of interest
5. Deliver the Geotechnical 3D model for presentation

Syllabus
Geotechnical modeling considers the nature, validity and consequences of the supporting soil assumptions. Topics cover: Introduction to geotechnical modeling, soil constitutive modeling, introduction to physical modeling, centrifuge modeling, theoretical modeling, numerical modeling and applications, and empirical models.

Textbooks
Wood, David Muir. *Geotechnical Modelling*. Spon Press. New York. 2004

Assessment
Continuous: Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Geotechnical Modelling)
Final Examination: 20%

CEME 522: Foundation Engineering

Hours per week: 6(3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify and analyze foundation failures
2. Perform foundation preventive maintenance
3. Perform foundation engineering forensic work
4. Examine legal issues associated with foundation failure issues
5. Analyze and design foundations applicable to different soil conditions.

Syllabus
Foundation engineering covers loads, the soil bearing capacity, and effect of loads that will undergo settlement. Lateral pressures. Foundation, drainage and waterproofing. Footings types (spread and Strip footings, etc). Pile foundations, retaining walls, caissons. Sheet piling walls and braced cofferdams. Cellular cofferdams. Anchors .Foundation failure analysis, forensic and legal implications. Also includes preventive maintenance, and improvement of foundations.

Textbooks
Brown, Wade. *Practical Foundation Engineering Handbook*. Second Edition. McGraw-Hill: New York. 2001

Day, Robert. Foundation Engineering *Handbook. Design and Construction with the 2009 International Building Code*.Second Edtion. ASCE Press. New York.2009

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Foundation Design)
Final Examination: 20%

CEME 523: Advanced Hydrology

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Determine the rate of movement of contaminants in surface water and groundwater
2. Statistically analyze hydrologic data, including extreme events, time series, and spatial data.
3. Use remote sensing, automated data collection, forecasting, and advanced computer methods in hydrology
4. Calculate the rate of rainfall, evaporation, infiltration, groundwater flow, snow-melt, and stream flow
5. Determine the rate of movement of contaminants in surface water and groundwater

Syllabus
Hydrologic cycle, systems concept, hydrologic model classification; Reynold's Transport Theorem, continuity equation, momentum equation, and energy equation; Atmospheric hydrology; Hydrologic processes, precipitation, evaporation, surface flow, sub-surface flow, and groundwater flow; Unit hydrograph, various response functions and their interrelationships; Hydrologic statistics, statistical parameters, fitting a probability distribution, testing goodness of fit, frequency analysis, and reliability analysis.

Textbooks
Maidment, David. *Handbook to Hydrology*. McGraw-Hill. NY.1993

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Advances and Design in Hydrology)
Final Examination: 20%

CEME 524: Urban Drainage

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Choose reliable methods for urban drainage design
2. Estimate the magnitudes of floods and mitigate their effects
3. Assess water usage for a city or an irrigation project
4. Select reliable methods for urban drainage design
5. Develop solutions for cleaning up and preventing pollution of surface water and groundwater in urban areas.

Syllabus
Topics of study include the hydrology and drainage requirements of urban areas. An introduction to the effects of urbanization on the hydrological cycle, develop basic methods of hydrological analysis including rainfall-runoff models and flood frequency analysis. Rainfall analysis and hydraulics, in application to storm, foul and combined sewer for design. Also included are sewer flow and quality models, storm water management and the increasing influence of 'sustainability principles'. Formulate integrative goals regarding to hydrologic, environmental and social consequences for a sustainable urban storm water management.

Textbooks
Butler David and John Davies. *Urban Drainage.* Second Edition. CRC Press. USA. 2004

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Urban Drainage Design)
Final Examination: 20%

CEME 525: Asphalt Technologies

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 18
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Make/create asphalt mixtures in Lab, optimizing the components and analyzing the results
2. Use new technological approach using Computer software and Labs (Marshall Test)
3. Create, test and analyze two (2) different sorts of asphalt mixtures
4. Present a technical report of two (2) asphalt mixtures.
5. Make a scientific based prediction on the mechanical behavior and durability of any asphalt specification.

Syllabus
To introduce a more applied approach covering the state-of-the-art in asphalt technologies. The course covers the basic principles of bitumen & asphalt as construction material, bitumen modification, new technological approach, effects & problems during application etc. Student will have the opportunity to make/create asphalt mixtures in Lab, optimizing the components and analyzing the results, eventually using new technological approach. Computer software and Labs (Marshall Test), Penetration Tests, are necessary.

Textbooks
Subroto, H. *Asphalt Technology Integrated into Road Engineering for the Tropics, Bridging Science and Practice.* Netherland. 2014.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Asphalt Technology Advances)
Final Examination: 20%

CEME 526: Road Engineering

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 18
Pre or co-requisite: CEME525

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Construct (almost) any road meant for various purposes
2. Analyze and predict the behavior and durability of the pavement as a whole.
3. Use shell software in pavement design
4. Calculate pavement design using manual and software.
5. Analyze existing road condition in PNG setting for road engineering project

Syllabus
The subject introduces calculating the construction using various pavement materials (asphalt, concrete, element block) and based on various conditions (purpose of the road, traffic intensities, axle loads differentiation, type of subgrade & sub-base, weather conditions, project budget, material available, controlling/checking procedures etc.).
The way of constructing asphalt pavement on a concrete or steel bridge as well as on swamp area is incorporated, next to making a comparison and an economic balance due to the use of different pavement materials.

Textbooks
Subroto, H. *Asphalt Technology Integrated into Road Engineering for the Tropics, Bridging Science and Practice.* Netherland. 2014

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Asphalt Technology Advances)
Final Examination: 20%

CEME 527: Pavement Design & Rehabilitation

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes

Upon completion of the subject, students should be able to:
1. Discuss the fundamental principles and concepts of pavement design
2. Determine load bearing capacity of pavement
3. Perform structural, drainage and safety design of road and airfield pavement
4. Perform non-destructive testing and compute structural capacity of in-service pavements
5. Evaluate condition of pavements and recommend rehabilitation solutions.

Syllabus
The course covers basic principles and concepts of the pavement design and rehabilitation for airfield and roads, major structural and functional requirements of pavement, including load bearing capacity, material and thickness selection, durability against traffic and environmental loading, drainage and safety roads, mechanism of pavement distress, techniques and approached of pavement rehabilitation, principles of pavement re

Textbook
Huang Baoshan, Benjamin F. Bower, Gua-Xiong Mei, Si-Hai Luo, and Zhongjie Zhang. *Pavement & Geotechnical Engineering for Transportation*. ASCE. 2011

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Pavement Design & Rehabilitation)
Final Examination: 20%

CEME 528: Pavement Network & Management System

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Illustrate the fundamental principles and concepts of pavement management systems
2. Perform planning and supervise operation of pavement management system (PMS) for road and airfield pavement network
3. Plan a data collection program, perform data analysis and recommend management actions
4. Perform life cycle cost analysis (LCCA) of different pavement management strategies
5. Perform optimization analysis and recommend an

optimal pavement management solution

Syllabus

The course covers basic principles and concepts of management systems for road and airfield pavement network to address conflicting objectives and requirements of pavement operators, challenges to developing a sound pavement management systems and analytical tools and techniques involved in the system development, pavement management, techniques of evaluating different financing and management strategies of pavement operations method of pavement condition and performance data collection, optimal programming of pavement management activities, budget planning and life cycle cost analysis and pavement management system (PMS): deficiencies and improvement.

Textbook

Hudson, W. Ronald. *Development of Prioritization Procedure for the Network Level Pavement Management System*. USA. 1983

Assessment

Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Pavement Network & Management System)
Final Examination: 20%

CEME 529: Operation & Management Infrastructure

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes

Upon completion of the subject, students should be able to:

1. Formulate mathematical models for optimal operation and management of infrastructure systems via resource management
2. Evaluate performance of infrastructure systems considering resource management, its economics, society and policy
3. Design and analyze specific solution to solve infrastructure system modes
4. Perform sensitivity analysis of parameters involved in a model

Syllabus

The course covers effective operations and management of infrastructure systems (water resource, transportation networks, structural) considering constraints and allocation of available resources, mathematical modeling for best operations and management strategies, initially continues type resources, nonlinear constraints and objectives, dynamic variation, built solution models and implication (economy, society and policy).

Textbook

Coffelt, Donald and Chris Hendrickson. *Fundamentals of Infrastructure Management*. Pittsburgh Pennsylvania. USA. 2017

Assessment

Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Operation & Management Infrastructure)
Final Examination: 20%

CEME 530: Intelligent Transport System

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes

Upon completion of the subject, students should be able to:

1. Discuss the fundamental concepts of Intelligent Transportation system (ITS)
2. Analyze and identify the needs of ITS research and development
3. Use the tools for quantitative ITS assessment and evaluation
4. Perform ITS planning and design of a sustainable development.

Syllabus

The course covers broad range of diverse technologies (information processing, computing, communication and control) of intelligent transportation system (ITS), and ITS research and development.

Textbook

Bison, Nic, Lucian Dascalescu, Naser Mahdavi Tabatabaei. *Autonomous Vehicles: Intellegent Transport Systems and Smart Technologies*. Nova Publishers, Inc. 2015

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Intelligent Transport System)
Final Examination: 20%

CEME 542: Engineering Economics & Project Evaluation

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify and frame the engineering project development (objective, scope, constraints and requirements)
2. Develop and characterize feasible alternatives and develop estimates for the life cycle cost analysis of the project
3. Apply principles of cash flow to evaluate economic worth of project alternatives considering risk, uncertainty, inflation, taxation and their evaluation
4. Compare project alternative for best alternative when there are multiple objectives
5. Perform Engineering economics and project evaluation for a variety of projects including public infrastructure, commercial projects and its utilities.

Syllabus
The course covers analytical methods and techniques to evaluate projects from an economics perspective, rational project selection and capital allocation (risk, uncertainty, inflation, foreign exchange)

Textbook
Park, C.S. and Tippett, D.D. Engineering Economics and Project Management. Mechanical Engineering Handbook Ed. Frank Kreith Boca Raton: CRC Press LLC, 1999

References
Sarja, Asko. Predictive and Optimized Life Cycle Management, Building & Infrastructure. Taylor & Francis. 2006
Bull, John W. Life Cycle Costing, For the Analysis, Management & Maintenance of Civil Engineer Infrastructure. Whittles Publishing. UK. 2015
Park, Chan S., Pravin Kumar & Nand Kumar. Fundamentals of Engineering Economics. Third Edition. International Edition. Pearson. 2013

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Engineering Economics & Project Evaluation)
Final Examination: 20%

CEME 543: Global Infrastructure Project Management

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Discuss a global infrastructure project considering the risk exposures and components in the project to achieve desired project Outcomes.
2. Perform industry standard risk analysis software to work out the feasibility of proposed project
3. Evaluate the impact of the project in a global and societal context
4. Create a multi-disciplinary and global team to work on a proposed large infrastructure project in an international market

Syllabus
The course covers issues covers engineering construction in a large-scale infrastructure projects in international construction markets, global characterization of a large-scale civil infrastructure projects, topics on feasibility study, risk management, international construction, international contracting, project financing , value management, engineering and procurement management and project collaboration.

Textbook
Coffelt Donald, & Chris Hendrickson. Fundamentals of Infrastructure Management. Carnegie Mellon University. 2017

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Building & Material Performance)
Final Examination: 20%

CEME 544: Sustainable Construction

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Use the LEED credit template
2. Conduct Performance Certification
3. Design methodologies in sustainable construction
4. Calculate the return on investment used for making decisions concerning LEED credits
5. Assess Green building rating and Environmental impact

Syllabus
The course covers sustainable construction due to climate change impact as the configuration of the land is transform during the construction for climatic adaptation. It taught the techniques and methods of sustainable construction or development in collaboration with stakeholders (owners, developers, architect, engineers, constructors, consultants, etc). Cost analysis on green development and life cycle cost assessment (LCCA), performance certification techniques for sustainable sites and use of natural renewable resources through design building systems (MEPF: mechanical, electrical, plumbing & fire protection).

Textbook
Kibert, Charles J. *Sustainable Construction - Green Building Design and Delivery* . 2nd edition, John Wiley & Sons, 2008.

Leffers, Regina. *Sustainable Construction and Design.* Prentice Hall, 2009.

McLennan, Jason F. *The Philosophy of Sustainable Design* by. Ecotone Publishing Co., 2004.

Montoya, Mike. *Green Building Fundamentals.* 2nd edition. Pearson, , 2010.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Sustainable Construction)
Final Examination: 20%

CEME 545: Building Information Modelling & Project Management

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Perform integrated BIM project
2. Evaluate the impact of BIM in pre- and post-construction phases
3. Perform in a multi-disciplinary team in the analysis, design, performance of BIM

Syllabus
The course covers Building Information Modelling (BIM), its analysis, design, construction and management, building performance, project delivery, facility management.

Textbook
Sacks, Rafael, Charles Eastman, Ghang Lee, Paul Teicholtz. *BIM Handbook: A Guide to Building Information Modelling for Owners, Designers, Engineers, Contractors, and Facility Managers*. Third Edition. Wiley. 2018

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Building Information Modelling & Project Management)
Final Examination: 20%

CEME 546: Advance Earthquake & Wind Engineering

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Discuss principles in seismic impact to structures
2. Conduct and collect data for modelling
3. Design and analysis of earthquake and wind impact to structures
4. Perform modeling

Syllabus
The course covers introduction to engineering seismology, causes of earthquake, seismic waves, magnitude and Intensity of earthquake, seismographs, seismic zoning, base-excited SDOF system(review), DVA Spectrum, Base-excited MDOF system, Lumped mass modeling and analysis of multi-storey shear building, response spectra, earthquake analysis of linear systems-response history analysis-modal analysis, earthquake response of inelastic systems, elasto-plastic idealization, inelastic spectra, effects of earthquake on various types of structures. It will include philosophy and principles of earthquake.- resistant design, ductility-based design and detailing, analysis and design.

Textbook
Anil. K. Chopra. Dynamics of Structures (Theory and Applications to Earthquake Engineering). 2nd Edition, Prentice Hall of India Private Limited. New Delhi. 2003

Pankaj Agarwal and Manish Shrikandhe, Earthquake Resistant Design of Structures, PHI

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Earthquake and Wind)
Final Examination: 20%

CEME 547: Finite Element Method

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Calculate theoretical basis of the finite element method, stiffness matrices and load vectors for elements, stiffness relationships for a structure (assembling the stiffness matrix of a structure based on the stiffness matrices of the individual element), numerical integration method and convergence criteria
2. Formulate element types for the modeling of beams, discs, plates, shells and massive (three dimensional) structures for linear static structural analysis
3. Perform FEM calculation using the software to perform linear static analyzes of simple structural system
4. Evaluate results of the finite method calculations

Syllabus
The course covers Finite Element Method (FEM) to calculate stresses and strains in different parts of the structure due to large dimensioning, and complicated structures. The course provides the theoretical basis for the finite element method and describes the different types of elements used in the modelling of frames, beams, discs, plates, shells and massive structures. It shows how the fundamental linear theory behind the method, combined with numerical calculations, predicts displacements, strains and stresses including the properties of the elements, convergence requirements and modeling errors. In the modelling of structures, emphasis is placed on the choice of element types, the application of loads and the introduction of boundary conditions, as well as the verification of the final analysis results.

Textbook
Long, Yu-Qiu, Song Cen, Zhi-Fei Long. *Advance Finite Element Method in Structural Engineering*. Tsinghus University Press. Springer 2009

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Finite Element Method)
Final Examination: 20%

CEME 548: High Rise & Industrial Building Design

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Perform functional planning and structural design of various types of structural systems of high rise building and industrial buildings.
2. Select suitable structural systems for tall buildings and
3. Design a fire protection for tall buildings & industrial buildings
4. Analyze and design high rise structures and industrial structure using structural engineering

software
5. Design and detail different types of machine foundations, gantry girders, and stability of high-rise building
6. Discuss structural behavior of industrial buildings and high-rise buildings

Syllabus

The course covers design philosophy of high rise building materials (RCC, steel, PSC), loading (gravity loading, wind loading, earthquake loading, blast loading), structural planning of tall building, behavior of various structural systems, analysis and design, shear wall frame interaction (basic design of shear walls), stability of tall buildings (overall buckling analysis of frames, P- Delta analysis), functional design of industrial buildings (classification, layout planning requirements, factories act, principles of lighting, ventilation, noise and vibration control, industrial floorings); general overview of thermal /nuclear power plant structures, conveyor structures (boiler supporting structures, substation structures); structural design of industrial buildings (braced and unbraced industrial frames, Gantry girders, Machine foundations, Reinforced concrete deep and shallow bins, Tall Chimneys (RCC), Cooling Towers, Transmission line Towers

Textbook

Taranath , B.S. Structural Analysis and design of Tall Building". Tata McGraw Hill. 2011.

Wilfgang Schuller, High Rise Building Structures, John Wiley and Sons.

Lynn S. Beedle,(1986),"Advances in Tall Buildings",CBS Publishers and Distributers, Delhi,

Brayan Stafford Smith, Alex Coull. Tall Building Structures, Analysis and Design", John Wiley and Sons. 1991.

Srivasulu and Vaidyanathan. Handbook of machine foundations-Tata McGraw Hill. 2002.

Murthy and Santhakumar. Transmission Line structures, McGraw Hill 7. 1990.

Assessment

Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (High rise & industrial building design)
Final Examination: 20%

CEME 549: Structural Forensic, Evaluation & Retrofitting

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes

Upon completion of the subject, students should be able to:
1. Identify cause of failures
2. Analyze the causes of failures
3. Recommend best solution for retrofitting or repair of damaged building and restoration

Syllabus

The course covers failure of structures (construction theory, performance problems, responsibility and accountability, diagnosis and assessment of distress); visual inspection, non-destructive tests (ultrasonic pulse velocity method , rebound hammer technique), environmental problems and natural hazards, durability of RCC structures (damage due to earthquakes and strengthening of buildings), modern techniques of retrofitting, use of chemicals in repair (application of polymers ferrocement, fiber composites and fiber reinforced concretes as rehabilitation materials), strengthening by pre-stressing

Textbook

Noon, Randall. Forensic engineering investigation. ISBN 0-8493-0911-5 (alk. paper)1

Liu, Rui; Michael P. Lester; Alicia E. Díaz de León; and Michael J. Drerup, (Editors). Forensic Engineering 2018. American Society of Civil Engineers. pp.1173, 2018.

Feld, Jacob and Kenneth L Carper. Structural Failures. Wiley Europe. 2008

Raikar R.N. Diagnosis and treatment of Structures in Distress" ,Jioural of performance of Xonstitutional Facilities,ASCE. 1996.

Raina V.K., Bridge Rehabilitation. Shroff publications.2006

Ransom W.H., Building Failures – Diagnosis and Avoidance. Wiley Europe.2002

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Structural Forensic)
Final Examination: 20%

CEME 550: Geotechnical Investigation & Monitoring

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Describe of the role and scope of geotechnical investigation and monitoring in the proper design and construction of engineered structures and facilities.
2. Perform the essential concepts and methodology for the planning, design and implementation of the site investigation and ground monitoring instrumentation program.
3. Interpret the geotechnical investigation results unto the design of geotechnical work.
4. Discuss the effect of disturbance during the soil sampling and testing stages unto the soil parameters obtained for design
5. Design a proper monitoring scheme that will detect the potential ground movements that may lead to failure during the construction stage to ensure safety.

Syllabus
The course covers essential concepts and methodology for the planning, design and implementation of site investigation and ground instrumentation program, density of bore holes, sampling technology and disturbance, in-situ and laboratory testing and geophysical methods, ground instrumentation, monitoring ground movement, drawdown, excess pore pressures, strut forces, wall deflection and observational method.

Textbook
ISO 18674-5:2019. Geotechnical investigation and testing- Geotechnical monitoring by field instrumentation – Part 5: Stress change measurements by total pressure cells (TPC)

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Geotechnical Investigation & Monitoring)
Final Examination: 20%

CEME 551: Underground Space

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Describe underground construction for tunneling characteristics of soil and rocks parameters
2. Perform modeling in underground space
3. Analyze and design tunnel excavation and support
4. Estimate appropriate soils parameters for various modes
5. Prepare a geotechnical engineering report

Syllabus
The course covers analysis and design of tunnel, includes bored tunneling method, jack tunneling, stability of underground openings, ground movement prediction due to tunnels, effects of ground movements on building and structures, instrumentation and monitoring, and stresses on lining. It includes the development of underground structures to form subway, underpasses, metro stations and other uses is an increasing requirement in managing urbanization worldwide.

Textbook
Yun, Bai. Underground engineering: planning, design, construction and operation of the underground space. London: Academic Press, Elsevier, 2019.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Underground space)
Final Examination: 20%

CEME 552: Structural Excavation Support System

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Design steel strutting system, earth retaining wall systems and their structural components using modern design aids and tools.
2. Create acceptable construction statement and discuss engineering safety issues related to the excavation construction.
3. Design the excavation support system and the basement excavation construction.
4. Discuss professional practices and responsibility and code requirements for deep excavations construction.

Syllabus
The course covers topics in earth retaining structures and deep excavations to include earth pressure theories, rigid retaining structures, flexible retaining structures, cellular cofferdams, retaining walls for deep excavations, support system for deep excavation, and field monitoring. It discusses the design construction issues pertaining to a spectrum of earth retaining systems from low rigid retaining walls to flexible support systems for deep excavations, application of the method of limit state design of rigid and flexible retaining walls, use of commercial geotechnical FEM software's to aid in the design of deep excavations and advance earth pressure theories selection of appropriate retaining structures and verification of capacity and movement requirements using limit equilibrium and FEM analysis tools.

Textbook
Guyer, J. Paul. Introduction to Retaining Walls and Excavation Support Systems. USA. 2013.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Structural Excavation Support System)
Final Examination: 20%

CEME 553: Earth Retaining Structures

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Evaluate the lateral earth pressures that develop behind retaining walls under different types of loading conditions and wall movements.
2. Design earth retaining systems and their components in accordance with limit state design
3. Discuss safety issues related to the construction of earth retaining structures.

Syllabus
The course covers topics in earth retaining structures and deep excavations to include earth pressure theories, rigid retaining structures, flexible retaining structures, cellular cofferdams, retaining walls for deep excavations, support system for deep excavation, and field monitoring. It discusses the design construction issues pertaining to a spectrum of earth retaining systems from low rigid retaining walls to flexible support systems for deep excavations, application of the method of limit state design of rigid and flexible retaining walls, use of commercial geotechnical FEM software's to aid in the design of deep excavations and advance earth pressure theories selection of appropriate retaining structures and verification of capacity and movement requirements using limit equilibrium and FEM analysis tools.

Textbook
Guyer, J. Paul. Introduction to Retaining Walls and Excavation Support Systems. USA. 2013.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Structural Excavation Support System)
Final Examination: 20%

CEME 554: River Mechanics

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Describe the basic principles of open channel flows and sediment transport for steady and unsteady situations.
2. Calculate simple wave problems
3.Design open channel flows stability
4. Design flood routing using advance software

Syllabus
The course covers open channel covering the conservation of mass, the momentum and energy equations, steady flows, design of channels for steady flows (lateral inflows-side spillways, lateral outflow-side weirs), flow concepts, development of continuity and momentum equations for unsteady flows, flood routing, kinematic wave, diffusive wave, and the dynamic wave, concepts of the characteristic and its application to the solutions of the simple wave problems associated with sluice gate operation and dam break, sediment transport concepts and the resistance to flow due to bed form in alluvial channels and design concept on sediment transport capacity.

Textbook
Julien, Pierrey Y. River mechanics. Cambridge University Press. 2002

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (River Mechanics)
Final Examination: 20%

CEME 555: Coastal Process & Sediment Transport

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Apply engineering problems on concepts of boundary layer and sediment transport.
2. Assess of run up on wave forces and stability of coastal structures.
3. Describe a mathematical model for sediment transport in coastal areas.
4. Discuss transport models and the se of similarity analysis in physical movable bed model studies of coastal sediment movement.

Syllabus
The course covers the wave theory, empirical approaches to the assessment of wave action that will break on non-breaking of coastal structures (sea walls and break walls), concepts in boundary layer and sediment transport for currents, waves and combine currents and waves, similitude and physical model and their application to engineering problem such as assessment of erosion and sedimentation around coastal structures.

Textbook
Graf, W.H. Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry. John Wiley and Sons, New York. 1998.

ASCE. Sedimentation Engineering: Processes, Measurements, Modeling and Practice. ASCE Manual sand Reports on Engineering Practice No. 110, ed. M.H. Garcia, ASCE, Reston, VA.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Coastal Process and Sediment Transport)
Final Examination: 20%

CEME 556: Wave Hydrodynamics

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Discuss fundamental concepts of the linear wave theory, sea state and basic elements of shallow water waves
2. Apply the engineering properties of small amplitude waves in determining water particle kinematics, pressure fields, energy propagation,

shoaling, and diffraction.
3. Calculate statistical and spectral analysis of sea waves, short- and long-term statistics, selection of design waves for prescribed return period.
4. Calculate large scale shallow water waves including the long wave theory, one-dimensional, tides, seiching, geostrophic, effect on long waves and storm surge.
5. Apply various theories in wave to affect

Syllabus
The course covers the study of basic concept in wave hydrodynamics, the conservation of mass and its momentum to the solution, amplitude waves together with its engineering properties such as particle kinematics, pressure fields, energy propagation, shoaling refraction and diffraction, non-linear properties, linear theory (mass transport, momentum flux and the radiation stress concepts), non-linear waves, wave spectrum and super position principle, design, wave selection, generation of wind waves in deep water and their statistical properties using crossing and spectral analysis for both short- and long-term strategies.

Textbook
Le Mehaute, Bernard. *An Introduction to Hydrodynamics and Water Waves*. Springer. 1976

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Wave Hydrodynamics)
Final Examination: 20%

CEME 557: Numerical Methods in Mechanics & Environmental Flows

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Discuss the principles of the approximate methods
2. Perform basic numerical methods for mechanics and flow problems
3. Conduct engineering analysis using the software
4. Analyze and report the solution for an engineering problem by use of numerical method

Syllabus
The course covers basic principles of numerical methods used for analysis of mechanics and environmental flow problems, fundamental concepts of eigen-analysis and finite difference method and the associated convergence and stability issues, application in engineering mechanics problems,, fundamental concepts and issues related to environmental flow problems, concept of box models, transport processes, application od numerical methods for analysis.

Textbook
Schäfer, Michael. Computational Engineering – Introduction to Numerical Methods. Springer. 2006

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Numerical Methods in Mechanics & Environmental Flows)
Final Examination: 20%

DEPARTMENT OF CIVIL ENGINEERING

➢ MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT PROGRAM (MScSWRM)

MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT PROGRAM (MScSWRM)

The Master Program provides the opportunity for the students to specialize in solid waste management and prepares them to become experts in this very important topic and emerging issue. The Program also covers in detail all aspects of the environment (air, water, wastewater) in as far as it is related to solid waste management. All topics are covered in the greatest detail. The subjects are presented in modular form. The content of each module has been drawn and prepared from the experiences of the participating partners, and each module is a stand-alone subject which can be presented in a designed Program. The Program provides the students with the potential to engage in a project from their workplace or a selected project which may be based on current situation.

The curriculum for this MSc was developed in the frame of the EDULINK project CODWAP, coordinated by Aristotle University of Thessaloniki, Greece. Participating countries and universities included: Bremen University of Applied Sciences and Dresden University, both from Germany; University of Mauritius, Mauritius; University of Sierra Leone, Fourah Bay College, Faculty of Engineering; and, PNG University of Technology. The project also included the running of the Master Program at the University of Mauritius in 2011/2012, as a test case.

PROGRAM OUTCOMESS (POs) FOR MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT

PO1: An ability to apply a body of knowledge that includes the understanding of current developments, research principles in a specialized practice.

PO2: A cognitive skills that demonstrates mastery of theoretical knowledge which is reflected in the way the learner thinks critically and scholarly according to chosen specialized practice.

PO3: A cognitive, technical and creative skills able to investigate critically, analyze and synthesize complex information, problems, concepts and theories or to apply established theories to different bodies of knowledge in the learner's specialized practice.

PO4: A cognitive, technical and creative skills that is able to generate and evaluate complex ideas and concepts at an abstract level.

PO5: Possess a communication and technical research skills to justify and interpret theoretical propositions, methodologies, conclusions, and professional decisions that are according to chosen field of specialized practice.

PO6: Recognize the need for engaging in life-long learning to upgrade to higher learning and research activities and specialization.

PO7: Comprehensive knowledge of contemporary issues due to changing technical scenario and be able to plan and execute a substantial research or project-based capstone.

PO8: Apply knowledge and skills that demonstrate autonomy, expert judgment, adaptability and responsibility as a learner.

ADMISSION REQUIREMENT & PROCEDURE-MScSWRM

Entry is open to students with a four (4) year Bachelor of degree in sciences or equivalent or related field with experience in Civil Engineering works. The rules about admission, registration, supervision, and administration of postgraduate programs shall be those of the PNG University of Technology Master in Engineering Programs.

CONTENT AND STRUCTURE

The candidate must complete a total of 96 credit points. There has to be 24 credit points for core units, 36 credit points of specialization, 36 credit points of Research. The candidate should undertake no more than 12 credit points on Specialist units. A completion of 48 credit points and a Pass mark is a pre-requisite in taking
CEME 516: MSc Thesis.

All subjects can be taken at any semester except if there is a pre-requisite.

DELIVERY

In class, blended learning.

MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT (MSc, SWRM

STRUCTURE OF COURSES

Code	Subject	Credit Points
Year 1	**First Semester**	
CEME511	Method of Research	6
CEME531	Introduction to Solid Waste Management	6
CEMEC532:	Hazardous Waste Management	6
CEMEC 533:	Waste Management Systems	6
		24
Year 1	**Second Semester**	
CEME513	Sustainable Technology & Engineering	6
CEME514	Solid Waste & Resource Management	6
CEMEC 535:	Final Disposal / Land filling in Developing Countries	6
Select from Specialist Unit		6
		24
Year 2	**First Semester**	
CEME515	ME Project I/Research1	12
Select from Specialist Unit		6
Select from Specialist Unit		6
		24
Year 2	**Second Semester**	
CEME516	ME Project/Research 2	24
		24

SPECIALIST UNIT

CEME536	International Environmental Policy	6
CEME537	Environmental Economics	6
CEME538	Mining Waste Management	6
CEME539	Sustainable Production Technologies	6
CEME540	Environmental Management Systems	6
CEME541	Special Waste Management	6

CORE SUBJECTS

CEME511 Method of Research

Hours per week: 6 (3 lectures + 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Prepare their (Masters) dissertation proposals.
2. Determine best experimental design appropriate to his/her study.
3. Critically analyze and interpret results from their experimental designs.
4. Analyze various types of qualitative and quantitative data from all sources including manipulation of software in the analysis.
5. Conduct and present research results to research committee.

Syllabus
The subject covers classical and contemporary research strategies, research designs and writing a research proposal, format and presentation, data management, research ethics, plagiarism and information sources, qualitative and quantitative research methodology, interviews and participant observations, organizing and analyzing qualitative data, quantitative research methodology using statistical software.

Textbook
John Creswell. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Fourth Edition. SAGE Publications, Inc. NY. 2013

Assessment
Continuous: 50% (Test - 20%, Assignment- 30%)
Project Based: 25% Paper write up and 25% oral presentation

CEME513: Sustainable Technology & Engineering

Hours per week: 6 (3 lectures + 3 Project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Address sustainable development in built environment during any civil engineering activities
2. Prepare a life cycle assessment strategies and analysis
3. Discuss environmental ethics and create an eco-label application paper in his workplace
4. Identify renewable energy and conservation strategy in PNG
5. Discuss concepts in new urbanism, bioclimatic design, and ecological.

Syllabus
This course addresses the application and fundamental concepts of the sustainable development paradigm to the built environment in application to evolving technologies and engineering possibilities; the environmental / resources issues and industrial / construction metabolism. The course will discuss environmental ethics and environmental justice; ecological / environmental economics including Life Cycle Costing; building assessment (frameworks) and Eco labels. Additionally, this course develops basic knowledge about energy systems, entropy, energy conservation and renewable energy; Life Cycle Assessment, embodied energy, and materials. Concepts such as New Urbanism, bioclimatic design principles, ecological concepts, and passive design strategies will be discussed.

Textbooks
Kauffman, Joanne, LEE, Kun Mo (eds.) *Handbook of Sustainable Engineering*
Wiley & Sons Boston, 2001

Herriott, Scott R. *Feasibility Analysis for Sustainable Technologies: An Engineering-Economic Perspective.* Wiley & Sons. 1999.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Design & Technologies)
Final Examination: 20%

CEME514: Recycling & Resource Management

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes:
Upon completion of the subject, students should be able to:
1. Assess on recycling and resource management possibilities
2. Estimate cost analysis on recycling and resource management
3. Deliver case study on best practice of recycling and resource management
4. Identify threats, hazards of as is practices and with recycling
5. Deliver a project on PNG's recycling and resource management portfolio

Syllabus
Topics in recycling covers material and energy flow management and analysis, influences of production and consumption, ecological and economically valuation of substances, assessment of sustainability of material flows, optimization of material, energy and information flows, treatment technologies, design of material flows, treatment technologies, design for recycling, upgrading and repair, recycling and reuse, engineering cost estimation, regulatory aspects of waste management, waste minimization, basic unit process, application and utilization or reclaimed products. In Resource management covers are: people, facilities, communications and warning technologies, fire protection and life safety systems, pollution control systems, equipment, materials and supplies, funding, special expertise and information about threats and hazards.

Textbooks
Hung, Yung Tse . *Handbook of Environment and Waste Management - Volume 2* ISBN: 9789814449168 (ebook). 2013
.
Steffen Lehmann (Editor) and Robert Crocker (eds.) *Designing for Zero Waste* ISBN: 9780203146057. 2012.

Assessment
Continuous: 70% (Test -20%, Case Work- 30%) 30% Project Paper)
Final Examination: 20%

CEME 516: Thesis

Hours per week: 6 (Thesis)
Credit Hours: 6
PNG Credit: 19
Pre-requisite:
CEME 511 Method of Research

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify solid waste and resource management project involving investigation, research and/or field laboratory execution.
2. Plan and perform a detailed schedule of activities (from start to finish) of the project.
3. Apply skills and knowledge in the execution of the project.
4. Present the thesis and objectives in an organized research seminar.
5. Create and produce a written thesis and preliminary discussions

Syllabus
Topics of the research project will be chosen in consultation with the supervisor in the area of interest or specialization. Students are expected to prepare objectives, carry out a literature review on the topic, use appropriate reference and citation protocols (APA or AMA) and propose a methodology of research. Full discussion of topics selected for the research project in consultation with the supervisor in the area of interest or specialization. Students are expected to follow prepared objectives, carried out a complete literature review on the topic, used appropriate reference and citation protocols (APA or AMA) and follow proposed methodology of research. The student shall do exhaustive research to seek answers on his/her thesis either in experimental, scientific, qualitative and quantitative analysis as deemed appropriate in consultation with supervisor. This will form the basis of seminar presentation by the student during the semester. The thesis will be examined by two external examiners approved by Higher Degree Committee.

Textbooks
Experimentation: Design and Analysis. John Wiley and Sons, New York. 2001

John Creswell. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Fourth Edition SAGE Publications, Inc. USA. 2013

Assessment
Continuous: 20% Research paper (Title, Objectives, Introduction and Literature Review), 10% Supervisor's rating, 40% External Examiner's (2 examiners, 20% each), 30% Research Oral Presentation

CEME531: Introduction to Solid Waste Management

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Determine different composition of waste generation
2. Identify international regulations
3. Determine biological treatment
4. Discuss principles of waste management
5. Identify technologies appropriate to changing environment

Syllabus
The course covers waste generation and composition, national and international regulations for waste, waste avoidance, collection and transport of waste, separate collection of recyclables, sorting of recyclables, recycling technologies for paper, glass, metal, plastic, biological treatment of waste, waste disposal, ecological indicator systems, principles of waste management, polluter and producer pays principle, the precautionary principle, waste hierarchy, concept from cradle to grave.

Textbook
Tchobanoglous, George and Frank Kreith. *Handbook of Solid Waste Management*. Second Edition. McGraw-Hill Companies, Inc. New York. 2002.

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Solid Waste Management)
Final Examination: 20%

CEME532: Hazardous Waste Management

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Characterize hazardous waste
2. Classify hazardous waste
3. Calculate thermal and energy recovery
4. Identify alternative hazardous waste management program
5. Perform treatment and disposal of hazardous waste

Syllabus
The course covers hazardous waste treatment and disposal; hazardous waste identification, basic properties of hazardous waste, classification of hazardous waste, hazardous waste generation and characteristics, transportation and storage of hazardous waste, physical, chemical and biological treatment, thermal and energy recovery, stabilization and solidification and land disposal of hazardous waste, alternative hazardous waste management programs.

Textbook
Tchobanoglous, George and Frank Kreith. *Handbook of Solid Waste Management. Second Edition.* McGraw-Hill Companies, Inc. New York. 2002

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Solid Waste Management)
Final Examination: 20%

CEME533: Waste Management Systems

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Plan waste management in system view
2. Identify pollution and its prevention using proven methodology
3. Calculate economic evaluation of pollution prevention
4. Assess of investment portfolio on various manufacturing processes waste disposal
5. Monitor and prevention of impact of solid waste to the environment

Syllabus
The course covers planning of waste management systems (costs, aims, basics) logistics, collection (storage systems), transport and transfer stations (policy, economics, planning) identification of pollution prevention, opportunities, implementation of proven methodology as defined by International Environmental Agencies (i.e. EPA), emphasis on economic evaluation of pollution prevention practices and investment for various manufacturing and post-consumer processes, monitoring.

Textbook
Tchobanoglous, George and Frank Kreith. *Handbook of Solid Waste Management. Second Edition.* McGraw-Hill Companies, Inc. New York. 2002

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Waste Management System)
Final Examination: 20%

CEME535: Final Disposal / Land filling in Developing Countries

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Plan and design landfill
2. Design methodologies on landfill construction on latest technologies
3. Describe a landfill system appropriate to PNG setting
4. Deliver case studies of landfill system from at least two (2) different developing countries.
5. Evaluate future energy production, maintenance, emission control and treatment.

Syllabus
The course covers landfill emissions, site requirements, landfill construction, monitoring landfill technology and operation, sitting and construction, design characteristics, life span, extraction of landfill gas – future energy production, operation and maintenance, emission control and treatment.

Textbook
Tchobanoglous, George and Frank Kreith. *Handbook of Solid Waste Management. Second Edition.* McGraw-Hill Companies, Inc. New York. 2002

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Landfill)
Final Examination: 20%

SPECIALIZATION

CEME 536: International Environmental Policy

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify solutions on environmental problems supported by environmental policy
2. Analyze policies from the perspective of developed and developing countries
3. Prepare a case study relative to international environmental policy
4. Present a case in relation to PNG setting
5. Develop a policy framework appropriate for PNG

Syllabus
The course covers methods and strategies for promoting solutions to global environmental problems, policymaking from perspective of developed and developing countries, the United Nations system, international financial entities, and non-governmental interest groups, progress of international community, obstacles preventing effective international solutions, links between politics, policy and the environment, origins and evolution of different forms of environmental policy, different stages of the environmental policy process, study of academic research papers.

Textbooks
Rudig, Wolfgang. *International Environmental Policy*. Worldcat. 1999
Salzman, James and Barton H. Thompson Jr. *Environmental Law and Policy*, Second Edition (Concepts and Insights Series) 2nd Edition. USA. 2007

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (International Environmental Policy)
Final Examination: 20%

CEME 537: Environmental Economics

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Calculate monetary value on environmental problems
2. Analyze environmental instruments
3. Analyze implications of economic activity for PNG
4. Calculate ecological footprints
5. Design an effective environmental management using economic tools

Syllabus
The course covers internalizing an externality, instruments of environmental policy, monetary valuation of environmental problems, basic economic principles to assist environmental analysis and management, implications of economic activity and development of environmental quality, and the economic tools and framework, participatory method, cost-benefit analysis, multi-criteria assessment, sustainability indicators (i.e. ecological footprints).

Textbooks
Kolstad, Charles D. *Environmental Economics*. Second Edition. Oxford Press. USA. 2012
Field, Barry and Martha Field. *Environmental Economics: An Introduction* .The Mcgraw-Hill. USA. 2012

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Environmental Economics)
Final Examination: 20%

CEME 538: Mining Waste Management

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Characterize mining waste
2. Assess risk of mining facilities
3. Review of techniques for the prevention of abatement of pollution generated by mining waste
4. Use at least two decision management support tools for minimizing the impact of mining waste

Syllabus
The course covers methods for the characterization of mining waste, risk assessment of mining facilities including old/abandoned mining waste facilities, review of techniques for the prevention of abatement of pollution generated by mining waste, examples of decision support tool for minimizing the impact of the mining industry on the environment.

Textbooks
Tchobanoglous, George and Frank Kreith. *Handbook of Solid Waste Management*. Second Edition. McGraw-Hill Companies, Inc. USA. 2002.

Hutchison, Ian P. G. and Richard D. Ellison. Mine *Waste Management: A resource for mining industry professionals, regulators and consulting engineers*. Wiley. USA. 2009

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Mining Waste Management)
Final Examination: 20%

CEME 539: Sustainable Production Technologies

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None
Learning Outcomes
Upon completion of the subject, students should be able to:
1. Plan sustainable development and sustainable production
2. Evaluate impact of production process on the environment
3. Prepare and assess sustainable production process in an industrial setting
4. Deliver CDM project
5. Tap or propose opportunities-financing economies of CDM

Syllabus
The course covers introduction to sustainable development and sustainable production, impact of production processes on the environment, sustainable production, impact of production processes on the environment, sustainable production process in the chemical, metal and ceramic industries, purpose and implementation of CDN/JI, Kyoto Protocol, CDM Market, Investments, incentives, opportunities-financing economics of CDM/JI projects.

Textbooks
Tchobanoglous, George and Frank Kreith. Handbook of Solid Waste Management. Second Edition. McGraw-Hill Companies, Inc. USA. 2002

Sustainable Production Technologies. CODWAP

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Project (Sustainable Production Technologies)
Final Examination: 20%

CEME 540: Environmental Management Systems

Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Audit environmental impact using EMAS, EMS , ISO 1400 and ISO 14001
2. Develop a mock EMS manual for an organization
3. Implement ISO 1400 compliant EMS within organization

Syllabus
The course covers integration of environmental issues on sustainability in business, key elements of the Eco-Management and Audit Scheme (EMAS) and ISO 14001, principles and elements of environmental management systems, environmental management and reporting, examples of Environmental Management System (EMS) manual, developing a 'mock' EMS manual for an organization, developing and implementing an ISO 1400 compliant EMS within an organization.

Textbook
Tchobanoglous, George and Frank Kreith. *Handbook of Solid Waste Management*. Second Edition. McGraw-Hill Companies, Inc. USA. 2002

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Environmental Management Systems)
Final Examination: 20%

CEME 541: Special Waste Management
Hours per week: 6 (3 lectures+ 3 project)
Credit Hours: 6
PNG Credit: 19
Pre-requisite: None

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Design hazardous health care from hazardous waste
2. Identify potential health hazards
3. Audit industrial health program
4. Deliver special waste management project

Syllabus
The course covers introduction, definition of hazardous health care waste, infectious waste, genotoxic waste, waste sharps, biomedical waste-categories and composition, sources of health care wastes, hospital waste management, potential health hazards, legislation and policies on health care waste management, Works Health Organization guidelines, industrial waste definition, industrial waste audit, industrial waste management, hospital and industrial wastes collection, treatment and disposal.

Textbook
Tchobanoglous, George and Frank Kreith. *Handbook of Solid Waste Management*. Second Edition. McGraw-Hill Companies, Inc. USA. 2002

Assessment
Continuous: 50% (Test-20%, Case Work- 30%), 30% Paper (Special Waste Management)
Final Examination: 20%

DEPARTMENT OF COMMUNICATION AND DEVELOPMENT STUDIES

- MASTER OF COMMUNICATION STUDIES (MCS)
- MASTER OF ARTS IN ORGANISATIONAL LEADERSHIP (MAOL)
- GRADUATE CERTIFICATE IN COMMUNICATION OF SCIENCE AND TECHNOLOGY (SCICOM)
- POSTGRADUATE CERTIFICATE IN STUDENT-CENTRED TEACHING

COMMUNICATION AND DEVELOPMENT STUDIES

Head of Department

Wrondimi, G., MASW (Victoria Univ. NZ), BA Social Works (UPNG)

Deputy Head of Department

Maino, L., MCS (PNGUoT), BEd. (UOG), DipST (UPNG-GTC)

Professor

Gilder, E., Prof Dr *habil*. in Philology (Lucian Blaga University, Sibiu), PhD in Communication (Ohio State Univ.), MA in Speech Communication & Drama/Radio-TV-Film (Univ. of N. Texas), BA in Communication /Political Science (Univ. of Texas/Arlington)

Senior Lecturer

Aisoli-Orake, R., PhD in Education (Newcastle Univ), MLitt Hons (ANU), BEd. (UPNG), PGCCST (PNGUoT)

Lecturer 2

Wrondimi, G., MASW (Victoria Univ. NZ), BASW (UPNG)

Winuan, M., MA App. Ling. (Waikato Univ. NZ), BEd. (UPNG), BEd. Hon. (UPNG), DipST. (UPNG-GTC)

Lecturer

Makara, S., MCS (PNGUoT) BTCD & DTCD, (PNGUoT). On study leave.

Kuri, F. J., MA (CSU) BEd. (UPNG-UOQ)

Molus, W., MCS (PNGUoT), BEd. (UOG), DipEd (Balob) On study leave.

Sefo, J., MCS (PNGUoT), BEd. (PAU), CertT (Balob)

Paul, S., MCS (PNGUoT), BA (Journalism and Com) UPNG

Sangundi. A., MCS (PNGUoT), BEd. (UOG)

Moka, R., MCS (PNGUoT), BEd. (UOG)

Jesse, N., MCS (PNGUoT), BTCD & DTCD, (PNGUoT)

Administrative Officer 2

Lero, M., BA in Public Policy & Social Development (UPNG)

Principal Technical Officer

Jack, E., BCom (UOT), DipCom (UOT), Cisco CCNA ICND (UOT)

Senior Secretary 2

Senginawa, A. Cert in Secretarial Studies, (Lae Tech), Dip. In Management, (DWU)

Secretary

Gamong. P., Trade Cert in Bus. Studies (Lae Tech)

Janitor

Eng, J.

DEPARTMENT OF COMMUNICATION AND DEVELOPMENT STUDIES

Postgraduate Programs

The Department offers the following postgraduate programs: Master of Communication Studies (MCS), Master of Arts in Organizational Leadership (MOAL), Postgraduate Certificate in Communication in Science and Technology (SCICOM), and Postgraduate Certificate in Student-Centred Teaching and Learning (PGCSCT).

The Department also has Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) programs in Communication and Development Studies by research.

The MCS is a two-year program consisting of coursework and a dissertation component. In the first year, candidates take eight subjects (four in each semester), and complete a thesis by research in the second year. The MAOL program, which is for three years, is offered through the Distance Mode in partnership with Development Associates International (DAI) of the USA. The participants are expected to register and enroll for required subjects which are completed via the Distance Mode. They come in for two residencies for a week in a year. The PGCCST program is offered to graduates occasionally according to perceived needs. The MPhil program is offered to suitable candidates who wish to pursue their postgraduate studies by research alone, without having to do course work. The PhD program is offered to those who wish to pursue their studies to the highest level demonstrated by meeting set academic requirements, including a well-developed PhD research proposal.

MCS Program Details

Program Goal

To provide a high-quality postgraduate education at the Masters level to meet the manpower needs of the government departments, non-government organizations and the private sector industries in Papua New Guinea and the wider global community, particularly to the Pacific Island countries.

Program Outcomes (POs)

a) Impart to the students a broader understanding and appreciation of the various structures and dynamics of society and their connections to patterns of human behavior and individual life changes.
b) Offer various communication theories and their applications that sets forth the foundation for further analysis and research in the field of development communication.
c) Teach and equip the students with knowledge and skills to communicate socio-economic and political development issues and agendas of society.
d) Provide advanced training in writing by creating an academic environment for students to develop critical awareness of the organization, linguistic features and the production of selected academic writing genres.
e) Educate t students not only to understand the knowledge, skills and techniques in planning and carrying out independent research but also to grasp the key methods of data processing using relevant computer software programs.
f) Produce high quality dissertations reflected by skills and knowledge, originality of scholarly research, critical assessment, logical structure and scholarly discussion of findings to address research questions and problems.

Rules for Master Degree with Coursework

This program shall be offered in accordance with and within the meaning of the rules governing the University's Master Degree through the coursework and dissertation mode.

In consultation with the University Higher Degrees Committee, the Department shall, from time to time, make such adjustments where necessary, particularly in the program's course structures.

Program Structure

The candidate for the Degree of Master of Communication Studies (MCS) shall register for eight (8) units of coursework and dissertation (MCS 520) built into four (4) semesters of the two-year program. The course-structure is presented below:

Year 1 First Semester 17

Code	Subject	Weekly Hours
MCS 501	Communication Theories	4
MCS 502	Sociological Thought	4
MCS 503	Advanced Research Methods	4
MCS 504	Media Editing & Reporting	4

MCS 520	Dissertation	1
Year 1 Second Semester		17
MCS 505	Advanced Writing Skills	4
MCS 506	Participatory Communication & Community Development	4
MCS 507	Sociology of Crime & Deviance	4
MCS 508	Public Relations, Advertising & Campaign	4
MCS 520	Dissertation	1
Year 2 First Semester		14
MCS 520	Dissertation	6
Year 2 Second Semester		
MCS 520	Dissertation	8
TOTAL HOURS		48

Duration of the Course

Consistent with the Higher Degrees rules, the following duration of study shall apply:
A candidate shall normally have a minimum of twelve calendar months and a maximum of twenty-four calendar months. A special extension may be sought, if the student has valid reason/s for not completing his/her work. If, however, a student does not complete his/her studies without any valid reason/s, his/her studies may be terminated by the University Academic Board upon recommendation from the Higher Degrees Committee.

SUBJECT DETAILS

MCS 501: COMMUNICATION THEORIES

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Know contemporary communication theories on Western perspectives
2. Understand major communication theories and application in their societies
3. Understand studies on media and society, invention of reality (mediated realities), classic studies on media effects will be discussed to expand the foundation of students to keep pace with the concept of modern media use to enrich their professional capacity
4. Apply knowledge of theoretical aspects of relationship between mass communication and society; effects of mass media; media and violence; and needs, expectations and gratifications of media will be brought into discussions so that the students can plan further to take mass media channels as part of effective communication in future.

Syllabus

Introduction to Communication Theory:
What is Communication? What is a Theory? Theoretical scholarship, Good Vs. Bad Theories
Assumptions Behind Communication Theories: Reality, Knowledge and Values
Researching Theory in Communication: Inductive vs. Deductive, Quantitative vs. Qualitative
Verbal Communication Processes
Nonverbal Communication Processes
History of Communication Study
Theories of Interpersonal Communication
Theories of Group Communication
Theories of Organizational Communication
Theories of Mass Communication
Theories of Intercultural Communication
Theories of Gender Communication

References

Baldwin, J.R., Perry, S.D. & Moffitt, M.A. (2004). Communication Theories for Everyday Life. Pearson.
Hahn, L. K., Lippert, L., & Payton, S. T. (2011). Survey of Communication Study. Wkibooks.
West, R. & Turner, L. H. (2010). Introducing Communication Theory, McGraw Hill.

Assessment

Examination	50%
Continuous Assessment	50%

MCS 502: SOCIOLOGICAL THOUGHT

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Understand the roots of both classical and contemporary sociological theories
2. Know the pioneering works of Augustine Comte, Karl Marx, Emile Durkheim, and Max Weber for their modern ideas of society
3. Examine the major theoretical perspectives of

Talcott Parsons and Robert Merton
4. Emphasize on the relevance of theories for socio-economic and political transformation in Papua New Guinea
5. Look at how various sociological theories explain the 'driving force' of social change in the contemporary Papua New Guinea.

Syllabus

Precursors to Sociological Theory: Of the social contract: Jean-Jacques Rousseau; Enlightenment: Immanuel Kant; Division of labor: Adam Smith.
Development of Sociology as a Science of Society: Augustine Comte and sociology; Perspectives of sociology; Wright Mills and sociological imagination; Social science research methodology
The Sociological Theory of Karl Marx and Friedrich Engels: History and class struggle: Manifesto of the Communist Party; Capitalism and the labor process.
The Sociological Theory of Emile Durkheim: The rules of sociological method; Solidarity and modern life; The division of labor in society; Origins of collective conscience; The elementary forms of religious life; Anomie and suicide
Sociological Theory of Max Weber: Objectivity' in social science; Basic sociological terms; The distribution of power within the political community; The types of legitimate domination and the ideal bureaucracy.
Structural-Functional Analysis:
Talcott Parsons: The position of sociological theory; the notion of the social system Structural components of the social system Robert Merton: On sociological theories of the middle range; Social structure and anomie
Contemporary Sociological Thought or Modern Social Theory:
Democracy: Socialism and capitalism; Modernization theory; Dependency theory: development of underdevelopment; Globalization and the global community; Social theory and social change in Papua New Guinea

Textbook

Giddens, A. (2009), Sociology. Cambridge: Polity Press.

References

Schaefer, R. T., (2006), Sociology: a Brief Introduction. New York: McGraw Hills. 6th Edition.
LaCapra, D., (1972). Emile Durkheim: Sociologist and Philosopher. London: Cornell University. Matherson Library Call No. 301.092D963
McKee, J. B., (1969). Introduction to Sociology. New York: Holt, Rinehart and Winston, Inc. Special Reserve, Matherson Library, Call No. 301M154
Mills, C. W., (1959). The Sociological Imagination. New York: Oxford University Press. Special Research, Matherson Library, Call. 301M657
Plange, N., (1996). The Science of Society: Exploring the Links Between Science and Theories of Development. Suva: University of the South Pacific.
Truzi, M. (ed.), (1971). Sociology: the Classic Statements. New York: Random House. Matherson Library, Call No. 301S678
Worsely, P. (Ed.), (1978). Modern Sociology. Middlesex: Penguin Books. Matherson Library Call No. 301M689.

Assessment

Examination	50%
Continuous Assessment	50%

MCS 503: ADVANCED RESEARCH METHODS

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Understand research techniques and employ the qualitative and quantitative methods
2. Write research proposals
3. Apply theoretical perspectives by interpreting social reality in order to enhance participation in research
4. Undertake independent research using various methods and styles of research
5. Chose topics, gather, analyze, interpret and report data
6. Learn the techniques in planning and carrying out research, competently design questionnaires and understand the key methods of data processing and analysis
7. Understand ethical issues in conducting research.

Syllabus

The Nature of Inquiry: The search for truth; Two conceptions of social reality; Strengths and criticisms of positivist and interpretive paradigms; The assumptions and nature of science.
Research proposal: Elements of research proposal; Problem or Objective; Literature Review; Subjects for study; Measurement; Data Collection methods;

Analysis; Schedule, and Budget.
Aspects of Research: The tools of science; The scientific method; Research and evaluation; Research, politics and policy-making and Characteristics of good research, validity and reliability issue
The Ethics of Social Research: Informed consent; Access and acceptance; Ethics of social research; Sources of tension; Voices of experience; Ethical dilemmas; Privacy and anonymity; Confidentiality; Betrayal and deception and Research and regulation
The Research Process: The problem identification; Data collection and analysis; Data interpretation and reporting and Actioning research findings
Data Preparation and Analysis: Data summary and summary sheet; Tabulation and graphs; Computer software and Correlational statistics (univariate, bivariate, multivariate, and others).
Quantitative Research Methods: The survey style; The experimental style; Correlational style and Content analysis
Qualitative Research Methods: The case study style; Observation (non-participant and participant); Ethnographic and anthropological style; Historical analysis and Action research

References

Babbie, E. (2004), The Practice of Social Research, Belmont: Thomson Wadsworth. 10th Edition.
Guthrie, G. (ed), (1984), Basic Research Techniques, University of Papua New Guinea, Port Moresby: Education Research Unit.
Perrin, R,. (2007), Pocket Guide to APA Style. Boston: Houghton Mifflin Company.

Assessment

Examination	50%
Continuous Assessment	50%

MCS 504: MEDIA EDITING AND REPORTING

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Understand the skills and techniques of editing and reporting for media communication under the rubric of citizens' journalism, crisis journalism and journalism as a factor of national development
2. Develop practical skills of reading and producing media content in various forms
3. Use editing and reporting tools in print and electronic media as appropriate
4. Provide students a broad range of writing and production procedures in the print sector, broadcasting and electronic media, such as radio production, journalism and information technology
5. Deal with media editing and reporting across a broad range of professional domains, including government, corporate and NGO sectors, in which communication skills and knowledge of media platforms could be obtained.

Syllabus

Media reporting: Under the three models considering both "Hard News" and its structure; "Soft News" and its structure; Report seminars, workshops, meetings, speeches, Parliament proceedings, etc.; Reporting social, economic, political and cultural events for print and electronic media.
Newsroom and news copy: Editing copies; re-writing copies; headline writing; photo editing; caption writing; Editing and page design processes for broadsheet and tabloid newspaper: obtaining balance, harmony, unity and coherence in media outputs.
Critical analysis of the settings of journalism practices in the "post-journalist" age: print and video processes and practices in citizen media (blogs, etc.). crisis journalism and changing journalism practices in developing countries.

References

Collins, F. R. (2013). Editing Across Media: Content and Process in a Converged World. MacFarland Publishers.
Hunter, M. L. (ed.). (2012). The Global Investigative Journalism Casebook. UNESCO.
Institute for War & Peace Reporting. (2004). Reporting for Change: A Handbook for Local Journalists in Crisis Areas. Author.
Investigative Journalism Manuals.(n.d.). Konrad Adenauer Stiftung.
Wahl-Jorgensen, K. & Hanitzsch, T. (2009). The Handbook of Journalism Studies. Routledge.

Assessment

Examination	50%
Continuous Assessment	50%

MCS 505: ADVANCED WRITING SKILLS

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Develop critical awareness of the linguistic features and academic writing genres
2. Emphasize accurate production of text types of writing and outcomes-based approaches to achieve this goal
3. Know theoretical foundations of the writing process relating to the theory that informs writing practices
4. Produce grammatically accurate written products and apply the principles of genre analysis in writing
5. Produce texts that show higher degree of linguistic complexity and use and use appropriate language and style in writing.

Syllabus

Writing and learning;
The writing process: pre-writing and actual writing phases; developing a voice in writing
Academic writing: process and product viewpoints
Trends in writing instruction. On the use of models in writing instruction
Writer-oriented vs. Reader-oriented writing
Language and style: coherence, fragments vs. complete sentences, subordination, dangling modification, sentence variation, faulty parallelism, wordy phrases and expressions, obscure words, sexist language, etc.
Argumentation: claims, arguments, support, counterarguments, refutation.
Substantiation: use of sources, citations, status of claims, the concept of face, politeness strategies
Discourse Elements: signposting, topic development, cohesion, grammatical choices, lexis.
Approach to genre analysis: Linguistics and genre analysis; Sociology and genre analysis, cross-cultural factors in genre analysis
Language description of written products, direction words in writing
Editing: grammatical forms, spelling, punctuation, redundancies, capitalization, etc.
Research genres in academic settings: research article abstracts, research article introductions, etc.
Genre analysis in action: job application letters, newspaper editorials, project proposals, assignments, and term papers, etc.
Paragraph/Essay patterns: analytical, comparison and contrast, evaluative, etc.

References

Goodson, P., (2013), Becoming an Academic Writer. London: Sage.
Moody, J. A., (1992), Working with English. Gaborone: The Foundation for Education with Production.
Moxley, J. M., (1992), Publish, Don't Perish: the Scholars Guide to Academic Writing and Publishing. London: Greenwood Press.
Richard, J. C., (1985), The Context of Language Teaching. New York. Cambridge University Press.
Swales, J.M. and C.B. Feak, C.B., (1985), Academic Writing for Graduate Students: A Course for Nonnative Speakers of English. The University of Michigan Press.

Assessment

Examination	50%
Continuous Assessment	50%

MCS 506: PARTICIPATORY COMMUNICATION AND COMMUNITY DEVELOPMENT

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Know theoretical perspectives of participatory communication and community development and establish the role of communication and participation in community
2. Apply principles of adult learning theories relevant to participatory development communication approaches emphasizing dialogue across disciplines as central to development
3. Make efforts to design communication strategies using action research for sharing of knowledge and for enhancing community empowerment.

Syllabus

Review of modernization theory in relation to development communication focusing on rural peoples' knowledge, participation and empowerment. Discussions will be on concepts such as development communication, development, participation and action-research. Role of various stakeholders will also be defined in using

communication to facilitate community participation within specified contexts.

Explore how the concept of adult learning can be applied to enable people to discuss developmental issues and to strengthen decision making at the community level. Participants of this course will draw from experiential learning, social learning and community learning theories to facilitate dialogue in transdisciplinary teams to build capacity of communities to use communication and other essential services to improve their own livelihoods.

Introduce approaches for planning communication strategies and to facilitate the active involvement of different groups in the local community, to collectively identify problem situations and the potential and seek potential solutions. The process involves critical analysis of the community livelihood issues followed by planning, implementing, monitoring and evaluating and sharing and using of information derived from the communication program. Discuss some communication tools within the participatory approaches for multi-stakeholder learning to enable changes in the local community.

References

Bessette, G., (2004), Involving community. A guide to participatory development communication. Ottawa, International Development Research Centre

Chambers, R., (1987), Sustainable livelihoods, environment and development: Putting rural people first. Brighton, England, Institute of Development Studies, University of Sussex.

Chambers, R., (1997), Whose reality counts? Putting the first last. London, ITDC.

Dick, B. (1997). Action learning and action research [online] Available at http://www.scu.edu.au/schools/gcm/ar/arp/actlearn.html

Freire, P., (1973), Education for the critical consciousness. New York: The seabury press.

Kolb, D. A., (1994), Experiential learning. Experience as the source of learning and development. Englewood Cliffs: Prentice-Hall.

Tufte, T. & P. Metalopulos, 2009. Participatory Communication: A Practical Guide. Washington, DC: The World Bank.

Assessment

Examination	50%
Continuous Assessment	50%

MCS 507: SOCIOLOGY OF CRIME AND DEVIANCE

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Know classical and contemporary criminological theories
2. Understand the major contributions of sociologists and criminologists, who explained various aspects of crime in society
3. Enrich students' understanding of how these crime theories explain the criminal activities that occur in the world
4. See how the media influences crime especially through the television and movie industries
5. Examine the social and economic costs of crime and assess how the criminal justice system attempts to prevent criminal activities
6. Understand the state responses to crime in different societies and alternative strategies aimed at preventing the occurrences of crime in the society
7. Assess how criminal justice system is organized to prevent crime
8. critically analyze current crime policy approaches and suggest constructive alternatives.

Syllabus

Classical and Neo-Classical Theories: the classical school; new-classical school; positivist school
Individual Theories Crime: biological and psychological approaches
The Sociological Theory Theories of Crime: social Disorganization; sub-culture; social control; situational; labelling; and radical.
Modernization and Crime: organic solidarity; mechanical Solidarity; colonialism; westernism; rural-urban migration; urbanization; and squatter settlements.
Crime and the Criminal Justice System: police; courts; and prison systems
Approaches to the study of mass communication effects
Impact of television advertising
Impact of mass media on social issues like crime, violence, crisis and social disorder
White collar crime, violent crime and transnational crime
Children's learning from mass media, Media Reporting of Crime, Capital punishment
State Responses and Crime Alternatives

References

Alexander, R. (2000). Counselling, Treatment and Intervention: Methods with Juvenile and Adult Offenders. Ontario: Wadsworth

Jim R M., (2003) Mass Media Effects: A Review of 50 Years of Media Effects Research (2003), CARMA International, Australia.

Thomas, J. B., Snipes J., and Gerould, A., (2010), Vold's Theoretical Criminology. New York: Oxford University.

Sali, G., (1986). Law and Order in Contemporary Papua New Guinea: An Examination of Causes and Policy Options. Unpublished PhD Thesis Paper Submitted to the Department of Applied Social Sciences, Victoria University of Wellington, New Zealand.

Vicki, L. and Dinnen, S. (eds.), (2010), Civic Insecurity: Law, Order and HIV in Papua New Guinea. State Society and Governance Program, Canberra. Australian National University.

Assessment

Examination	50%
Continuous Assessment	50%

MCS 508: PUBLIC RELATIONS, ADVERTISING AND CAMPAIGN

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes

1. Grasp important themes of communications as public relations, advertising, and campaigns
2. Work professionally in business organizations, media houses, government and non-government offices and community relations departments
3. Practice the art of public relations (PR) activities and foster an understanding of PR ethics
4. Undertake case studies in PR and advertising through the lens of the strategic communications planning matrix
5. Know the history of advertising and PR in print and electronic media
6. Know the role of politics in communities and how it affects PR campaigns.

Syllabus

Theories and practical aspects of public relations; Building image and goodwill of organizations; Managing internal and external public(s) of organizations; Public opinion and persuasion; Looking at crisis management as PR personnel; Public Relations ethics; Studying cases of public relations and community relations problems; Preparing press releases, brochures, folders, media kits and campaign materials.

The course will take the students through the Strategic Communications Planning Matrix as designed by Wilson and Ogden, and have them also analyze case studies of successful and unsuccessful PR campaigns via the model. Relevant analysis of individual theoretical and applied studies from the literature will also be employed.

Students will finally learn to apply these PR insights into the political context of nation and communities.

References

Dye, T.R., & MacManus, S. A. (2009). Politics in States and Communities, 13th ed. Pearson (selected).

Handy, C. (1993). Understanding Organizations. Penguin. (selected)

Saylor Academy. (n.d.). Mastering Public Relations.

Wilson, L. J. & Ogden, J. D. (2004). Strategic Communication Planning: For Effective Public Relations and Marketing, 4th(ed.) Kendall/Hunt (selected).

Assessment

Examination	50%
Continuous Assessment	50%

MCS 520 DISSERTATION

Hours per week: (1 hour first semester, first year) + (1 hour second semester first year) + (6 hours first semester second year) +8 hours second semester second year) = 16 hours

Total Hours 16: (0 Lecture + 16 tutorial)
Credits: 36

Learning Outcomes

1. Produce a high-quality dissertation paper based on original research
2. Address research problems and questions considering the relevant subject-matter of the research dealt with
3. Discuss and declare the originality of scholarly research, critical assessment, logical structure and research findings

4. Build a clear argument on the major objectives of the dissertation in a logical and consistent manner through orderly progression of work.

Instructions

The students will be supervised by department approved faculty and to complete within the stipulated time and submit a dissertation for the partial fulfillment of a Master of Communication Studies (MCS). They will select topic, finalize methodology and complete literature review in the first semester to present them at a seminar. The remaining part of the research such as data collection, analysis, and writing should be completed and presented at a seminar and submit the dissertation at the end of the second semester of second year.

The candidate will be provided with specific instructions on dissertation style, methods, techniques, contents, volume and other details to support him/her in writing the dissertation.

References

Earl Babbie (2004), The Practice of Social Research, Belmont. Thomson Wadsworth.

Goodson, P., (2013), Becoming an Academic Writer. London. Sage.

Moody, J. A., (1992), Working with English. Gaborone. The Foundation for Education with Production.

Moxley, J. M., (1992), Publish, Don't Perish: the Scholars Guide to Academic Writing and Publishing. London. Greenwood Press.

Perrin, R. (2004). Pocket Guide to APA Style. Boston: Houghton Mifflin Company.

Richard, J. C., (1985), The Context of Language Teaching. New York: Cambridge University Press.

Swales, J.M. and C.B. Feak, C.B., (1985), Academic Writing for Graduate Students: A Course for Nonnative Speakers of English, The University of Michigan Press.

Assessment

Satisfactory or Unsatisfactory

DEPARTMENT OF COMMUNICATION AND DEVELOPMENT STUDIES

➢ MASTER OF ARTS IN ORGANISATIONAL LEADERSHIP (MAOL)

MASTER OF ARTS IN ORGANISATIONAL LEADERSHIP (MAOL)

Program Mode: Distance Education (Blended Learning)

Program Goal

To provide high quality postgraduate education at the Masters level to significantly enhance the effectiveness and integrity of Christian leaders in various institutions and organizations in order to maximize the quality, relevance and value of the products and services they deliver. Additionally, to provide an educational experience which results in a qualitative change in the leader's life, relationships, and leadership practices.

Program Outcomes

This program prepares candidates to create and lead transformative organizations that improve the well-being of all stakeholders in terms of Kingdom values by means of a cohort-based Christian education that emphasizes:

a. Value-based leadership competencies required for envisioning and leading performance-oriented organizations
b. Team-oriented managerial competencies that create well-run systems to serve the organization mission and the well-being of all stakeholders
c. The professionalism of the leader/manager through enhanced mission competence, commitment, and vision as well as problem solving abilities
d. A worldview and understanding that is grounded in biblical foundation for critical reflection, ethical integrity, thoughtful integration and personal spiritual growth and character development of the leader in Christian discipleship and maturity
e. An interactive forum in which curricula matters are focused on understanding one's organization and context so as to be able to apply what is learned to one's current work setting; and
f. A social network of peers and mentor supporting the leader in the task of developing the skill and wisdom essential for navigating the sometimes chaotic and confusing environment of their world.

Program Partners

This program is initially the proposal of four partnering institutions/organizations, and these are:

a. The Papua New Guinea University of Technology (PNG Unitech)
b. Development Associates International (DAI)
c. The Christian Leadership Training College of Papua New Guinea (CLTC)

In partnership with DAI, CLTC and Pioneers of Australia, the program is expected to be offered through the PNG University Technology housed by the Department of Communication and Development Studies.

Program Delivery Method

Today there are a wide range of different distance learning models; from paper based correspondence courses to completely online web-based e-learning. This program is somewhere in between. This program is usually called hybrid or blended learning.

The candidates will complete the program based on a cohort learning model. That is a group of participants who stay together throughout a degree program. The cohort model brings students together in a collaborative, team-focused learning experience, with the goal of developing a learning community. This model encourages participants to draw upon both their peers and instructors for support. The program will be delivered as follows:

a. Participants will come together for a residency 2 times per year for a total of two weeks (one week each residency)
b. All courses are completed via the appropriate distance education curricular formats. These methods will incorporate course workbook, readers, and other additional materials.
c. Dialogue with course teachers, supervisors and students will be by a variety of means including face to face meetings, e-mail, telephone and fax according to the location of participants and institutions.
d. Institution mentors are responsible for coaching and facilitating the dialogue with their cohort group, both individually and collectively, during this specific course period.
e. Participants have practical projects where they have to apply what they are learning to their current leadership role, as well as teach it to others and complete written assignments and course papers.
f. The participants should be able to produce a high quality dissertation reflected by his

technical competence, originality of scholarly research, critical assessment, logical structure and scholarly discussion of findings to address research questions and problems. The dissertation must be a coherently 135organized sequence of chapters that should show clear headings and sub-headings. In all, the object of the dissertation is to build a clear argument in a logical and orderly progression.

Program Coordination

CLTC will assist UNITECH to provide the program coordination which includes:

a. Marketing and Communication
b. UNITECH will provide the teaching location in Lae.
c. CLTC will provide the teaching location in Port Moresby.
d. UNITECH will arrange collection of tuition, accounting and distribution of those funds to partners.

Rules Governing this Program

This program shall be offered in accordance with and within the meaning of the rules governing the University's Master Degree program.

In consultation with the stakeholder partners (PNG Unitech, DAI and CLTC) the CDS Department shall, from time to time, make such adjustments where necessary particularly in the program's course structures.

Exams and Marking

Assessment of the students will be based on 60% continuous assessment and 40% examination administered in each semester.

The current grading system used by PNG UNITECH will be applied for processing the marks and grades. The CDS Department will submit the marks and grades for record keeping purposes.

Quality Assurance Strategy

The program shall be reviewed after its first academic year, and thereafter three years, to assess its relevance, suitability and quality. The CDS Department with its partners shall form the review committee. In the review processes, other stakeholders from government and industries shall be consulted as a means of wider community participation in the program.

Admission to Candidature

In accordance with the Unitech's rules governing the Master program, an application for admission to candidature in this program shall have:

a. A Postgraduate Diploma of the University or of a tertiary institution approved by the Higher Degrees Committee; or
b. A Bachelors Degree of the University or of a tertiary institution approved by the Higher Degrees Committee in any field of study; or
c. In all *a* and *b* above, the candidate must have the potential to provide significant leadership in their organizations or communities.

An application for admission into candidature for the degree of MAOL shall be approved by the Higher Degrees Committee only on the recommendation of the Head of Department in consultation with its program partners.

Duration of the Course

Consistent with the Higher Degrees rules, the following duration of study shall apply:

The candidate shall have 36 calendar months (3 years) for this program. A special extension may be sought, if the student has valid reason/s for not completing his/her work. If, however, a student does not complete his/her studies without any valid reason/s, his/her studies may be terminated by the University Academic Board upon recommendation from the High Degrees Committee in consultation with CDS Department and its partners.

Course Structure & Delivery

The candidate for the Degree of Master of Arts in Organization Leadership (MAOL) shall register for 11 (eleven) courses and a dissertation component in 3 years, of which 3 courses will be taken in the third year from 6 (six) optional courses. The matrix below indicates the course-structure.

Code	Subject	Average Weekly Hours
Year 1 First Semester		
MOL511	Leadership: Making Human Strength Productive	4
MOL512	Teaching and Learning for Impact	4
Year 1 Second Semester		
MOL513	Strategic Thinking	4
MOL514	Women in Leadership	4

Year 2 First Semesters

MOL521	Integrity and Financial Management	4
MOL522	Research Methodology	4

Year 2 Second Semester

MOL523	Spiritual Formation	4
MOL524	Conflict Management and Resolution	4

Three subjects to be taken from optional subjects in year 3 during semester 1 and 2, and dissertation is obligatory.

Year 3 First Semesters

MOL531	Ethics for Decision Making	4
MOL532	Development and Social Change	4
MOL533	Mentoring	4

Year 3 Second Semester

MOL534	Culture, Ethnicity and Diversity	4
MOL535	Fundraising	4
MOL536	Partnership	4
MOL611	Dissertation	8
	TOTAL HOURS	52

SUBJECT DETAILS

MOL 511: LEADERSHIP – MAKING HUMAN STRENGTH PRODUCTIVE

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Investigate and critique the traditional perception of leadership in the participant's context.
2. Develop a comprehensive understanding of servant-hood in the theological and historical context of Jesus
3. Evaluate the applied foundational principles of servant-hood in across a range of core issues related to leadership in an organization.
4. Assess analytically the application of leading as a servant to the present context of the participant's leadership role.

Syllabus

Unit 1: Can I Be a Leader?
Unit 2: Leader - Know Yourself
Unit 3: Power
Unit 4: Leading Change
Unit 5: Setting Vision
Unit 6: The Right Person for the Right Job
Unit7: Motivating Individual Excellence and Fulfillment
Unit 8: Developing Others
Unit 9: Team Building
Unit 10: Organizational Accountability

References

D'Souza, A., (1990). *Being a Leader*. Africa Christian Press.
Engel, J. F., "Clarification of Mission".
Engstrom, T and Dayton, E., *Christian Leadership Letter.*
Foster, R J., "Destructive Power" from *Money, Sex & Power.*
Henderson, D., *Through the Dust,* Chapter 1
Hayes, E., "Effective Boardsmanship".
Job Descriptions, *Feb, 1975*; Motivation, *July/August 1975*; "…a Word of Appreciation, *Dec, 1974.*

Assessment

Examination	40%
Continuous Assessment	60%

MOL 512: TEACHING AND LEARNING FOR IMPACT

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Examine what can be learnt about teaching methods of Jesus and describe how they can be applied in facilitating learning.
2. Identify the five key factors that trigger learning and describe how a facilitator can help learners address each factor.
3. Examine the importance of selecting learning outcomes in learning process, and describe how to express and evaluate them.
4. Evaluate a variety of different methods of facilitating learning and indicate when it is appropriate to use a particular method.

5. Explore a variety of different settings for learning environment and decide on an appropriate approach for selected learning outcomes.
6. Plan, prepare and facilitate a learning experience for a minimal group of learners.

Syllabus

Unit 1: Introducing Teaching and Learning
Unit 2: What we know about adult learners
Unit 3: Understanding Learning Styles
Unit 4: Factors underpinning Effective Learning
Unit 5: Facilitating Effective Learning
Unit 6: Communication and Learning Methods
Unit 7: Designing and Delivering Learning
Unit 8: Listening and Asking Questions
Unit 9: Learning through Feedback
Unit 10: Evaluating Learning

References

Race, P., (2005). *Making Learning Happen*. London: Sage Publications.

Assessment

Examination	40%
Continuous Assessment	60%

MOL 513: STRATEGIC THINKING

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Analyze the roots of management and strategic thinking that lie within Scriptures.
2. Develop positive attitude towards strategic thinking as a God-led process, seeing ministry and work as a base upon partnership between God and decision making.
3. Outline, critique, and explain various elements of strategic thinking process.
4. Construct strategic statements for an organization using learned steps and process.
5. Evaluate personal approaches to strategic thinking, focusing on areas needed insights, to enable change in patterns of engaging in work or ministry.

Syllabus

Unit 1: What Strategic Thinking is All About
Unit 2: Mission, Vision and Purpose
Unit 3: Research the Situation
Unit 4: What Resources Do We Have?
Unit 5: Strategy and Action
Unit 6: Evaluation

References

Dayton, E. and Fraser, D., Planning Strategies for World Evangelization, "Perspectives,""Assumptions"
Engel, J., "Doing the Right Things to Extend
Engel, J., "Clarification of Mission"
Engel, J., "The Spiritual Decision Process"
Engel, J., "Audience Receptivity"
Engel, J., "Using Survey Research to Help Understand Your Target Audience"
Rickett, D., "Seven Mistakes Partners Make and How to Avoid Them"
Engel, J. and Dyrness, W., "A Preoccupation with Numerical Success"
Plueddemann, J., "Measurable Objectives, No! Faith Goals, Yes!"
Engel, J., "Best Practices in Evangelism: An Evaluation Tool"
Engel, J. and Morey, J., "Impact Evaluation of the Jesus Film Project: Executive Summary"

Assessment

Examination	40%
Continuous Assessment	60%

MOL 514: WOMEN IN LEADERSHIP & GENDER ISSUES

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Explore and be familiar with the assumptions about what the Bible says about women.
2. Study the importance of authority of scripture, and discover some of the challenges of interpreting it.
3. Review and be acquainted with that changing one's beliefs can be biblical.
4. Analyze and understand the importance of studying biblical roles of women.

Syllabus

Unit 1: Choosing the Better Part
Unit 2: God's Perfect Plan for Relating and Working Together
Unit 3: God's Perfect Plan for Us to Rule His Garden
Unit 4: Tragedy and Redemption

Unit 5: How Do We Interpret God's Word for Today?
Unit 6: First Timothy
Unit 7: First Corinthians 7, 11 and 14
Unit 8: Ephesians 5
Unit 9: How Do I Choose the Better Part?

References

Cunningham, L. and Hamilton, D., Why Not Women? Chapters 1, 12, 16, 17
Articles found at www.cbeinternational.org
Christians For Biblical Equality: Statement on Men, Women and Biblical Equality, taken from www.cbeinternational.org
Giles, K., "The Doctrine of the Trinity and Subordination"
Bilezikian, G., Beyond Sex Roles, Chapter 1, God's Creation Design
The Place of Women in the 21st Century—Reports from around the world
Gill, D., God's Women Then and Now, Chapters 6, 9 and 10
Fee, G. & Stuart, D., How to Read the Bible for All It's Worth, Second Ed., A Guide to Understanding the Bible Chapter 1: Introduction: The Need to Interpret
Fee, G., "The Cultural Context of Ephesians 5:18–6:9. Is there a divinely ordained hierarchy in the life of the church and home that is based on gender alone?"
Tucker, R., Women in the Maze: Questions & Answer on Biblical Equality, Chapters 20-23

Assessment

Examination	40%
Continuous Assessment	60%

MOL 521: INTEGRITY & FINANCIAL MANAGEMENT

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Articulate the need for integrity in society and the life of Christian organizations.
2. Define integrity and show how it is relevant to many contexts of life, including finances.
3. Describe how one can develop a character of integrity that is biblically based.
4. Investigate and discuss the enemies of integrity and explain how to avoid them.
5. Create a basic budget and interpret it.
6. Analyze and interpret the meanings of basic financial spreadsheets and financial ratios.

Syllabus

Unit 1: The Importance and Meaning of Integrity
Unit 2: Values: The Foundation of Integrity
Unit 3: Conscience: The Inner Compass to Keep us on the Track of Integrity
Unit 4: Personal Accountability
Unit 5: Motivation and Rewards for Integrity
Unit 6: Leading with Integrity
Unit 7: Money and Stewardship
Unit 8: Debt and Contentment
Unit 9: Financial Policies, Procedures and Statements
Unit 10: Financial Planning and Budgeting

References

Kouzes, J. and Posner, B., 2003. Credibility, Jossey Bass.
Freeman, J., 1989. Living with your conscience without going crazy.
Josephson, M. & Hanson, W., 1998.The Power of Character, Jossey Bass.
Josephson Institute for Ethics, The Six Pillars of Character: http://www.josephsoninstitute.org/MED/MED-6pillars.htm
Center for Character Development: http://www.charactercenter.com
The Content of our Character Project: http://www.contentofourcharacter.org/toolkit.htmlVerhey, A., Remembering Jesus, Erdmans 2002
Leading with Integrity: http://www.teal.org.uk/dl/integrity.htm

Assessment

Examination	40%
Continuous Assessment	60%

MOL 522: RESEARCH METHODOLOGY

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Explore the value and components of empirical, field research.

2. Demonstrate the basic skills of field research by writing a mini-project involving all elements of a research process.
3. Research and produce a final Master's thesis project.

Syllabus

Unit 1: Starting Where You Are
Unit 2: Selecting and Clarifying the Concern Behind Your Thesis
Unit3: Selecting a Focus for Your Mini-Project
Unit 4: Evaluating other People's Research
Unit 5: Designing Your Strategy
Unit 6: Drafting, Refining and Testing Your Field Questions
Unit 7: Doing Your Field Research
Unit 8: Writing Your Mini-Project Research Report
Unit 9: Writing Your "So What" Document
Unit 10: Building from Your Mini-Project to Your Full Thesis
Unit 11: Ending Where You Want to Be: as a Different Kind of Leader

References

- Nussbaum, S., Breakthrough! Steps to Research and Resolve the Mysteries in Your Ministry (GMI, 2007)
- Sogaard, V., Research in Church and Mission (William Carey Library, 1996)
- Robson, C., Real World Research, 2nd Edition (Blackwell, 2002)

Assessment

Examination	40%
Continuous Assessment	60%

MOL 523: SPIRITUAL FORMATION

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Explore the nature and depth of longing for God, and a healthy life in Christ.
2. Discover the complexity of reasons Christians experience "mid-life crisis" in their spiritual lives.
3. Examine range of God's provisions which links to spiritual giftedness, vocation and spiritual disciplines, and describe them as hard work and as an expression of God's grace.
4. Diagnose weaknesses and habitual patterns of sin; discern good and bad habits as well as true from false forgiveness and examine their spiritual health and plan for regular discipline.
5. Identify the God's call to discipleship and describe activities that, if done regularly, would make significant differences in spiritual and vocational life of continued development and change.
6. Identify the wholeness of life and describe how God takes the lost through suffering to new levels of engagement with Himself and the business of His Kingdom

Syllabus

(With associated spiritual discipline)
Unit 1: Thirsty for God: Restoring our Passion for God (Solitude and Silence)
Unit 2: Images of Spiritual Formation: What's the Goal of Life in Christ? (Study)
Unit 3: The ABCs of Spiritual Formation: Reviewing the Foundation (Prayer)
Unit 4: Obstacles: Why Aren't We Making It All the Way? (Fasting)
Unit 5: Spirituality: What It Is and What It Isn't (Service)
Unit 6: The Spiritual Aspects of the Disciplines (Meditation)
Unit 7: The Hard Work of Spirituality (Submission)
Unit 8: Person, Place and Provision (Celebration)
Unit 9: The Cardinal Sins: Radical Solutions for Radical Sins (Simplicity)
Unit 10: Forgiveness and Reconciliation: Remedies for Individuals and Communities (Confession)
Unit 11: The Life of Integrity: Discernment, Steadfastness and Forthrightness (Guidance)
Unit 12: Adversity and Crisis: Getting Ready (A week without Disciplines)
Unit 13: Getting Ready for the Rest of Life (Worship)

References

Foster, R. and Smith, J.B., Devotional Classics: Selected Readings for Individuals and Groups, Revised and Expanded (Harper San Francisco, 2005)

Assessment

Examination	40%
Continuous Assessment	60%

MOL 524: CONFLICT MANAGEMENT & RESOLUTION

Hours per week: 4(3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Describe problems and potentials in managing and resolving conflict in the context of ministry and organizational leadership.
2. Examine case studies as examples for evaluation and learning how to deal with conflict through actual events and histories that demonstrate the models used in the course.
3. Examine Biblical texts for the purpose of managing conflicts and working towards resolution of issues from Biblical perspectives.
4. Discover the significances of understanding human cultures in conflict management.

Syllabus

Unit 1 How Should Christian Leaders Think about Conflict?
Unit 2 What Obstacles do Christian Leaders Face in Handling Conflict?
Unit 3 How Do Christian Leaders Resolve Conflict? Learning to Forgive.
Unit 4 How Do Christian Leaders deal with Conflict?
Unit 5 How do Christian Leaders Manage Socio-political Conflict?
Unit 6 The Incarnation: The Supreme Model for Conflict Management & Resolution

Text books

- Elmer, D., Cross-Cultural Conflict: Building Relationships for Effective Ministry. Downers Grove: Intervarsity Press. 1993.
- Osterhaus, J., Jurkowski, J. & Hahn, T., Thriving through Ministry Conflict: Understanding Your Red & Blue Zones. Grand Rapids, Zondervan. 2005

References

Ford, L., Transforming Leadership: Jesus' Way of Creating Vision, Shaping Values & Empowering Change. Downers Grove, IL. Intervarsity Press. 1991.
Lingenfelter, S. &Mayers, K., Ministering Cross-Culturally: An Incarnational Model for Personal Relationships, Grand Rapids, Baker Book House. 1996.
Love, R., Peacemaking: Resolving Conflict, Restoring & Building Harmony in Relationships. Pasadena, CA. William Carey Library. 2001.
Palmer, D., Managing Conflict Creatively. Pasadena, CA. William Carey Library. 1999.
Sande, K., The Peace Maker: A Biblical Guide to Resolving Personal Conflict. Grand Rapids, Baker Books. 2005.

Assessment

Examination	40%
Continuous Assessment	60%

MOL 531: ETHICS FOR DECISION MAKING

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Identify how Christian world-view influences ethical life and leadership, and examine the relationships of ethics to the Christian life.
2. Evaluate authoritative sources of ethical norms used by Jesus and Apostle Paul, and critique His teachings about exercising authority in ministry of Christian leaders.
3. Examine works of the Holy Spirit which enables us to live and lead ethically, and look at examples of ways in which African, Islamic, secularist/postmodern world-views influence moral behavior.
4. Analyze ethical decisions of biblical characters, and describe what it means to manage one-self and state why this is important.
5. Recognize ethical issues; work with ethical decision-making process tools designed to assist in positive moral action by Christians to live according to the gospel.
6. Explore ways in which conformity to the expectations of culture and submission to the authority of the State may create tensions with commitments to obey God.

Syllabus

Unit 1: How do ethics fit into the Christian life? (The significance of Christian ethics)
Unit 2: Where do we find dependable ethical guidance? (The role and moral impact of divine revelation)
Unit 3: What is the central challenge of Christian ethics? (How we treat other people)

Unit 4: How do we live ethically in our relationships? (Loving others according to the pattern of Jesus)
Unit 5: What is critical to the ethics of leadership? (It starts with managing ourselves)
Unit 6: How do we make ethical decisions? (A process for ethical decision making)

References

Stott, J.R.W., Human Rights & Human Wrongs: Major Issues for a New Century, (Baker Books, 1984, 1990, 1999).

Assessment

Examination	40%
Continuous Assessment	60%

MOL 532: DEVELOPMENT AND SOCIAL CHANGE

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Discover God's concerns for poor and oppressed, for the entire creation, and describe how it impacts how we live and what we do.
2. Search and explain how scripture records about Jesus and his disciples acted upon his mission and ways in which churches through the centuries have been faithful to the mission of Jesus.
3. Identify how local churches in student's context can respond to issues regarding destruction of environment, impacts of human violence and oppression, poverty, diseases and human sufferings, and inequality and injustice.

Syllabus

Unit 1: An Introduction to Development and Social Change
Unit 2: A Theology for Christian Activism: Part 1
Unit 3: A Theology for Christian Activism: Part 2
Unit 4: In the Footsteps of Christ-God's Mandate to the Church: Part 1
Unit 5: In the Footsteps of Christ-God's Mandate to the Church: Part 2
Unit 6: In the Footsteps of Christ-God's Mandate to the Church: Part 3
Unit 7: Transformation - A Kingdom Agenda for Development and Social Change
Unit 8: Transformation – Part 1 Principles for Community Transformation
Unit 9: Transformation – Part 2 From Kingdom Theory to Kingdom Practice

References

(excerpts and readings from the following, most included in the Units)
Arnold, E (Editor), The Early Christians in Their Own Words. Farmington, PA. Plough Publishing House. 1997.
Bercot, D. (Editor), A Dictionary of Early Christian Beliefs. Peabody, MA. Hendrickson Publishers, Inc. 1998.
Bercot, D., The Kingdom That Turned the World Upside Down. Tyler, TX. Scroll Publishing Company. 2003.
Biblical Worldview and Skills for Wholistic Ministry.Vision Conference Training Workbook. Harvest International and Food for the Hungry, USA, 2004
Black, M., The No-Nonsense Guide to International Development. Oxford. New Internationalist™ Publications Ltd. 2002.
Dayton, D., Discovering an Evangelical Heritage. New York. Harper & Row. 1976.
Dichter, T., Good Intentions – Why Development Assistance to the Third World has Failed. Amherst and Boston.University of Massachusetts Press. 2003.
Elliston, E., (Editor), Christian Relief and Development – Developing Workers for Effective Ministry. Dallas. Word Publishing, 1989.
Fung, R., The Isaiah Vision. Geneva. WCC Publications. 1992
Koyama, K., No Handle on the Cross, Great Britain. SCM Press Ltd. 1976.
McCreary, A., Up-With People - Christian Aid Around the World. Great Britain. Font Paperbacks. 1979.
McLaren, B., The Secret Message of Jesus. Nashville. W Publishing Group, a Division of Thomas Nelson. 2006.
Myers, B., Walking with the Poor. New York. World Vision International, published by Orbis Books. 1999.
Philip, P., Journey with the Poor. Australia. Collins Dove. 1988.

Rickett, D., Building Strategic Relationships: A Practical Guide to Partnering with Non-Western Missions. USA. Partners International. 2000.
Sine, T. (Editor), The Church in Response to Human Need. Missions USA. Advanced Research and Communication Center. 1983.
Stark, R., The Rise of Christianity. San Francisco. HarperCollins. 1997.
In addition to the texts indicated above, several key articles were obtained from the following internet sites:
Association of Evangelical Relief and Development Organizations (AERDO). http://www.aerdo.org
Learning to Give. http://www.learningtogive.org
Sojourners Magazine. http://www.sojo.net/sojomail
The Micah Network.http://www.micahnetwork.org

Assessment

Examination	40%
Continuous Assessment	60%

MOL 533: MENTORING & COACHING

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Define the word 'mentoring', and explore Biblical models of mentoring, in both Old and New Testament.
2. Describe what makes a mentoring relationship effective or ineffective, and articulate the different roles that a mentor can play.
3. Assess the values of mentoring, identify a range of strategies including storytelling, and write a development plan for mentoring.
4. Define the expectations in a mentoring relationship, identify the strengths and personal style of mentoring, and expand mentoring skills through empathetic listening, giving and receiving feedback.
5. Expound the differences between mentoring and coaching, and identify different models used in coaching.
6. Critique and identify appropriate forms or techniques for coaching, plan and describe how to choose the right coach and evaluate it.

Syllabus

Unit 1: Introduction and Case Study – Mama Mary
Unit 2: Mentoring Basics and Examples
Unit 3: Mentoring Roles and Competencies
Unit 4: Your Story as an Effective Mentoring Tool
Unit 5: Mentoring Skills
Unit 6: Mentoring Relationships
Unit 7: Tools for Mentoring and Coaching
Unit 8: Leadership Coaching: Introduction
Unit 9: Leadership Coaching: Frameworks and Outcomes
Unit 10: Leadership Coaching: Different Types of Coaching
Appendix - Developing and Implementing a Mentoring Program

References

Mallison, J., Mentoring to Develop Disciples and Leaders, 1998 (Openbook)
Stanley, J. & Clinton, P., Connecting, 1992 (Navpress)

Assessment

Examination	40%
Continuous Assessment	60%

MOL 534: CULTURE, ETHNICITY AND DIVERSITY

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Distinguish and describe complex issues related to culture and ethnic identity – issues of history, sociology, and more.
2. Define technical terms like ethnicity, ethnocentricity, culture, and more which are used throughout this course.
3. Review and evaluate tragedies in recent history that have been influenced by ethnicity and diversity, esp. that of intolerance of people who are different, "the Other."
4. Prepare to enter the process of asking where diversity-training fits in training of others in Christian leadership as well as in their lifestyle and obedience to Jesus' Great Commission

Syllabus

Unit 1: Course Introduction
Unit 2: Creation and Fall
Unit 3: And God Created Diversity
Unit 4: Aliens and Strangers
Unit 5: Blessed to Bless All Nations

Unit 6: What Do We Do With the Past?
Unit 7: Reaching Out to the "Other"
Unit 8: The Church After Pentecost
Unit 9: A Church For All Peoples
Unit 10: Forgiveness and Reconciliation
Unit 11: One New Humanity
Unit 12: Culture, Ethnicity, and Diversity in the Future
Unit 13: Intentionality

References

Yancey, G., Beyond Racial Gridlock: Embracing Mutual Responsibility (Inter-Varsity Press, 2006).
Contained in the Module Units (Partial listing)
Andrew Walls, A. (Article), "The Gospel as Prisoner and Liberator of Culture"
U.N. Universal Declaration of Human Rights
The Willowbank Report: Consultation on Gospel and Culture (Copyright © 1978, LCWE)
Biblical Language to Help Understand "Outsiders" Christianity Today, October 2, 2000 (http://www.christianitytoday.com/ct/2000/011/2.36.html)
Color-Blinded: Why 11 o'clock Sunday morning is still a mostly segregated hour.
(An excerpt from Divided by Faith by Michael O. Emerson and Christian Smith)
Case Study #1: Christian Witness and Reconciliation Initiatives in Burundi
Case Study #2: Forgiveness in Bethlehem: A Personal Experience
Case Study #3: Israel/Palestine, Reconciliation Between Women
Case Study #4: The Treatment of Australian Aborigines and the Church's Role in Reconciliation

Case Study #5: Intercession and Conflict Transformation in the Democratic Republic of Congo

Case Study #6: Nyack College, USA: Building a Multi-Ethnic Campus
Case Study #7: Kosovo, Witness, and the Orthodox Church
Reconciliation as the Mission of God

Assessment

Examination	40%
Continuous Assessment	60%

MOL 535: FUNDRAISING

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Explore God's perspective on fundraising by identifying scriptural models and Paul's models of fundraising as providing biblical principles for fundraising, and describe how leadership impacts such fundraising models.
2. Understand the importance of communication in fundraising process, and identify the fundamentals of communication process that enables relationship building and communicate directly and simply in fund raising.
3. Explore how fundraising works in a local culture and knowhow to begin, and state ways to invite and involve local churches and others to participate in such ministry, and see how to write a case statement for the ministry.
4. Study the biblical basis for personal support-raising and point out its benefits, and describe how personal support raising flows out of relationships and learn how to cultivate personal supporters through communication.
5. Investigate what Western Charitable Foundations expect from those requesting funds from them and find out why they say "no" or "yes", review the basic components of writing a proposal, and craft a proposal to fit their interests and instructions.
6. Reflect on how cultural differences impact relationships in giving and receiving, and appreciate the role business play in the Kingdom of God, and describe new trends to transform societies and nations through business

Syllabus

Unit 1: Kingdom Foundations
Unit 2: Leadership in Fund Raising
Unit 3: Communication in Fund Raising
Unit 4: Strategy and Planning
Unit 5: Beginning Closest to Home
Unit 6: Personal Support Raising
Unit 7: Understanding the Western Donor
Unit 8: Proposal Writing
Unit 9: Business as Mission

References

Nouwen, H., The Spirituality of Fund-Raising, Fundraising as Ministry

Kiiru, MacM., How to Develop Resources for Christian Ministries (Nairobi, 2004), Ch. 1.
Haynie, R., "The Road Less Traveled in Fundraising"
Richard, H., "WHO GIVETH THE INCREASE? Non-Profit Organizations, Business Growth and Fund Raising"
Engel, J., "Your Style in Working With Others"
www.tearfunduk.org: "Roots 6: Fundraising, Section 1. Christian Fund Raising"
Downes, D. and Awuku, A., "Funding the African Missionary Movement: Fulfilling the Dream"
Ezemadu, R., Sending and Supporting African Missionaries in the 21st Century: Chs. 3, 4, 5, 6, 9, 10.
Oginga, J., "Raising Missionary / Church Worker Support in Africa", from The Church Leader in Africa, 2nd Quarter 2005
www.parkerfoundation.org
www.firstfruit.org
Tunehag, M., Business as Mission: Holistic Transformation of People & Societies
"The Essentials of Good Business as Mission, 10 Guiding Principles" (an extract of Lausanne Occasional Paper on Business as Mission)

Assessment

Examination	40%
Continuous Assessment	60%

MOL 536: PARTNERSHIPS

Hours per week: 4(3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes

1. Critique the argument that working together is a biblical imperative, describe and outline the different stages of partnerships.
2. Evaluate and explain the differences between a simple and a complex partnership; and horizontal and vertical partnerships, and give examples of both.
3. Evaluate and describe the impact of different types of ministry, and explain how conflict can damage a partnership and state what needs to be done to de-escalate conflict.
4. Investigate and evaluate the different methods of exploring a partnership to identify success and failure factors, and critique ways in which participants could approach ministry differently as a result of new understanding about what the Scripture says about partnership.
5. Discuss and evaluate the characteristics of effective and ineffective teams, and State the aspects and agenda for meetings to launch a partnership.
6. Evaluate ways in which cultural differences can impact a partnership and indicate how to minimize the differences and maximize multi-cultural understanding.

Syllabus

Unit 1: Partnership – a theological perspective
Unit 2: What do we mean by "partnership"?
Unit 3: The strategic importance of working together in partnership
Unit 4: Exploring a partnership
Unit 5: Launching a partnership 1
Unit 6: Launching a partnership 2: a Reflection and Review
Unit 7: The Operations Stage of a partnership
Unit 8: Developing Effective Groups and Teams in partnerships
Unit 9: Partnerships and Conflict
Unit 10: Trust, Evaluation and other key issues in Partnerships

References

Addicott, E., Body Matters – a Guide to Partnership in Christian Mission (Interdev Partnership Associates, 2005)

Assessment

Examination	40%
Continuous Assessment	60%

MOL 611: DISSERTATION

Hours per week: 8 (1 tutorial)
Credits: 16

Learning Outcomes

1. Produce a high-quality dissertation paper based on a selected research topic.
2. Address research questions and problems considering the relevant subject-matter of the research dealt with.
3. Discuss and declare the originality of scholarly research, critical assessment, logical structure, and research findings
4. Build a clear argument on the major objectives of the dissertation in a logical and consistent manner through orderly progression of work.

Directions

The students will be supervised by department approved faculty and to complete within a stipulated time and submit a dissertation for the partial fulfillment of a Master of Arts in Organizational Leadership. The dissertation, which is based on the candidate's coursework and field research, is the reflection of the student's three-year study program.

The candidate will be provided with specific instructions on dissertation style, methods, techniques, contents, volume and other details to support him/her in writing the dissertation.

References

Perrin, R. (2004). Pocket Guide to APA Style. Boston: Houghton Mifflin Company.
Guthrie, G. (Editor) - Basic Research Techniques, University of Papua New Guinea, Port Moresby: Education Research Unit.
Perrin, R. - Pocket Guide to APA Style. Boston: Houghton Mifflin Company.

Assessment:

Satisfactory or Unsatisfactory

DEPARTMENT OF COMMUNICATION AND DEVELOPMENT STUDIES

➢GRADUATE CERTIFICATE IN COMMUNICATION OF SCIENCE AND TECHNOLOGY (SCICOM)

GRADUATE CERTIFICATE IN COMMUNICATION OF SCIENCE AND TECHNOLOGY (SCICOM)

This SCICOM course developed from an ACIAR PNG Scientific Communication Project), to assist researchers, academics and others whose work involves communicating science and to nurture a national partnership for better communication in science. The SciCom course has resulted from a collaborative effort involving five PNG universities (UOT, UOG, UPNG, UOV, DWU), PNG research institutes and the University of Queensland. Communication and Development Studies Department has taken over the facilitation of this SCIICOM course and is offering it as a short course program towards a Graduate Certificate. The module consists of two core subjects LS 501 Communicating with Adults and LS 502 Language of Science. There are five electives LS 503: Science Communication in the Community,
LS504: Writing Scientific Reports, LS505: Transformation of information into Knowledge,
LS506: Advance Roles for Scientists and LS507: Directed Product Development (Workplace based project). On completion of the two core subjects and two electives a graduate certificate in Communicating Science and Technology can be awarded. Offered as a short course each subject can be offered in a five-day workshop

Program Structure

Subjects can be taken in any order, and are taught within one-week residential mode:

Core Subjects

LS501 Communication with Adults
LS502 Language of Science and Technology

Elective Subjects

LS503: Communication of Science and Technology on the Community

LS504: Writing Scientific Reports

LS505: Transformation of Information into Knowledge

LS506: Advanced Roles for Science and Engineers
LS507: Directed product Development

LS501: COMMUNICATING WITH ADULTS

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes

1. Demonstrate understanding of the concept of 'andragogy' – the principles of adult learning and be able to apply these in a communication setting.
2. Understand the scope of the communication needs in terms of target audiences and their context.
3. Understand the four basic learning styles and their implications for communication with adults.
4. Plan a mixture of communication methods to cater for the different learning styles.
5. Understand how to approach communication and learning in a gender sensitive fashion.
6. Understand ethical and power issues associated with communication between adults and be able to account for them.

Syllabus

This is a foundation subject that provides a theoretical and practical base for effective communication with adults. It covers adult learning principles, their application and the importance of different learning styles in developing communication strategies. Participants coming from different experiences will expand their capacity and skill in adult learning as a precursor for developing appropriate products for communicating scientific and technological topics to adults. Four themes in the subject are:

i. What's so special about communicating with adults?
ii. What has learning got to do with communicating with adults?
iii. Reducing the noise in adult-adult communication.
iv Dealing with gender, ethics and power.

Reference

A *Book of Readings* containing supporting materials for each theme is provided.

Textbook

Knowles, M., (1980), 'The Modern Practice of Adult Education', Prentice Hall Regent: Cambridge.

Assessment

Participation	20%
Group Presentation	30%
Individual Assignments	50%

LS502: LANGUAGE OF SCIENCE AND TECHNOLOGY

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes

1. Understand some of the important terms in the language of science.
2. Appreciate some of the language constraints in communicating 'science' to different groups of people.
3. Appreciate the methods used in natural and social sciences, their relative merits and their impacts on communication style.
4. Consider measures to improve scientific communication across different groups.
5. Learn how to express ideas as effectively as possible.

Syllabus

This is a foundation subject for elective subjects. It assumes that participants will have varied experiences in science and technology, and the language related to them. This is a strength that enables the subject to use experiential learning techniques to provide an appreciation of science and technology, and the components of language for effective communication. Participants will produce a personal style guide for writing scientific and technological materials in their workplace. The subject has four themes:

- Language of science and technology in the workplace
- Scientific method and its impact on language
- Communicating complex ideas and relationships
- Effective writing styles.

References

A B*ook of Readings* containing supporting materials for each theme.

Textbook

Participants will receive a copy of the following resources:

Snooks & Co., (2002) *Style Manual for Authors, Editors and Printers.* John Wiley & Sons Australia, Ltd., as a guide for writing style.

Bourke, RM, Allen, MG, & Salisbury, JG., (eds) 2001, *Food Security for Papua New Guinea, Proceedings of the Papua New Guinea Food and Nutrition 2000 Conference, PNG University of Technology, Lae, 26 – 30 June 2000, ACIAR.*.

Assessment

Peer Appraisal	30%
Personal Style Guide	70%

LS 503: COMMUNICATION OF SCIENCE AND TECHNOLOGY IN THE COMMUNITY

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes

1. Demonstrate an appreciation of the importance and benefits of communicating new science knowledge to a range of audiences.
2. Determine appropriate communication media for various audiences and identify benefits and constraints of each in the varied contexts.
3. Plan a communication project.
4. Evaluate the effectiveness of a communication project.
5. Produce a communication product that meets and demonstrates the criteria for effective communication through a given medium to a given audience.

Syllabus

This subject is set within the broad context of having participants use their wide and varied experiences to appreciate the need to effectively communicate scientific information. It considers the appropriate application of different mediums for communication of scientific and technological matters through planning, selection, demonstration and evaluation. It builds on the theories and reflections of learning as adults, and the components of language for effective communication in science. During the workshop, participants are expected to produce a communication product that meets and demonstrates the criteria for effective communication through a given medium to a given audience. The four themes in the subject will be presented in an experiential learning approach:

- Scope of Communicating Science to the

Community
- Planning a communication project
- Preparing a communication product
- Evaluating the effectiveness of a communication project.

References
A book of supplementary readings containing support materials from a range of sources will be given to participants.

Textbooks
Participants will use the following resources:
Snooks & Co., 2002, *Style Manual for Authors, Editors and Printers,* John Wiley & Sons Australia, Ltd.
Mortiss, P.D., (1993) *Extension for Rural Change*, Department of Primary Industries, Queensland Government, Australia.

Assessment
Communication medium	20%
Communication Product	60%
Peer Appraisal	20%

LS 504: WRITING SCIENTIFIC REPORTS

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes
1. Understand the process of writing a scientific paper by using: (a) The IMRaD model of scientific reporting, (b) Appropriate language for sections of a paper, (c) Appropriate arrangement of ideas in a paper

Syllabus
The ability to communicate in writing is an important role for scientists and engineers. This subject is set within the broad context of participants having a wide and varied experience in science and/or technology and their related language. This background enables the subject to use experiential learning techniques to develop capacity and skill in writing scientific reports, form a base for other reports of technical nature. It emphasizes the use of appropriate structure and language for the various sections of a research paper. It demonstrates the use of bibliographic software. Seven themes in the subject cover the main sections of a research paper:
- Introduction
- Materials & Method
- Results
- Discussion
- Abstract
- References, Acknowledgment & Appendices
- Other Scientific and Technical Reports

Participants will be required to present a draft of a research paper, or a critique or two papers to the group for peer feedback and general response, conclusions and assessment.

References
A B*ook of Readings* containing supporting materials for each theme.

Textbooks
Participants will use the following material for reference and examples:

Lindsay, D., (1995) *A Guide to Scientific Writing*. Second Edition. Melbourne: Longman.
Snooks & Co. (2002) *Style Manual for Authors, Editors and Printers*. John Wiley & Sons Australia, Ltd.
Bourke, RM, Allen, MG, & Salisbury, JG (eds) 2001, *Food Security for Papua New Guinea, Proceedings of the Papua New Guinea Food and Nutrition 2000 Conference, PNG University of Technology, Lae, 26 – 30 June 2000, ACIAR.*

Assessment
Documentation of your learning	60%.
Group presentation	20%
Peer appraisal	20%.

The documentation of your learning from the course will take the form of either:
- A summary of your comparison of two papers using the tools of analysis introduced in the workshop, or
- A draft research paper or other scientific report as negotiated with the facilitator.

LS 505: TRANSFORMING INFORMATION INTO KNOWLEDGE

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes

1. Demonstrate an understanding of the steps and approaches for transforming information into knowledge.
2. Design ways to evaluate the relevance of information within a specific context.
3. Appreciate techniques for critical thinking and synthesizing information.
4. Develop a framework for managing information sources

Syllabus

This subject presents a process for transforming information into knowledge as part of a decision making process. Gaining an understanding of the complex interactions that impact on a particular issue is the underlying principle that guides this approach to transforming information into knowledge. As an elective subject, it builds on the skills and expertise developed in the core subjects.

The subject comprises six key themes that give participants an opportunity to develop their professional capacity and practice in transforming information into knowledge. The six themes of this subject are:

- Data, information and knowledge,
- The context,
- Information access
- Evaluating and managing information
- Synthesis
- Application, review and monitoring.

References

Participants will have access to:
A *Book of Readings* with chapters and articles from recent publications relating to the six key themes described above will be provided for participants.

The bibliographic software Endnote together with a CD ROM of scientific abstracts pertaining to PNG.

Textbooks

Snooks & Co. (2002) *Style Manual for Authors, Editors and Printers.* John Wiley & Sons, Australia Ltd.
Bourke, RM, Allen, MG, & Salisbury, JG (eds) 2001, *Food Security for Papua New Guinea, Proceedings of the Papua New Guinea Food and Nutrition 2002 Conference, PNG University of Technology, Lae, 26-30 June 2002,*

Assessment

Peer Assessment	20%
Group Presentation of case study	40%
Written Report of case study	40%

LS506: ADVANCED ROLES FOR SCIENTISTSAND ENGINEERS

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes

1. Edit and referee peer written articles and research reports
2. Organize and run a workshop or conference for peers
3. Achieve high quality verbal presentations
4. mentor PG students / researchers in the workplace
5. Manage a research project.

Syllabus

Scientists and engineers are called upon to fulfil a number of roles for which they are often inadequately trained. These include roles such as: mentoring/supervising junior staff or post-graduate students; refereeing report from peers; organizing workshops and conferences for information sharing; giving verbal presentations; and managing research projects. This elective subject consists of five 1-day workshops that combine as a week-long workshop.

References

A workbook including appropriate examples and readings will be provided to participants.

Textbooks

Expected that participants will have read:
Stapleton, Paul (1987). Writing Research Papers: an easy guide for non-native English speakers. The Australian Centre for International Agricultural Research, Canberra (ISBN 0 949511 55 5).

It is also assumed that all participants have a working knowledge of:
Lindsay, David (1995) A Guide to Scientific Writing,

Longman, Melbourne (ISBN 0 582 803128).

Assessment

Each of the five 1-day workshops will have a separate assessment that contributes 20% of marks in LS506. The nature of assessment varies across topics, and may involve some form of peer assessment.

Verbal presentations	
Individual Verbal Presentation	20%
Refereeing and Editing Assignment	20%
Supervising Post Graduate Students Assignment	20%
Managing a Research Project Group Presentation	20%
Organizing A Research Conference Group Presentation	20%

LS 507: DIRECTED PRODUCT DEVELOPMENT

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes

1. apply principles of good scientific communication to preparation of a workplace-based communication product.

This subject could well be the final subject for participants who wish to prepare:
a scientific report: LS501, LS502, LS504, LS507
an extension product: LS501, LS502, LS503, LS507;
a major review: LS501, LS502, LS505, LS507.

Syllabus

This subject provides an opportunity for participants to apply the learning, experiences and lessons across other subjects to develop a significant communication product for their workplace. It acknowledges the fact that this may take up to one semester and allows participants to work in remote locations.

The nature of the product can be wide and varied ranging from traditional scientific or technical reports to novel ways of communicating science and technology to the community. Participants will select and develop the communication product on a case by case basis after negotiations with their employer and experienced university or industry staff.

Assessment

Proposal	10%
Finished project	60%
Documentation	30%

DEPARTMENT OF COMMUNICATION AND DEVELOPMENT STUDIES

➢ POSTGRADUATE CERTIFICATE IN STUDENT-CENTRED TEACHING

POSTGRADUATE CERTIFICATE IN STUDENT-CENTRED TEACHING

While the course focuses on ICT and its teaching tools, it also intends to equip the participants with awareness and appreciation of current pedagogical trends in teaching and learning in higher education. It is expected that with the combined knowledge and skills in ICT and current trends in education, graduates of the program will be well equipped to deliver sound education to the students they serve at the PNG University of Technology, both currently and in the future. While the course focuses on ICT and its teaching tools, it also intends to equip the participants with awareness and appreciation of current pedagogical trends in teaching and learning in higher education. It is expected that with the combined knowledge and skills in ICT and current trends in education, graduates of the program will be well equipped to deliver sound education to the students they serve at the PNG University of Technology, both currently and in the future.

Duration of study

The minimum duration of this postgraduate certificate course for a full-time candidate shall be not less than one semester.

The minimum duration of this postgraduate certificate course for a part-time candidate shall be two semesters.

Criteria for selection and admission of candidates

The selection and admission of candidates shall be coordinated by the Dean of the Postgraduate School in consultation with the HoDs in the respective academic departments.

Program Outcomes

1. Model the delivery of a subject's syllabus in a flipped classroom setting using a Learning Management System (LMS), such as Google Classroom or Moodle, demonstrating its advantages over traditional "chalk and talk" delivery methods.

2. Increase collaboration and engagement in a flipped classroom environment to foster effective student learning. Comprising online and blended learning, the program will focus on placing the learning goals of taught subjects in perspective, encompassing issues of content delivery (via instructional strategies of using Google Classroom, Google Apps, Google Tools and other free and open source authoring tools). Furthermore, tractable and holistic assessment methods of both content and meta-cognitive skills to be gained by students will be introduced.

3. Understand the principles behind and uses of problem-based learning so that the participants can enhance their competence to deliver problem-based learning method in the courses they deliver.
4. Identify and explain the basic theories and elaborated practices of current teaching and learning trends in higher education.

5. Facilitate structured reflection on appropriate teaching pedagogies (both traditional and ICT driven), tapping from the wealth of experience of the participants.

6. Equip thereby the teaching staff members at UNITECH to be able to deliver learning-focused academic subjects in their academic discipline (via both blended and online modalities) with ICT tools effectively, both now and in the future.

Program Structure

To elaborate this course of study, there will be three subjects taught weekly for 15 weeks. Each subject will be taught for two hours per week, usually from 4 to 6 pm. The subjects will be taught by suitable specialist identified within the University. The three subjects that will form the initial basis of the course structure are:

(a) Learning Management Systems and Flipped Classrooms
(b) Problem Based Teaching and Learning
(c) International Trends in Higher Education Landscapes and Practices

The Subject Details

CODE	SUBJECT	WEEKLY HOURS
CDS 511	Learning Management Systems and Flipped Classrooms	2
CDS 512	Problem-Based Teaching and Learning	2

CDS 513	International Trends in Higher Education Landscapes and Practices	2
Total Hours		6

CDS 511: LEARNING MANAGEMENT SYSTEM (LMS) & THE FLIPPED CLASSROOM

Hours per week: 2
Credits: 10

Learning Outcomes

1. Prepare a complete course presented in LMS (e.g, Google Classroom).
2. Plan appropriate student learning activities in a Flipped Classroom environment.
3. Design appropriate Blended learning activities in a Flipped Classroom and within LMS setting.
4. Prepare relevant videos and other interactive learning material to support a LMS.
5. Use Assessment and other Authoring Tools to support student-teacher interaction within a LMS setting.

Syllabus

This is an important subject offered as part of this program. The subject provides and develops 21st century skills to practicing academic staff in order to foster the effective delivery of varied disciplinary courses (and specific subjects) content in a flipped classroom setting using an integrative Learning Management System (LMS), such as Google Classroom or Moodle. The subject is focused on demonstrating how instructors can employ ICT tools such as to use Google Classroom, Google Apps, Google Tools and other free and open source authoring tools can enhance their teaching effectiveness.

References Used in Class

Notes Prepared for each module

Additional References

JCU Workshop Notes

Assessment

40% Continuous Assessment (10% individual class participation, 30% Deliverable)
60% Capstone Project (20% Mod1, 20% Mod2 and 20% Mod3)

CDS512: PROBLEM BASED TEACHING AND LEARNING (PBTL)

Hours per week: 2
Credits: 10

Learning Outcomes

1. Understand the principles behind and uses of Problem Based teaching and learning.
2. Be able to develop a rich and relevant problem which promotes deep learning.
3. Be able to conduct a Goals Session in Problem Based Teaching and Learning.
4. Be able to conduct a Teaching Session in Problem Based Teaching and Learning.
5. Learn how to use rubrics in assessment of written and oral work.
6. Be able to introduce Problem Based Teaching and Learning in a subject.

Syllabus

Problem based teaching and learning is a proven pedagogical approach. Research has shown that retention rate of information is vastly superior compared to other teaching methods. Another major advantage is that students develop communication, presentation and team working skills which make them ready for the job market.
In this subject, participants will develop a problem for one of the subjects they are currently teaching, and learn how to conduct a “Goals PBL” session and a “teaching PBTL” session. They will also learn how to update and adapt their problems, how to assess student performance in PBTL enhanced course, and how to prepare and give mini-lectures when concepts are unclear to students.

CDS 513: INTERNATIONAL TRENDS IN HIGHER EDUCATION LANDSCAPES AND PRACTICES

Hours per week: 2
Credits: 10

Learning Outcomes

1. Understand the new, shifting international higher education landscape, inclusive of theoretical, comparative aspects of higher education pedagogy.

2. Understand and apply shifting definitions of the adult student and varied teacher "selves" across vectors of time, place and valued ends.

3. Understand and apply best professional practices in higher education, appropriately drawing from an international menu of institutional and disciplinary options when designing courses/subjects/seminars.

4. Be able to devise a course/subject lesson plan, according to PNGUoT AQAT guidelines, as well as organize and maintain subject files.

5. Understand and appropriately apply relevant and useful continuous and summative assessment procedures so to assist students to learn and certify their achievements.

6. Promote appropriate student involvement in embodied teaching and learning processes, e.g., "flipped classrooms."

7. Appreciate approaches and trends in the appropriate use of new digital technologies in varied higher education settings and apply them to one's taught classes.

Syllabus

The shifts in society (1st, 2nd, 3rd and 4th revolutions), especially the shift from analogue to digital modes of knowledge production and dissemination.

"Best practices" of general higher education pedagogical provision in a new, fast changing topography of teaching and learning, from an international, comparative perspective, in informal, non-formal and formal educative contexts, aimed at achieving quality and relevance.

The impact of specific disciplinary and knowledge domains on teaching and learning conceptions and practices at the PNGUoT. Aligning Program Objectives/Learning Outcomes with student learning and outcome assessment.

Making classes "work" for the student and professor: Developing the art of assignments as bridges to ongoing "conversations" of knowledge transmission, use and creation. Knowledge of varied student-learning styles and approaches: Lecture, Learner-centred, (inter)active, team and group learning; pedagogical differences among large and small classes and levels of learners, online learning, project-based learning, etc.

Educating students for both expected short-term and unpredictable mid to long-term changes in the world of work across the lifespan.

References Used in Class

A wide variety of up-to-date online resources mixed with some relevant classical works.

Additional References

JCU Workshop Notes

Assessment

40% Continuous Assessment (10% individual class participation, 30%
Deliverable)
60% Capstone Project (20% Mod1, 20% Mod2 and 20% Mod3)

DEPARTMENT OF ELECTRICAL AND COMMUNICATION ENGINEERING

MASTER OF ENGINEERING IN COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRICAL & COMMUNICATION ENGINEERING

Head of Department
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Deputy Head of Department
Kupale, G. (Mr.), M.Eng. (PNGUoT), B.Eng, (PNGUoT)

Professors
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Associate Professors
Vacant

Senior Lecturers

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Lecturers
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Chen, D. (Mr), M.IT (QUT, Australia), B.CS (VUW, New Zealand)

Kunsei, H. (Mr). PGC Student Centred Teaching (PNGUoT), MPhil (UQ, Australia), M.Eng.Sc (UNSW, Australia), PGC Scientific Communication (PNGUoT), B.Eng. (PNGUoT)

Kupale, G. (Mr.), M.Eng. (PNGUoT), B.Eng, (PNGUoT)

Yuanko, J. (Mr.). MPhil, B. Eng. (PNGUoT)

Part Time Technical Instructor

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Dugumari J. (Mr), M.Eng, (VUT, Australia), B. Eng. (PNGUoT)

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Isiah Koldai (Mr.) (MPhil/2) B.Elect Eng (Power) (PNGUoT)

Charles Akipia (Mr) B.Elect Eng (Com) (PNGUoT)

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Tyrones. S. (Mr.) (MPhil/2 (PNGUoT-yet to graduate), Master's Degree in Research into Design of Microcontrollers Based Smart Battery Management System Enhancement for Off-grid Remote Homes, Design of Microcontrollers Based Smart Battery Management System Enhancement for Off-grid Remote Homes

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Principal Technical Officer (Communication)
Mandawali, E., B.Eng. (PNGUoT)

Principal Technical Officer (Power)
Vacant

Principal Technical Officer (Computing)
Pek, C., B.Sc. (UPNG)

Senior Technical Officer (Power)
Vacant

Senior Technical Officer (Computing)
Kevin, L., Dipl. Comp. Technology, (DBTI)

Senior Technical Officer (Research & Training)
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Technical Officer (Communication)
Karato R., B.Sc App. Phy. & Elect., (PNGUoT)

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Measure & Analysis Signal Strength & Bandwidth for quality services in Lae. MPhil Research (PNGUoT), B.Eng (PNGUoT), Dip.Power Eng (PNGPolytechnic)

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PNGUoT), B.Eng (PNGUoT), Dip.Power Eng (PNGPolytechnic)

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Technical Officer(Electronics)
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Onopiso, Q., Dipl. Business Stud. (PNG PolyTech), SecCert, StenoCert, (Goroka Bus. Coll.)

Senior Admin Officer
Sandruweh, D., Dipl. Business Stud, SecCert (Polytech), StenoCert (Rabaul Tech)

MASTER OF ENGINEERING IN COMMUNICATION ENGINEERING

INTRODUCTION

The Department of Electrical Engineering was established to produce highly qualified professionals and technical manpower in the field of Electrical, Electronics and Communication Engineering. The Department runs degree programs, organizes and conducts short-term training programs on the topics of interest for practicing engineers, technicians as well as technical teachers of various organizations, colleges and schools. The graduating engineer of the department can work as a design engineer, technologist and maintenance engineer, as a researcher in research institutions and as a manager in firms dealing with production, service and trade in the field of Electrical, Electronics and Communication engineering at various industrial and commercial establishments.

It is imperative and indeed a demand to look ahead for the department curriculum to meet the present and future needs of the country in the field of Communication engineering and to provide educational means to meet these needs. Thus, to minimize the gap between the state-of-the-art technology and the present teaching learning process, the department has successfully brought the changes in the curriculum that supports and maintain the relevance of educational standards in the field of engineering. Thus, the department proposes a Graduate Program with specialization in Communication Engineering.

RATIONALE OF THE GRADUATE PROGRAM

The basic rationale for all of the programs is the prevailing conditions in the country as a whole with respect to the needs for professionals in the proposed areas and the future trends that are developing in the demands for the professions. The following points provide some of the major facts and observations on which the need for developing of the postgraduate programs premised.

a) Country's Need: The needs of the country for engineers specialized in specific areas of Communication engineering can be met through graduate studies that are being currently proposed. The graduate program that is now proposed is an outgrowth of the experiences of the department in offering undergraduate courses over the years, and a series of discussions within the Department and with major employers/stakeholders and practicing professionals.

b) Rapid development: With the rapid development of ICT and communication networks in the country deeper knowledge of various branches of Communication engineering is required.

c) Future Economy: We feel, the country would take necessary steps to strengthen the Communication industrial sectors for its economy. To equip the students with the necessary knowledge and skills for assisting such vision and objectives of country, it would be necessary to launch P.G program in these fields.

d) Increasing number of Graduates: With the increasing number of graduates from the Electrical and Communication engineering department, it is becoming inevitable that many shall be seeking higher education. In addition, many practicing engineers and teaching staff in the ranks of Graduate Assistants and Assistant Lecturers at the Universities both in and outside the country are seeking for admission into Graduate Programs.

e) Limited Higher Learning Institutes: Limited or no number of higher learning institutions offering the proposed programs in country.

f) Research and Development: The higher studies in these fields are essential for engineers who can engage themselves in academic and industrial sector in fields, such as research, development and engineering administration are also being felt.

PROGRAM OUTCOMES

On completion of this program, students would have attained the adequate scientific knowledge and skills related to:

1. Competency in application of knowledge and skills from basic engineering and other disciplines to identify, formulate and present solutions to technical problems related to Communication engineering and technology.
2. Management of new technologies in the fields of tele and wireless networks along with the

concepts of that require advanced knowledge within the field.
3. Designing advanced state of the art communication systems and conduct experiments, analyze and interpret data.
4. Selection of techniques, modern engineering tools, software and equipment necessary to evaluate and analyze the systems in tele environments.
5. Conducting systematic research studies under minimal supervision and on significant research topic within the field at global standards.
6. Effective communication of information, ideas, problems and solutions to the professionals, peers and clients.
7. Being open to acquiring knowledge and skills (both formally/informally) to keep up-to-date on advances in field of expertise so to remain valuable in the workplace and a worthy member in the professional group/society

DURATION OF THE PROGRAM

This will be a full time Post Graduate program of four semesters spread over two academic years.

DEGREE NOMENCLATURE

The degree awarded would be Master of Engineering in Communication Engineering.

ADMISSION REQUIREMENTS

Entry is open to students with a four (4) year Bachelor of Engineering degree in Electrical/Electronic/ Instrumentation/Communication/Power/Electrical and Communication Engineering or equivalent as recognized by the University. The rules for admission, registration, supervision and administration of postgraduate programs shall be those of the PNG University of Technology applicable to Master of Engineering programs.

GRADUATION DEGREE REQUIREMENTS

In order to complete the degree requirements, each student is expected to earn credits as required by PNG University of Technology Master in Engineering programs (Subjects plus a Dissertation).

COURSE CREDIT REQUIREMENTS

The program courses including thesis work contains minimum of 130 credit points. In the second year, the student is required to undertake a suitable research work (dissertation) work which can be carried out in two phases in the department or industry in consultation with supervisors. During this stage, students must present their work to their respective supervisors to show the progress of their thesis work and the final completion presentation to be made to the panel constituted by Head of Department in consultation with the Principal Supervisor.

COURSE STRUCTURE

The program consists of four semesters. In second semester, students are eligible to choose elective courses. Every student will carry out dissertation under the supervision of a Supervisor(s). The topic shall be approved by a Committee constituted by Head of Department. Every student will be required to present two seminars, first at the beginning of Dissertation (Phase-I) to present the scope of the work and to finalize the topic and second towards the end of the semester presenting the work carried out by him/her during the semester. The Dissertation Phase-1 will be continued as dissertation in 4th Semester. At the end of fourth semester, the students have to submit the dissertation as stipulated in postgraduate rules and regulations and the dissertation will be assessed by two external examiners.

SUBJECTS AND SCHEDULES

Credit Structure (Summary)

Credits	Semester I	Semester II	Semester III	Semester IV	Total
Core Courses	43	31			74
Elective Courses		11			11
Seminar		1			1
Thesis			22	22	44
Total	43	43	22	22	130

COURSE MATRIX

Year I Semester I

Course	Course Title	CCC	L	T	Lab	Prerequisite
EE-511	Information Theory and Coding	11	2	1	0	-
EE-512	Linear algebra and Special functions	11	2	1	0	-
EE-513	Research Methodology	9	2	0	0	-
EE-514	Advanced Digital Communication	12	2	1	1	-
	Total	43	8	3	1	-

Year I Semester II

Code	Course Title	Credit	L	T	Lab	Prerequisite
EE-521	Statistical Signal Processing	11	2	1	0	EE -512
EE-522	Optical Communication Networks	11	2	1	0	EE-514
	Elective I	11	2	1	0	-
EE-523	Entrepreneurship for Engineers	9	2	0	0	
EE-524	Technical Seminar	1	0	0	1	-
	Total	43	8	3	1	-

Elective I

Code	Name of the subject	Prerequisite
EE-525	Nonlinear Dynamics	EE512, EE521
EE-526	Electromagnetic Interference and Compatibility in System Design	-
EE-527	Mobile Communication Networks	-
EE-528	Wireless Sensor Networks	-
EE-529	Base band algorithms on FPGA	-
EE-530	Mobile Adhoc Networks	-
EE531	Wireless Security	-

Year II Semester I

Course	Course Title	CCC	L	T	Lab	Prerequisite
EE-611	Thesis phase I	22	0	0	15	

Year II Semester II

Course	Course Title	Credit	L	T	Lab	Prerequisite
EE-611	Thesis phase II	22	0	0	15	EE-611

DETAILED SYLLABUS

EE-511: INFORMATION THEORY AND CODING

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

Credits: 11

Prerequisite: NIL

Learning Outcomes

On completion of this subject, students will be able to:

1. Design Analog communication systems to meet desired needs.
2. Examine the practical implementation issues, such as Error control coding, convolutional code.
3. Design and develop digital and analog systems.
4. Test various error correction techniques
5. Formulate convolution codes for information exchange.

Syllabus

Information theory

Concept of amount of information -units, Entropy - marginal, conditional and joint entropies -relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.

Discrete channels

Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, and Shannon theorem. Continuous channels – Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Tradeoff between band width and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system.

Source coding

Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes, Kraft's inequality, Coding efficiency and redundancy, Noiseless coding theorem. Construction of basic source codes – Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding.

Error detection and correction

Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. Cyclic codes – Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

Convolutional codes

Encoding- State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes - Viterbi algorithm, Sequential decoding -Stack algorithm. Interleaving techniques – Block and convolutional interleaving, Error Control and Signal Space Coding.

Text Books

1. Herbert Taub, and Donald L. Schilling, Principles of Communication Systems, Tata McGraw-Hill, 2007
2. Simon Haykin, Communication Systems, John Wiley & Sons. Pvt. Ltd, 2009

References

1. Shu Lin and Daniel J. Costello, Error Control Coding Fundamentals and Applications, Prentice Hall Inc, 2004.
2. Sklar Bernard, Digital Communications Fundamentals and Applications, Person Education Asia, 2001

Assessment

Continuous Assessment - 50%
Final Examination - 50% (1 x 3 hours)

EE-512: LINEAR ALGEBRA AND SPECIAL FUNCTIONS

Hours per week: 3 [Lecture: 2, Tutorial: 1, Laboratory: 0]

Credits: 11

Prerequisite: NIL

Learning Outcomes

On completion of this subject, students will be able to:

1. Integrate under graduate fundamentals with advanced knowledge to solve complex problems.

2. Test the idea of optimization and its applications.
3. Create Eigen values and Eigen vectors from differentiable equations.
4. Combination of theoretical knowledge and independent mathematical thinking using special functions.
5. Formulate the complex mathematical model of engineering problems

Syllabus

Calculus of Variations

Introduction to variation problems - Euler's equation - Functional dependent on first and higher order derivatives - Functional dependent on functions of several independent variables - Some applications - Direct methods: Ritz methods.

Vector space

Definition and examples of linear space - Linear dependence and independence - Basis and Dimension - Inner product space - Orthogonalization process - Gram - Schmidt process Least - square problems - Applications of inner product spaces.

Eigen values and Eigen vectors

Generalized Eigen values and Eigen vectors - Characteristic equation - Diagonalization - Eigen vectors and linear transformations - Complex Eigen values - Applications to differential equations - Iterative estimates for Eigen values.

Advance matrix theory

Diagonalization of symmetric matrices - Quadratic forms - Singular values decomposition - Change of basis. Matrix norms - Jordan canonical form - Pseudo inverse - Least square approximations - QR algorithm.

Special Functions

Bessel's equation – Bessel functions – Legendre's equation – Legendre's polynomials –Rodrigues's formula – Recurrence relations –-Generating functions and orthogonal property for Bessel's functions – Strum-Liouville problem – Error functions.

Text Books

1. David C Lay, Linear Algebra and its Applications, Pearson Education Asia, New Delhi, 2012.
2. Elsgolts L, Differential Equation and Calculus of variations, MIR Publishers, 1996.

References

1. Grewal B. S, Higher Engineering Mathematics, Fortieth Edition, Khanna Publications, New Delhi 2014.
2. Howard Anton, Elementary Linear Algebra, John Wiley & Sons, 2010.
3. Raisinghania M. D, Ordinary and partial differential equations, S. Chand & Co, New Delhi, 2006.

Assessment

Continuous Assessment - 50%
Final Examination - 50% (1 x 3 hours)

EE 513: RESEARCH METHODOLOGY

Hours per week: 2 [Lecture: 2, Tutorial: 0, Laboratory: 0]

Credits: 09

Prerequisite: NIL

Learning Outcomes

On completion of this subject, the students will be able to:

1. Demonstrate the concepts of engineering research and its methodologies.
2. Understand the various methods used to collect the data to research.
3. Categorize the research design into different steps.
4. Formulate appropriate research problem and conduct the experiments using systematics methods.
5. Select appropriate software and hardware tools for the research.

Syllabus

Foundations of Research: Meaning, Objectives, Motivation, Utility, Characteristics of scientific method

Research Design: Concept and Importance in Research, Features of a good research design, Background research for experimental planning

Experiments Design: Statistical data analysis, executing engineering experiments and analyzing experimental findings,

Communication and Ethics: Oral communication of research, Written communication of research, Engineering ethics, plagiarism and information sources, Intellectual property, social impact, and financial considerations of engineering research, Laboratory safety, a laboratory notebook maintenance.
Software and hardware tools: Matlab, LabView, Arduino, etc.

Text Books
1. Kothari., C. R., Research Methodology: Methods and Techniques, New Age Publications, New Delhi, 2009.
2. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.

References
1. Alan Bryman and Emma Bell, Business Research Methods, Oxford University Press.
2. Donald Cooper and Pamela Schindler, Business Research Methods, TMGH, 9th edition

Assessment
Continuous: 100% (Individual reporting-20%, Weekly Assignment- 30%, Case study 50%)

EE 514: ADVANCED DIGITAL COMMUNICATION

Hours per week: 4, [Lecture: 2, Tutorial: 1, Laboratory: 1]
Credits: 12

Prerequisite: NIL

Learning Outcomes
On completion of this subject, students will be able to:
1. Design Analog communication systems to meet desired needs.
2. Evaluate fundamental communication system parameters, such as bandwidth, power, signal to noise ratio and data rate.
3. Appraise practical implementation issues, such as non-ideal filters, non-ideal sampling pulses, aliasing, and intersymbol-interference (ISI).
4. Create detection of signal vectors and Gassian noise.
5. Estimate and formulate the parameters of the problem.

Syllabus
Baseband Data Transmission
Baseband PAM –One Shot Minimum Distance Receiver –Minimum Distance Sequence Detection-M-ary signaling scheme-shaping of the transmitted signal spectrum-Noise in Baseband System - Coherent and Non coherent Technique, Orthogonal Modulation-OFDM modulation and Demodulation– Multidimensional Modulation-Modulation with Memory.

Band-limited channels
Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel Models: Fading Dispersive channel, Time and Frequency Selective, Rayleigh channel, karhunen-Loeve Expansion; Diversity Technique: Space, polarization, path, angle, Time and frequency, Diversity Combining Technique

Equalization
Optimal Zero-Forcing Equalization- Generalized Equalization Methods- Fractionally Spaced Equalizer –Transversal Filter Equalizer –ISI and Channel Capacity –Constrained –complexity Equalizers – Adaptive Linear Equalizer – Adaptive DFE.

Detection
Detection of a Single Real-Valued Symbol- Detection of a Signal Vector –Known Signals in Gausian Noise –ML Sequence Detection with the Viterbi Algorithm – A Posteriori Probability Detection with BCJR-Symbol Error Probability for MLSD – incoherent Detection –Shot Noise Signal with known Intensity. Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman- Pearson Criterion, Sequential Detection.

Fundamentals of Estimation Theory
Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory, Types of Estimation Problems, Properties of Estimators, Bayes Estimation, Minmax Estimation, Maximum-Likelihood Estimation, Comparison of Estimator Parameters.

Text Books
1. John G. Proakis, Digital Communications, McGraw –Hill International Edition, 2009.

2. John R. Barry, Edward Lee and David G. Messerschmitt, Digital Communication, Springer, 2008.

References

1. Bernard C. Levy, Principles of Signal Detection and Parameter Estimation, Springer, 2008.
2. Simon Haykin, Communication Systems, PHI, 2008.

Assessment

Continuous Assessment - 50%
Final Examination - 50% (1 x 3 hours)

EE 521: STATISTICAL SIGNAL PROCESSING

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

Credits: 11

Prerequisite: EE512

Learning Outcomes

On completion of this subject, students will be able to:

1. Design and implement decimator and interpolator.
2. Construct multi rate filter bank and acquires knowledge of how a multi rate system work.
3. Understand different spectral estimation techniques and linear prediction.
4. Design LMS and RLS adaptive filters for signal enhancement, channel equalization.
5. Estimate of spectra from finite duration observations of a signal.

Syllabus

Multirate Signal Processing

Introduction-Sampling and Signal Reconstruction-Sampling rate conversion – Decimation by an integer factor – interpolation by an integer factor –Sampling rate conversion by a rational factor – poly-phase FIR structures – FIR structures with time varying coefficients - Sampling rate conversion by a rational factor- Multistage design of decimator and interpolator.

Multirate FIR Filter Design

Design of FIR filters for sampling rate conversion – Applications of Interpolation and decimation in signal processing –Filter bank implementation –Two channel filter banks-QMF filter banks –Perfect Reconstruction Filter banks – tree structured filter banks - DFT filter Banks – M-channel filter banks-octave filter banks

Linear Estimation and Prediction

Linear prediction- Forward and backward predictions, Solutions of the Normal equations-Levinson- Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.

Adaptive Filters

FIR Adaptive filters - Newton's steepest descent method – Adaptive filters based on steepest descent method -LMS Adaptive algorithm – other LMS based adaptive filters- RLS Adaptive filters - Exponentially weighted RLS - Sliding window RLS – Simplified IIR LMS Adaptive filter.

Power Spectral Estimation

Estimation of spectra from finite duration observations of a signal –The Periodogram-Use of DFT in Power spectral Estimation –Non-Parametric methods for Power spectrum Estimation – Bartlett. Welch and Blackman–Tukey methods –Comparison of performance of Non – Parametric power spectrum Estimation methods –Parametric Methods - Relationship between auto correlation and model parameters, Yule-Walker equations, solutions using Durbin's algorithm, AR, MA, ARMA model based spectral estimation.

Text Books

1. John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing, Pearson Education, 2006
2. Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., 2008

References

1. John G. Proakis, Algorithms for Statistical Signal Processing, Pearson Education, 2002.
2. P.P.Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, 2008.
3. Sophoncles J. Orfanidis, Optimum Signal Processing, McGraw Hill, 2007.

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 522: OPTICAL COMMUNICATION NETWORKS

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11
Prerequisite: EE514

Learning Outcomes
On completion of this subject, students will be able to:
1. Understand of various loss mechanisms and Non-Linear effects in optical communication.
2. Apply knowledge of optical components and WDM network elements.
3. Discus about Optical access network architectures
4. Compare layered architecture of, IP and MPLS over SONET network.
5. Measure Photonic packet switching, impediments involved and available techniques like switching, buffering, multiplexing and synchronization.

Syllabus
Optical Signal propagation and System Components
Propagation in optical fibers – Loss & bandwidth windows, Intermodal dispersion, Optical fiber as waveguide, Chromatic dispersion, , Non-Linear effects; Solitons; Optical Network Components– Couplers, Isolators &Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

Client layers of Optical Layer
SONET / SDH-Multiplexing, CAT & LCAS, SONET/SDH Layers, SONET Frame structure, Elements of SONET/SDH infrastructure, Optical Transport Network- Hierarchy, Frame structure multiplexing, Generic Framing Procedure, Ethernet-Framing structure, switches, IP over WDM- routing and forwarding, QoS, MPLS-Labels and forwarding, QoS, signaling and routing,. Carrier transport, resilient packet ring, storage area networks.

WDM Network Elements and Design
WDM Network elements - Optical line terminals, Optical line amplifiers, Optical Add/drop multiplexers-Architectures, Reconfigurable OADMs,, Optical cross connects, All optical OXC configurations. WDM Network Design – Cost Trade-Offs: A detailed ring network example, LTD and RWA problems, dimensioning Wavelength routing networks, Stastical dimensioning Models, Maximum load dimensioning models

Packet switching and Access networks
Photonic Packet Switching – OTDM, Multiplexing and De-multiplexing, Synchronization, Header processing, Buffering, Burst switching, OTDM Access Networks – Network Architecture Overview, Enhanced HFC, FTTC, PON – Evolution.

Network Design and Management
Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization; Overall design considerations; Control and Management – Network management functions, Optical layer services and interfacing, Layers within optical layer, Multivendor interoperability, Performance and fault management, Configuration Management.

Text Books
1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A Practical Perspective, Morgan Kaufmann, 2010.
2. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2006.

References
1. Biswanath Mukherjee, Optical Communication Networks, Tata McGraw Hill, 2004.
2. Green, P. E. Jr., Fiber Optic Networks, Prentice Hall, NJ, 2005.

Assessment
Continuous Assessment 50%
Final Examination 50% (1x3 hours)

EE 523: ENTREPRENEURSHIP FOR ENGINEERS

Hours per week: 2, [Lecture: 2, Tutorial: 0, Laboratory: 0]

Credits: 9

Prerequisite: NIL

Learning Outcomes

On completion of this subject, students will be able to:

1. Create a full business plan, a virtual company website.
2. Compare and organize several product presentations.
3. Compete in both the end-of-semester competitions in campus and off campus.
4. Present and discuss critical importance of entrepreneurship to world's economy (employment, technology advancement, societal development, etc.).
5. Enable students to hear from, and interact with, entrepreneurs from various sectors of economy like software, telephony, energy, light, water, social networks and enterprises, entrepreneurship and finance.

Syllabus

The course focuses on business sectors that derive from disciplines and areas of study. Engineering Entrepreneurship is a full-immersion, multidisciplinary, engineering experience holistically designed to integrate the skills and knowledge of the students in a more in-depth exposure to new product and business development to the engineering profession. The subject covers: Entrepreneurial engineer's readiness in 21st century, innovation, money, work, time, human behavior, ethics, organization and leadership, and assessment of technology opportunities.

Text Book

1. David Goldberg, The Entrepreneurial Engineer. Wiley, USA, 2006.

Assessment

Continuous: 100% (Individual reporting-20%, Weekly Assignment- 30%, Case study 50%)

EE 524: TECHNICAL SEMINER

Hours per week: 1, [Lecture: 0, Tutorial: 0, Presentation: 1]

Credits: 1

Prerequisite: NIL

Every student will be required to present a seminar on a topic approved by the Department except on his/her dissertation. The committee constituted by the Head of Department will evaluate the presentation and will award the grades accordingly.

ELECTIVES

EE 525: NONLINEAR DYNAMICS

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

Credits: 11

Prerequisite: EE512, EE514

Learning Outcomes

On completion of this subject, students will be able to:

1. Demonstrate the ability to design and analyze nonlinear systems.
2. Develop algorithms for controlling nonlinear systems.
3. Test Chaos in the nonlinear systems.
4. Design various applications of nonlinear systems.
5. Formulate control algorithms for nonlinear systems.

Syllabus

The implications of nonlinearity, dynamics and chaos

The role of dimensionality, One-dimensional systems, one dimensional ows: visualizing the solution space; stability and xed points; linear stability analysis; existence and uniqueness. Applications and numerical methods, Bifurcations: saddle-node, trans-critical and pitchfork, Flows on the circle: uniform and nonuniform oscillators. The case of the over-damped pendulum. Applications.

Two dimensional systems
Beyond linear systems, Phase portraits; topological consequences; fixed points and linearization. Conservative versus dissipative systems, Reversible systems, the important case of the pendulum, Limits cycles in non-conservative systems. Closed orbits in conservative systems. Poincare-Bendixson Theorem. Existence of limit cycles, Back to bifurcations: Hopf bifurcations. Global bifurcations of cycles. Poincare maps.

Chaos
Lorentz system of equations. Symbolic dynamics illustrated for this system. Introduction to strange attractors, One dimensional maps. The logistic map. Fixed points, cobwebbing and crises. Lyapunov exponents. Universality and renormalization, Planar maps. The standard and Henon maps. Local versus global chaos. More on attractors. Self-similarity, fractals, Meet the Cantor set. Generalized dimensions.

Control algorithms
Adaptive control, back stepping and sliding mode controls and its applications in synchronization.

Text books
1. Hassan K. Khalil, Nonlinear Systems, 3rd Edition Prentice Hall, 2002.
2. Kemin Zho and Jonn Doyle, Essentials of Robust Control, Prentice Hall, 1998.

Assessment
Continuous Assessment - 50%
Final Examination- 50% (1 x 3 hours)

EE 526: ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11
Prerequisite: NIL

Learning Outcomes
On completion of this subject, students will be able to:
1. Demonstrate electromagnetic concepts and its measuring parameters.
2. Compare EMI coupling of various types.
3. Design and architecture of Micro machined Antennas.
4. Model Mems phase shifters and its applications.
5. Design PCBs for various applications.

Syllabus
EMI Environment
EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

EMI Coupling Principles
Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

EMI/EMC Standards and Measurements
Civilian standards - FCC, CISPR, IEC, EN, Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures.

EMI Control Techniques
Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

EMC Design of PCBs
PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

Text Books
1. Paul, C.R., Introduction to Electromagnetic Compatibility, John Wiley and Sons, Inc, 2005.
2. Henry W. Ott, Noise Reduction Techniques in Electronic System, John Wiley and Sons, 2008

References
1. Bernhard Keiser, Principles of Electromagnetic Compatibility, Artech house, 1986.
2. Kodali., V. P., Engineering EMC Principles, Measurements and Technologies, IEEE Press, 1996.

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 527: MOBILE COMMUNICATION NETWORKS

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11

Prerequisite: NIL

Learning Outcomes
On completion of this subject, students will be able to:
1. Inspect the concepts of Cellular and Mobile Radio propagation.
2. Manage modulation and demodulation used in communication.
3. Rate multiple access techniques to solve communication problems.
4. Outline organization of Cellular networks and appreciate differences with fixed networks.
5. Infer on evolution of cellular networks and evaluate 2G and 3G networks.

Syllabus
Cellular Concepts and System Design Fundamentals
Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications. Cellular Concepts: Frequency reuse, Channel assignment, Hand off strategies, Interference and system capacity, tracking and grade of service.

Mobile Radio Propagation
Free space propagation model, reflection, diffraction, scattering, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Small scale Multipath measurements, parameters of Mobile multipath channels, fading and its types.

Modulation and Multiple Access Techniques
Minimum Shift Keying (MSK), Gaussian MSK, Orthogonal Frequency Division Multiplexing, Multiple Access Techniques: TDMA, FDMA, CDMA, SDMA.

2G and 2.5G Networks
Evolution of Cellular networks – AMPS, DECT and TETRA. GSM - GSM Network Architecture, Air Interface, Channel Organization, Protocols and signaling, Authentication and security, Routing of a call to Mobile Subscriber, Handover in GSM 2.5G-GPRS Network Architecture, Mobility Management, Location Management and Roaming

3G Networks and Beyond
UMTS Network Architecture, UMTS Interfaces, Channels, FDD and TDD, Time Slots, UMTS Network protocol architecture and transport network, Mobility Management, UMTS Handover. Concepts of Wi-Fi and WiMAX, Spectrum allocation for 3G, Wi-Fi, WiMAX, 4G and beyond
Improving Coverage and capacity in Cellular systems, Statistical models for multipath fading channels, Spectral Efficiency of different Wireless Access Technologies, Role of IP in GPRS and UMTS, Concepts of 5G, Cognitive Radio

Text Books
1. Blake, Wireless Communication Technology, Thomson Delmar, 2003.
2. Rappaport, R. T. S. and B. Viswanath, Fundamentals of wireless communication, Cambridge Press 2009.
3. Saha Misra, Wireless Communications and Networks: 3G and Beyond, McGraw Hill Education, 2013.

References
1. Andera Goldsmith, Wireless Communications, Cambridge University Press,2005
2. Palanivelu, T. G. and Nakkeeran, R., Wireless and Mobile Communication, PHI, 2009.

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 528: WIRELESS SENSOR NETWORKS

Hours per week: [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11

Prerequisite: NIL

Learning Outcomes
On completion of this subject, students will be able to:

1. Apply basics of wireless sensor networks to solve network problems.
2. Create applications in enabling technologies.
3. Examine the architecture and elements of wireless sensor networks.
4. Evolution MAC protocols for wireless sensor networks.
5. Select tools and platforms needed to establish sensor networks.

Syllabus

Overview of wireless sensor networks

Challenges for Wireless Sensor Networks- Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- Enabling Technologies for Wireless Sensor Networks.

Architectures

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

Networking of sensors

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy- Efficient Routing, Geographic Routing.

Infrastructure establishment

Topology Control – Motivation and Clustering, Time Synchronization - LTS, RBS, Localization and Positioning – Possible approaches, single hop localization.

Sensor network platforms and tools

Operating Systems for Wireless Sensor Networks, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Text Books

1. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.
2. Feng Zhao and Leonidas J. Guibas, Wireless Sensor Networks - An Information Processing Approach, Elsevier, 2007.
3. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley, 2005.

References

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks-Technology, Protocols And Applications, John Wiley, 2007.
2. Mohammad Ilyas and Imad Mahgaob, Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC Press, 2005.
3. Wayne Tomasi, Introduction to Data Communication and Networking, Pearson Education, 2007.

Assessment

Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 529: BASEBAND ALGORITHMS ON FPGA

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11
Prerequisite: NIL

Learning Outcomes

On completion of this subject, students will be able to:

1. Identify various construction blocks and operation of FPGA.
2. Implement arithmetic units and digital filters on FPGA.
3. Create FIR and IIR filter structures.
4. Design and implementation of Fourier transform and various baseband communication blocks.
5. Develop new algorithms based on FPGA.

Syllabus

FPGA Technology

Basics of FPGA, Gate array, Comparison of ASIC and FPGA, Introduction to FPGA Design flow, Programming languages, programming technology

Basic Building Blocks
Number representation, Binary adders, Binary dividers, Floating point arithmetic, MAC &SOP unit

Digital filter implementation
FIR filter, Theory and Structure, Filter design, Constant coefficient, FIR Design IIR filter, IIR theory, Coefficient computation and Implementation details, Fast IIR filter

Fourier Transform
DFT algorithms, Goertzel algorithm, Hartley transform, Winograd DFT, blustein chirp-z transform, Rader algorithm, FFT algorithms, Cooley-tukey, Good Thomas, Winograd FFT

Communication Blocks
Computation of Special Functions Using CORDIC, Error codes, Linear block code, Convolution codes, Modulation and Demodulation, Adaptive filters, LMS, RLS, Decimator and Interpolator, High Decimation Rate Filters.

Text Books
1. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation", Wiley, Inter Science, 1999
2. Uwe.Meyer Basese, "Digital Signal processing with Field Programmable Gate Arrays", Springer, Third Edition, May 2007

References
1. John G. Proakis, "Digital Communications", Fourth Ed. McGraw Hill International Edition, 2000
2. Michael John Sebastian Smith, "Applications Specific Integrated Circuits", Pearson Education, 2000

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 530: MOBILE ADHOC NETWORKS

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11
Prerequisite: NIL

Learning Outcomes
On completion of this subject, students will be able to:
1. Identify various challenges and vulnerabilities in MANET.
2. Revise cyber-attacks and threads in mobile networks.
3. Setup and recognize architectures, designing MAC, TCP, IP and security protocols.
4. Analyze the solutions for covering the security principles of adhoc networks.
5. Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems.

Syllabus
Wireless LAN, PAN, WAN and MAN
Characteristics of wireless channel - Fundamentals of WLANs - IEEE 802.11 standard - HIPERLAN–WLL - Wireless ATM - IEEE 802.16 standard – HIPERACCESS- Adhoc Wireless Internet.

MAC and Routing Protocols
MAC: Design issues - Goals and classification - Contention–based MAC protocols: MACAW, DPRMA, DPSMA.MAC protocols using directional antenna- Routing protocols: AODV, DSR, ZRP, LAR,CHGSR,FSR and power-aware routing protocols.

Transport Layer and Security Protocols
Transport layer Protocol: Design issues - Goals and classification - TCP over AdHoc wireless Networks – Security - Security requirements - Issues and challenges in security provisioning - Network security attacks - Security routing.

Energy Management
Need - Classification of battery management schemes - Transmission power management schemes - System power management schemes. Wireless Sensor Networks: Architecture - Data dissemination - Date gathering - MAC protocols - Location discovery - Quality of a sensor network.

Performance Analysis
ABR beaconing - Performance parameters - Route-discovery time - End-to-end delay performance - Communication throughput performance - Packet loss performance - Route reconfiguration/repair time - TCP/IP based applications.

Text Books

1. Charles E. Perkins, AdHoc Networking, Addison – Wesley, 2008
2. Murthy C. Siva Ram and Manoj, B. S., AdHoc Wireless Networks: Architectures and protocols, Prentice Hall, 2007
3. Toh, C. K., AdHoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall, 2008.

References

1. Mohammad Ilyas, The Handbook of AdHoc Wireless Networks, CRC press, 2002
2. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, Mobile AdHoc Networking, Wiley – IEEE press, 2004

Assessment

Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 531: WIRELESS SECURITY

Hours per week: [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11

Prerequisite: NIL

Learning Outcomes

On completion of this subject, students will be able to:

1. Identify the various attacks and threads of wireless Networks.
2. Setup and recognize the architectures, vulnerabilities and challenges of mobile protocols.
3. Analyze the solutions for covering the security principles of wireless networks.
4. Analyze and design security systems for wireless networks.
5. Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems.

Syllabus

Attacks on Routing Protocols

Vulnerability of MANET to attack - review of AODV and DSR - type of attack - active and passive - internal and external - behavior of malicious node - black hole, DoS, Routing table overflow, Impersonation, Energy consumption, Information Disclosure - Misuse type – Misuse goals – Security flaw in AODV -attack on AODV - wormhole and rushing attack -Performance analysis of AODV in the presence of malicious node.

Intrusion Detection in Wireless Ad Hoc Networks

Problem in current IDS techniques - requirements of IDS - classification of IDS – Network and host based - anomaly detection, misuse detection, specification based - intrusion detection in MANETs using distributed IDS and mobile agents - AODV protocol based IDS - Intrusion resistant routing algorithms - Comparison of IDS.

Mitigating Techniques for Routing Misbehavior

Watchdog, Parthrater, Packet leashes and RAP.

Secure Routing Protocols:

Self-organized network layer security in MANETs - mechanism to improve authentication and integrity in AODV using hash chain and digital signatures - on demand secure routing protocol resilient to Byzantine failures - ARIADNE, SEAD, SAR, and ARAN.

Challenges in Routing Security

Security - Challenges and solutions - Providing Robust and Ubiquitous security support - Adaptive security for multilevel Ad Hoc Network - Denial of service Attack at the MAC layer - Detection and handling of MAC layer Misbehavior.

Text Books

1. Amitabh Mishra, Intrusion Detection in Wireless Ad Hoc Networks, IEEE Wireless Communication, February 2004.
2. Murthy C. Siva Ram and Manoj, B. S., AdHoc Wireless Networks: Architectures and Protocols, Prentice Hall PTR, 2004.
3. Ivan Stojmenović, Handbook of Wireless Networks and Mobile Computing, Wiley, 2002.

Reference

1. Hongmei Deng, Wei Li and Dharma P. Agrawal, Routing Security in Wireless Ad Hoc Networks, IEEE Communication Magazine, Oct 2002.

Assessment

Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

DEPARTMENT OF FORESTRY

MASTER OF SCIENCE (MSc) IN FORESTRY

DEPARTMENT OF FORESTRY

TARAKA CAMPUS

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Vacant

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Professor
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Penu, I, BScFor (PNGUOT)

Storeman
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Steven, B.,TechTrainCert in Busines (LTC)

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Gebia, O., MPhil (PNGUT), DipFor (FORCOL)
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Ryan Dagoro, BSc. GIS (PNGUT)

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Alis, K., MSc (PNGUT), BScFor (PNGUT)
Nona, J., CISCO Cert.

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Menin, M., SecCert (LTC), Advance Cert. Computing (CTC)

Administrative
Yasepsa, K., BAcc (PNGUT)
Lenza, D, Cert. Accounting (Lae Bus)
Gonopan, A. SecCert (ComTrain, Lae)

Library
Asari, D. Cert. Information Technology (ITI)

ABBREVIATIONS OF THE UNIVERSITIES
AND COLLEGES ATTENDED BY STAFF

ANU - Australian National University, Canberra, Australia
BFU -Beijing Forestry University, China.
BulTech - Bulolo Technical School
CFNI - Christ for the Nations Institute, Dallas, United States
CTC - Commercial Training Center – Lae
FORCOL - PNG Forestry College, Bulolo,
FTI - Forest Training Institute of Japan
ITI - International Training Institute, Australia
LTC - Lae Technical College
PNGUT - PNG University of Technology, Taraka,
TFTC - Timber and Forestry Training College- Bumbu,
Tokyo - The University of Tokyo, Hongo, Japan
TUAT-Tokyo University of Agriculture &Technology, Fuchu, Japan
UniMelb – The University of Melbourne, Burnley, Australia
UPNG – The University of Papua New Guinea
Wales - University of North Wales, Bangor, UK

POSTGRADUATE PROGRAMS IN FORESTRY

Scope and Coverage

Postgraduate studies in Forestry provide advanced training in tropical forestry systems, inventory, and products. Specializations include wood science & technology; biodiversity and ecology; forest assessment/inventory and management; biometrics and mensuration; carbon and biomass measurement for climate change mitigation; agroforestry and community forestry, forest engineering and operations; environmental rehabilitation. The study program is designed to meet employment and career needs, starting with recently graduating B.S. Forestry graduates seeking to improve job-seeking prospects, and extending to career foresters who wish to upgrade their formal education credentials.

Program Educational Objectives (PEOs)

PEO1: Graduate will have developed a foundation in tropical forestry systems, forest inventory & management, and products to improve lives and livelihoods through a successful career in forestry.

PEO2: Graduates will have become effective collaborators and innovators, leading or participating in efforts to address scientific, social, and technical and forest products industrial challenges

PEO3: - Graduates will have engaged in life-long learning and professional development through self-study, formal and informal education, and professional studies in Forestry sciences and closely related disciplines.

Program Outcomes

PO1: Apply scientific knowledge, skills, and technology to sustainably manage and improve forest resources

PO2: Demonstrate knowledge and understanding of a range of basic concepts and fundamental principles that underpin wood science and technology

PO3: Demonstrate an understanding of the socio-economic benefits and values of extractive and no extractive values of forest resources

PO4: Understand the policies of other stakeholders that support forestry products at national and international levels

PO5: Demonstrate and apply entrepreneurial skills and knowledge in forestry projects

PO6: Communicate forestry ideas and information using appropriate forestry extension methods

PO7: Identify and analyze issues affecting forest resources and management

PO8: Demonstrate understanding to diagnose the roles of forest in counteracting climate change and communicate them to communities effectively.

Applying for Study

Competitive applications require that the intending applicant make advance personal contact with potential faculty supervisors and collaboratively develop an approved initial proposal that can be attached to the application.

Study Options (all full-time study)

(1) Master of Forest Science (MSc) (2 years, coursework + research, resulting in Thesis);

(2) Forestry Master of Philosophy (MPhil) (2 years, research, resulting in Thesis).

It is recommended that the applicant for MSc has demonstrated exceptional science writing skills, earned high marks in a final year project, and/or earned a bachelor's degree with distinction.

For MPhil in Forestry, it is recommended that a candidate has demonstrated exceptional science writing skill, at least published 1 or 2 papers in refereed or national journals respectively with at least 5 years work experience in the related field of study.

A research-only PhD program is available in specialized fields of forestry where faculty supervisory capacity and time exists; opportunities are announced in the current year's Unitech postgraduate study advertisement (usually June).

Study Requirements

MSc. degree study program involves a mixture of required and elective courses. Not all elective courses are taught every year. For further details on the general structure, consult "Procedures for Higher Degree Candidates" and the most recent University Calendar.

Assessments

All subjects in MSc. are assessed in varying combinations of reports, literature assessments and other assignments, tests, fieldwork, analytical discussions (via 'journal club' formats), and/or final examinations. Assessment tools are flexibly applied according to the number of students in the class.

Projects/Theses are graded as Satisfactory or Unsatisfactory, with satisfactory grades required in all subjects to earn the postgraduate degree.

List of Subjects for MSc in Forestry

FRP 501Thesis (Year 1 & Year 2)

FRP 511 Research Methodology

FRP 513 Problem Solving in Forestry and Presentation of Research Findings

FRP 516 Community Management of Land and Natural Resources

FRP 520 Physical and Mechanical Properties of Wood

FRP 522 Timber Technology and Utilisation

FRP 528 Biodiversity Characterisations for Multi-Purpose Forest Inventory

FRP 531 Ecological Principles and Applications in PNG Forests

FRP 532 Forest Health and Protection FRP 534 Tree Physiology and Ecophysiology

FRP 536 Forest Genetics

FRP 538 Plantation Management

FRP 540 Forest Biometrics

FRP 542 Forest Mensuration and Assessment

FRP 551 Forest Project Planning, Analysis and Management

FRP 552 Agroforestry Management

FRP 554 Geographic Information Systems and Remote Sensing for Natural Resource Management

FRP 561 Forest Operations

FRP 562 Hydrology and Watershed Management

FRP 575 Social Environmental Soundness (SES) and Climate Change

FRP 578 Land Use Planning and Climate Change

GENERALIZED COURSE STRUCTURE

YEAR 1, First Semester

Core Subjects:

Code	Subject	Weekly Hours (credits)
FRP 501	Thesis	10 (15-18)
FRP 511	Research Methodology	6 (16)
FRP 513	Problem Solving in Forestry and Presentation of Research Finding	4 (12)
Elective Subjects:	Choice of two courses designed by '*' in Schedule 2 list (2x4)	8 (12-36)
Total		18 (42-66)

YEAR 1, Second Semester

Core Subjects:

FRP 501	Thesis	10 (15 -18)
FRP 516	Community Management of Land and Natural Resources	4 (11)
Elective Subjects:	Choice of two subjects NOT designed by '*' in Schedule 2 list (2 x 4)	8 (12-36)
Total		18 (39-66)

YEAR 2, First Semester, Second Semester

FRP 501 Thesis 10 (15-18)

Total 10 (15-18)

COURSES SCHEDULES

SCHEDULE 1: CORE (required) Courses

FRP 511 Research Methodology 6 (16)

FRP 513 Problem Solving in Forestry and Presentation of Research Findings 4 (12)

FRP 516 Community Management of Land and Natural Resources 4 (11)

FRP 501 Thesis 10 (15-18)

SCHEDULE 2: ELECTIVE Subjects (ALL)

Wood Science and Technology

FRP 520 Physical and Mechanical Properties of Wood 4 (12)

FRP 522 Timber Technology and Utilization 4 (12)

Forest Biodiversity, Ecology, Breeding and Protection

FRP 528 Biodiversity Characterisations for Multi-Purpose Forest Inventory 4 (12)

FRP 531 Ecological Principles & Applications in PNG Forests 4 (5)*

FRP 532 Forest Health and Protection 4 (5)

FRP 534 Tree Physiology and Ecophysiology 4 (8)

FRP 536 Forest Genetics 4(14)

FRP 538 Plantation Management 4(11)

Forest Biometrics and Mensuration

FRP 540 Forest Biometrics 4(12)

FRP 542 Forest Mensuration and Assessment 4(12)

Forest Planning and Development

FRP 551 Forest Project Planning, Analysis and Management 4 (8)*

FRP 554 Geographic Information Systems and Remote Sensing for Natural Resource Management 4(14)

Agroforestry and Community Forestry

FRP 552 Agroforestry Management 4(14)

Forest Engineering and Operations

FRP 561 Forest Operations 4(12)*

FRP 562 Hydrology and Watershed Management 4(12)

Carbon, Biomass Measurement and Climate Change

FRP 575 Social, Environmental Soundness and Climate Change 4(12)*

FRP 578 Land Use Planning and Climate Change 4(12)

ALLOWABLE ELECTIVE SUBJECTS OFFERED BY OTHER DEPARTMENTS

Semester 1:

AG 531 Soil and Water Conservation Engineering 4 (6)*

Semester 2:

MAP 54 Probability and Statistics 4(13)

COURSE DESCRIPTIONS

FRP 501: THESIS

Common Credit: 15-18 [Core] **Hours per week:** 10-12

Learning Outcomes

LO1. Capable of identifying the main activities of a typical forestry project involving investigation, research, and/or field or laboratory execution.

LO2. Plan a detailed schedule of activities (from beginning to end) to meet project deadlines.

LO3. Apply skills and knowledge from a broad array of forestry-related subjects, including social science, cultural anthropology or engineering.

LO4. Successfully create and produce a comprehendible written thesis in an accepted, convention format that reports on the results of a piece of research related to forestry.

LO5. Present the discussions/results using effective communication skills.

LO6. Demonstrate greatly improved capacity in the specialized area of forestry of the student's choice.

Syllabus

Topics of the research project will be chosen in consultation with the supervisor in the area of interest or specialization. Students are expected to prepare objectives, carry out a literature review on the topic, use appropriate reference and citation protocols (for example: APA or Chicago Style), and propose the methodology of research during the first semester. These will form the basis of a seminar presentation by the student during the semester. The project work itself will be executed by the student following a standard procedure. The student is expected to present the results of his/her work in at least one month before the Semester 2 examinations. The dissertation will be examined by two or three examiners recommended by the Head of Department and approved by the Higher Degree Committee.

* - Offered in Semester 1 only; the remainder of Schedule 2 subjects are offered only in Semester 2.

Assessment

Continuous assessment seminar, dissertation 100%

FRP 511: RESEARCH METHODOLOGY

Common Credit: 16 [Core]

Hours per week: 6(2 Lecture/3 Tutorial/1 Field)

Learning Outcomes

LO1. Determine the best experimental design for various types of forestry and other related experiments

LO2. Analyze and critically interpret different results from different experimental designs

LO3. Analyze various types of qualitative and quantitative data

LO4. Show proficiency at applying appropriate computer software to facilitate forestry planning, management, and experimentation,

LO5. Demonstrate an understanding of socio-cultural considerations related to indigenous vs. western-style scientific investigations

LO6. Be able to conduct and objectively present proper research results.

Syllabus

General approach to research, analysis and evaluation procedures used in forestry experimentation. Planning and design of controlled field experimentation with emphasis on commercial trees and trees for agroforestry and other socio-cultural aspects of biodiversity or community-based forest management within the PNG context. This may include (but not be exclusively limited to), selection of treatments, demonstration and layout of designs in the field, on-field collection of qualitative and quantitative data, interpretation of experimental results, interpretation of ethnographic data (from participant observation) or other qualitative methodology. This will include the planning and implementation of semi-structured questionnaires (surveys), use of qualitative and quantitative methods for data collection from communities, villages or individuals, and subsequent analysis of results using appropriate computer software.

Students will become familiar with the use of computers, analysis of results, and scientific publication submissions and presentation of good research results.

References

i. Gessesse, B. (1992). Statistical Methods: Experimental Design and Analysis of Experiments. Training Manual, Vol. 20, Forestry College Bulolo, Lae

ii. Mayan, M (2001). An Introduction to Qualitative Methods: A Training Manual for Students and Professionals. Intl Institute for Qualitative Methodology, University of Alberta, Canada.

iii. Snedecor, G.W. & Cochran, G.W. (1967). Statistical Methods. (Sixth Ed.). The Iowa State University Press, Iowa.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 513: PROBLEM SOLVING IN FORESTRY AND PRESENTATION OF RESEARCH FINDINGS

Common Credit: 12 [Core]

Hours per week: 4 (2 Lecture/2 Tutorial)

Learning Outcomes

LO1. Understand and be able to apply different reasoning strategies that can be powerfully used to solve problems, and apply elements of creative thinking, including application of basic steps in the scientific method.

LO2. Be able to develop and propose research questions, formulate hypotheses, and propose research questions in forestry and about forests through initial observation and analysis, leading to formulation of a hypothesis.

LO3. Become skilled at rapid assessment of a problem and informal collection of preliminary data.

LO4. Be able to apply different approaches involved in answering research questions, including basic data analysis.

LO5. Be able to professionally create and present data tables and charts, using appropriate spreadsheet and presentation software.

Syllabus

Evolution of problem-solving approaches in science, including the scientific method.

Problem solving approaches: Critical analysis and reasoning (deductive, inductive); progressive steps in problem solving; elements of creative thinking.

Formulation of research questions: inferences and observations to develop research questions, refined into testable hypotheses; data analysis techniques, including picking out trends and patterns.

Answering research questions: Identifying trends and patterns in the data; avoidance of cherry-picking and data fishing.

Data presentation: Techniques for effective communication via charts and tables; presentation software and oral communication techniques.

References

i. Barnard, C., Gilbert, F & P. McGregor. 2011. Asking Questions in Biology. A Guide to Hypothesis-Testing, Experimental Design and Presentation in Practical Work and Research Projects. 4th ed., Pearson Education, Harlow, England, UK. 250pp.

ii. Gauch Jr, H. G. 2007. Scientific Method in Practice. Cambridge Univ. Press, UK. 435pp.

iii. Lehocky, S & R Rusczyk. 2011. The Art of Problem Solving. Volume 3: The Basics Solutions Manual. 7th ed., AoPSIncorp, Alpine, California USA. 272pp.

iv. Lehocky, S & R Rusczyk. 2006. The Art of Problem Solving. Volume 2: And Beyond. 7th ed., AoPSIncorp, Alpine, California USA. 296pp.

v. Lehocky, S & R Rusczyk. 2006. The Art of Problem Solving. Volume 1: The Basics. 7th ed., AoPSIncorp, Alpine, California USA. 272pp.

vi. Whimbey, A. & J. Lochhead. 2010. Problem Solving & Comprehension. 6th ed., Routledge, New York. 387 pp.

vii. Zeitz, P. 2007. The Art and Craft of Problem Solving. 2nd edition, John Wiley & Sons, New York.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 516: COMMUNITY MANAGEMENT OF LAND AND NATURAL RESOURCES

Common Credit: 11

Hours per week: 4 (2 Lecture/2 Project)

Learning Outcomes

LO1. Able to describe how PNG communities' function and how they can fully participate in sustainable land use systems, for their own livelihood and that of the economy of the country

LO2. Demonstrate a sound understanding of the principal theories underpinning community participation in management

LO3. Be able to describe important processes and techniques of group facilitation, participatory appraisal, planning and collaborative management of resources.

Syllabus

Land tenure in PNG, customary ownership of land, use rights in land (and trees), land conveyance, incorporated land group, integrated cropping systems, sustainability and productivity, philosophy and evolution of participation and community management, models of community management of forests and other natural resources, policy and institutional issues in community management, process and techniques in participatory enquiry, planning and management, forms of evaluation in community management programs and conflict management.

References

i. Crocombe, R. (Ed.), (1987). Land Tenure in the Pacific. University of the South Pacific, Suva.

ii. Frost, F., Forge, K., and Black, A.W., (2000). Extension and Advisory Strategies for Agroforestry. Rural Industries Research and Development Corporation. AusAID/RIRDC Publication No. 00/184, Australia.

iv. Lerner, D., and Schramm, W., (Eds) (1967). Communication and Changes in the Developing Countries. East West Centre Press, Honolulu.

iv. Nolan, P., and Lenski, G., (1999), Human Societies: an introduction to macro sociology. (Eight Ed.). McGraw-Hill College, New York.

v. Ray, G.L., (1976). Extension Communication and Management. R. Publishing Corp., Delhi.

vi. Sharma, N.P., (Ed.) (1992). Managing the World's Forests: looking for the balance between conservation and development. World Bank, Washington, D.C.

vii. Unasylva No. 143(36), (1984). Forestry extensions, making it work. FAO (various articles).

viii. Village Development Trust [VDT], (nd). Training and Reference Manual 1-8, VDT, Lae.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 520: PHYSICAL AND MECHANICAL PROPERTIES OF WOOD

Common Credit: 12

Hours per week: 4 (2 Lecture/2Tutorial)

Learning Outcomes

LO1. Able to identify common species of commercial PNG wood,

LO2. Be proficient in interpreting wood samples and reporting its qualities and properties.

LO3. Understand wood physical and mechanical properties for industrial standards,

LO4. Recommend appropriate wood (or timber) for structural and non-structural purposes,

Syllabus

Gross wood structure, anatomical features and properties including identification and measurement, wood macro-structure, mechanical and physical properties including industrial standards, testing methods, grading and evaluation of wood-based materials for structural and non- structural purposes.

References

i. Desch, H.E. & Dinwoodie, J.M., (1996). Timber: Its Structure, Properties and Utilization. (7th Ed.). MacMillan Press Limited.

ii. Oteng-Amoako, A.A., (1974). Macroscopic Wood Identification Manual for Papua New Guinea Timbers. PORO Printing Co., Lae.

iii. Tsoumis, G., (1991). Science and Technology of Wood: structure, properties and utilization. Chapman &Hall.

iv. USDA (2010). Wood Handbook: wood as an engineering material, General Technical Report FPL-GTR-190. Madison, WI: USDA, Forest Products Laboratory: 508 p.

v. Walker, J.F.C., (1993). Primary Wood Processing: Principles and Practices. Chapman &Hall.

vi. Wilson, K., & White, D.J.B. (1986).The Anatomy of Wood: its diversity and variability. Stobart & Son Ltd, London.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 522: TIMBER TECHNOLOGY AND UTILIZATION

Common Credit: 12

Hours per week: 4 (2 Lecture/2Tutorial)

Learning Outcomes

LO1. Able to gain better understanding to identify and produce different types of timber products

LO2. Demonstrate the treatment of the product for durability and its marketability

LO3. Understand the visual grading and machine stress grading and acquire knowledge of wood utilization as a whole

LO4.Understand the specifications and strength required for timber design

LO5. Learn the basic principles of timber engineering to apply in wood structure design and construction.

Syllabus

Commercial timber species of PNG, wood quality and utilization, design and interpretation of wood quality surveys, principles of timber engineering, the design and specification of timber, timber preservation, timber drying and standards, wood chemical properties, especially for wood pulping, species selection and use of wood products in construction, clear wood sampling and strength properties, visual grading, machine stress grading, serviceability and design philosophy, types of timber products, cost of production and market structures.

References

i. Eaton, R.A, and Hale, M.D.C., (1993). Wood: Decay, Pests and Protection. Chapman & Hall, London.

ii. Fengel, D, and Wgener, G., (1989). Wood: Chemistry, Ultrastructure and Reactions. Water de Gruyter, Berlin.

iii. Findlay, W.P.K., (ed.), (1985). Wood Preservation in the Tropics. Nijhoff/Junk Publishers.

iv. Nicholas, D.D., (1973). Preservatives and Preservative Systems: Wood Deterioration and its Prevention by preservative treatments. Syracuse University Press, New York.

v. Richard, B.A., (1993). Wood Preservation. (2nd Ed.). Chapman &Hall, London.

vi. USDA (2010). Wood Handbook: Wood as an Engineering Material, General Technical Report FPL-GTR-190. Madison, WI: USDA, Forest Products Laboratory: 508 p.

Assessment
Continuous Assessment 60%
Written Examination 40%

FRP 528: BIODIVERSITY CHARACTERISATION FOR MULTI-PURPOSE FOREST INVENTORY

Common Credit: 12

Hours per week: 4 (2 Lecture/1 Practical/1 Project)

Learning Outcomes

LO1. Be able to describe the most commonly used survey methods and technology for assessing site biodiversity of major taxonomic groups used today in forest inventory.

LO2. Understand the issues that different habitats place on assessment of biodiversity.

LO3. Understand and be able to plan out the best possible sampling scheme for different floral growth forms, and different faunal groups.

LO4. Be able to apply survey methods and technology, as well as how to analyse the data, from a selected taxonomic group of interest to the student.

LO5. Understand what statistical methods are used most commonly in analyzing biodiversity assessment data.

Syllabus

Biodiversity survey planning for PNG, Biodiversity characterization: Qualitative (incl. species lists) versus quantitative; rapid assessment Biodiversity sampling: total counts, timed searches, quadrats, distance sampling, line and strip transects, point counts, trapping webs, removal method, mark-recapture techniques; survey methodology for trees, forest vascular plants (general), amphibians, reptile, bats, Mammals (general), birds, Butterflies, moths, ants.

Biodiversity data analysis: Parametric and nonparametric statistics applied; use of spreadsheets in biodiversity assessments.

References

i. [Various] RAP Bulletin of Biological Assessments, publ by Conservation Intl, Center for Applied Biodiversity Science (CABS). [Selected numbers]

ii. Agosti, D., J. D. Majer, l. E. Alonso & T. R. Schultz. 2000. Ants. Standard Methods for Measuring and Monitoring Biodiversity. Smithsonian Inst. Press, Washington, D.C. 280pp.

iii. Bibby, C. J, N. D. Burgess, D. A. Hill & S. H. Mustoe. 2000. Bird Census Techniques. 2nd ed., Academic Press, U.K. 302pp.

iv. Hill, D., M. Fasham, G. Tucker, M. Shewry & P. Shaw (Eds). 2005. Handbook of Biodiversity Methods. Survey, Evaluation and Monitoring. Cambridge Univ. Press, Cambridge. 573pp.

v. Lindenmayer, D. O. & P. Gibbons (Eds) 2012. Biodiversity Monitoring in Australia. CSIRO Publishing, Canberra. 210 pp

vi. Magurran, A.E. 2004. Measuring Biological Diversity. Blackwell Publ., Malden, Massachusetts. 256pp.

vii. McDiarmid, R. W., M. S. Foster, C. Guyer, J. W. Gibbons & N. Chernoff. 2012. Reptile Biodiversity. Standard Methods for Inventory and Monitoring. Univ. Calif. Press, Berkeley. 412pp.

viii. Stohlgren, T. 2007. Measuring Plant Diversity. Lessons from the Field. Oxford Univ. Press, UK. 390pp.

ix. Wilson, D.E., F. R. Cole, J. D. Nichols, R. Rudran& M. S. Foster. 1996. Measuring and Monitoring Biological Diversity. Standard Methods for Mammals. Smithsonian Inst. Press, Washington, D.C. 409pp.

Assessment
Continuous Assessment 100%
[Includes a biodiversity assessment major project]

FRP 531: ECOLOGICAL PRINCIPLES AND APPLICATIONS IN PNG FORESTS

Common Credit: 5

Hours per week: 4 (3 Practical/1 Project)

Learning Outcomes

LO1. Able to demonstrate an advanced understanding of selected concepts and principles of ecology in the context of characterizing and understanding tropical and subtropical ecosystems of PNG.

LO2. Be able to apply ecological principles to design and implement an inventory of a forest area, including its biodiversity.

LO3. Be able to take an ecological problem and propose a methodology that would allow the problem to be solved conclusively.

LO4. Be able to do a rapid assessment of an ecological problem that yields enough preliminary data to determine whether the problem should be investigated further.

Syllabus

Concepts and principles of ecology in the tropical and subtropical ecosystems, the processes occurring within these ecosystems and importance of ecology in the sustainable management of forests, assessment, and management of biodiversity values of forests.

References

i. Corlett, R. T. 2014. The Ecology of Tropical East Asia. 2nd ed., Oxford Univ. Press, UK. 291pp.

ii. Marius, J., (1981). The Tropical Rain Forest: a first encounter. Springer-Verlag, Berlin.

iii. Osborne, P. L., (2000). Tropical Ecosystems and Ecological Concepts. Cambridge University Press, Cambridge, UK.

iv. Whitmore, T.C. and Burnham, C.P. (1984). Tropical Rain Forests of the Far East. Oxford University Press, Oxford.

Assessment

Continuous Assessment 100%

FRP 532: FOREST HEALTH AND PROTECTION

Common Credit: 5

Hours per week: 4 (3 Practical/1 Project)

Learning Outcomes

LO1. Able to identify a range of common insect pests and plant diseases affecting PNG trees OM plantation and natural situations

LO2. Develop strategies and plans that minimize the negative effect of significant pest and disease species on both natural and plantation forests.

LO3. Demonstrate an understanding forest fire and its behaviors to be able to institute appropriate measures to minimize its effect on the forest ecosystem.

Syllabus

Common insect pests and plant diseases, plant pathogens and abiotic agents, population dynamics of insects and plants and integrated pest management, which may involve biological control agents. Climatic factors that affect weather patterns and fire ecology and management, as well as the use of fire as a prescribed management tool.

References

i. Blanchette, R.A, and Biggs, A.R., (1992). Defense Mechanisms of Woody Plants against Fungi. Springer-Verlag, Berlin.

ii. Coates, B.J., and Peckover, W.S., (2001). Birds of New Guinea and the Bismarck Archipelago: a photographic guide. Dove Publication, Australia.

iii. Flannery, T., (1995). Mammals of New Guinea. Reed Books, Australia.

iv. Franklin, F.D., (1980).Forest Fire Protection. Training Manual for the Papua New Guinea Forestry College, Vol. 14., PNG Forestry

College, Bulolo and Office of Forests, Port Moresby.

v. Luke, R.H., and McArthur, A.G., (1986). Bush fires in Australia. Australian Government Publ. Service, Canberra.

vi. Metcalf, R. L., and Luckmann, W.H., (1982) (eds.) Introduction to Insect Pest Management. (2nd edition). John Wiley & Sons, New York.

vii. Schneider, M. F., (1999). Entomology: Textbook for Students, Agriculturalists and Foresters in PNG. Training Manual No. 19, PNG. Bulolo Univ. College, PNG

viii. Shaw, D.E., (1984). Microorganisms in Papua New Guinea. Research Bulletin No. 33. Department of Primary Industry, Port Moresby.

FRP 534: TREE PHYSIOLOGY AND ECOPHYSIOLOGY

Common Credit: 8

Hours per week: 4 (4 Tutorial)

Learning Outcomes

LO1. Able to investigate how environmental factors affect life functions of trees and develop workable strategies on how to respond to negative factors.

LO2. Identify the effects of varied soil characteristics on the capacity and capability of growth in commercial trees and other flora.

Syllabus

Photosynthesis, respiration, nutrient relations and water use, trees responses to stress due to environmental factors, including responses to global climate changes and carbon sequestration. Root growth of commercial timber species, fertilizer requirements of such species (natural and plantation), comparison of the performance of seedlings, forest soils and nutritional recycling in natural forests and plantations.

References

i. Chang, M. 2013. Forest Hydrology: An Introduction to Water and Forests, 3rd ed., CRC Press, Boca Raton, London, N.Y., 569pp.

ii. Hewlett, J.D., (1982). Principles of Forest Hydrology. The University of Georgia Press, Athens.

iii. Kozlowski, T.T., Pallardy, S.G., (Eds). (1979). Physiology of Woody Plants. Academic Press, San Diego.

iv. Pritchett, W.L., (1979). Properties and Management of Forest Soils. John Wiley & Sons, New York.

v. Rowell, D.L., (1994). Soil Science: methods and applications. Addison Wesley & Longman Limited, Edinburg.

vi. Salisbury, F.B., (1992). Plant Physiology. (4th Ed.). Wadsworth Publishing Company, Belmont.

vii. Street, H.E., and Öpik, H., (1984). The Physiology of Flowering Plants: Their Growth and Development. (3rd Ed.).Edward Arnold, London.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 536: FOREST GENETICS

Common Credit: 14

Hours per week: 4 (3 Lecture/1 Tutorial)

Learning Outcomes

LO1. Able to explain the basic principles of genetics and provide illustrative examples.

LO2. Provide examples of the application of genetics to both natural forest and plantation production.

LO3. Provide examples of how genetics can be applied to wider ecosystem management.

Syllabus

Principles of genetics, principles and methods of forest tree breeding, quantitative genetic approaches to tree improvement, methods, concepts and case studies in breeding for increased yield and quality of plant products, breeding for disease and insect resistance or tolerance in plants, and other genetic and breeding techniques.

References

i. Boshier, A. Y. D., (2000). Forest Conservation Genetics Principle and Practice. CSIRO, Australia.

ii. Wright, J. W., (1976). Introduction to Forest Genetics. Academic Press, New York.

Assessment
Continuous Assessment 60%
Written Examination 40%

FRP 538: PLANTATION MANAGEMENT

Common Credit: 11

Hours per week: 4 (2 Lecture/2 Practical)

Learning Outcomes

LO1. Able to describe in some depth the principles and practices of the development and management of plantations.

LO2. Explain the various ways in which plantation management contributes to sustainable forest management in the more holistic sense.

Syllabus

Designs of plantation; plant propagation, covering seedling production; vegetative and tissue culture; growth and development of stands; role of disturbance (natural and man- made); ecosystem stability and evolution of silvicultural methods in tropical rainforests.

References

i. Evans, J. (1992). Plantation Forestry in the Tropics. ELBS, Oxford.

ii. Fenton, R., Roper, R, & Watt, G.R., (1977).Lowland Tropical Hardwoods: An Annotated Bibliography of Selected Species with Plantation Potential. External Aid Division, Ministry of Foreign Affairs, New Zealand.

iii. Nambiar, E.K., and Brown, A.G., (Eds), (1997).Management of Soil, Nutrients and Water in Tropical Plantation Forests. ACIAR, Canberra.

iv. Neilsen W.A., (Ed). (1990). Plantation Handbook. Forestry Commission, Hobart.

Assessment
Continuous Assessment 60%
Written Examination 40%

FRP 540: FOREST BIOMETRICS

Common Credit: 12

Hours per week: 4 (2 Lecture/2Tutorial)

Learning Outcomes

LO1. Able to adopt appropriate techniques of data gathering in biological science,

LO2. Apply appropriate statistical methods, using appropriate statistical software, to accurately and successfully analyze a variety of forestry-related data sets.

Syllabus

Elementary descriptive statistics, basic probability theory, random variables and their basic properties, standard probability distributions: Binomial, Poisson, uniform, normal, the Central Limit Theorem, point and interval estimation of parameters of probability distributions, hypothesis testing: critical region, size and power, applications of the normal, t and X2 distributions, linear regression and an introduction to multiple regressions, analysis of variance and the Kruskal-Wallis test, design of experiments: one- and two-way classification, factorial designs, and analysis of residuals, and use of the computer in statistical

analysis, with special reference to the statistical package (e.g. Microsoft Excel, MINITAB etc.).

References

i. Akindele, S.O., (2008). Place of Biometrics in Forestry and Forest Products Research. In: Proceedings of the 1st National Conference of the forest & forest products Society of Nigeria, pp253-256. Cited: Research gate: on the 02nd September 2019 at http://www.researchgate.net/publications/228444965

ii. Bhattacharya, G.K., & Johnson, R.A., (1977). Statistical Concepts and Methods. John Wiley & Sons, New York.

iii. Clarke, G.M., (1980). Statistics and Experimental Design. (2nd Ed.). Edward Arnold, London.

iv. Martin, P. and Pierce, R., (1994). Practical Statistics for the Health Sciences. Nelson Publishing Melbourne.

v. Mead, R. & Currow, R.N., (1984). Statistical Methods in Agriculture and Experimental Biology. Chapman and Hall.

vi. Prodan, M. (1968). Forest Biometrics. Pergamon Press, Oxford.

vii. Weiss, N.A., [2017] Introductory Statistics 10E, Pearson Educational Ltd, Malaysia

viii. Bloch, S.C., [2003] Excel for Engineers and Scientists, John Wiley & Sons, Inc. New York

ix. Liengme, B.V., [2016] A guide to Microsoft Excel 2013 for Scientists and Engineers, 1E, Butterworth Heinemann, Oxford.

Assessment

Continuous Assessment	60%
Written Examination	40%

FRP 542: FOREST MENSURATION AND ASSESSMENT

Common Credit: 12

Hours per week: 4(2 Lecture/2Tutorial)

Learning Outcomes

LO1. Correctly selects and utilize all standard forest measurement equipment effectively

LO2. Evaluate and minimize various sources of error

LO3. Accurately measure tree and stand values for diameter, height, volume, defect

LO4. Be able to construct and evaluate volume based upon accurate measurements of appropriate parameters.

LO5. Be able to construct comprehensive yield tables

LO6. Be proficient in using basic growth and yield equations

LO7. Develop simple, workable models for tree and stand growth and yield

LO8. Appropriately apply standard statistical techniques to sampling processes, to the evaluation of tree and stand variables, and to the development of basic growthand yield models.

Syllabus

Tree measurement techniques (dbh, height, bark and crown), defects, geometry of stem volume, stem analysis, volume increment, stand basal area and volume, density, volume tables, yield tables, explanatory and predictive models for tree and stand growth, parameter estimation, site quality, sampling techniques (random, stratified and systematic samples).

References

i. Avery, T.E., and Burkhart, H.E., (1984). Forest Measurements. McGraw-Hill, Inc., New York.

ii. Carron, L.T., (1968). An Outline of Forest Mensuration with Special Reference to Australia. Australian National University Press, Canberra.

iii. Husch, B., Miller, C.I., and Beers, T.W. (1982). Forest Mensuration (3rd Ed.). John Wiley & Sons, New York.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 551: FOREST PROJECT PLANNING, ANALYSIS AND MANAGEMENT

Common Credit: 8

Hours per week: 4 (1 Lecture/3 Project)

Learning Outcomes

LO1. Able to acquaint with various processes and procedures of operating large scale logging companies whose operations are directly inclined to PNG Logging Code of Practice standards and policy matters required under the forest policy and Forestry Act 1991 amended (1996 & 2000).

LO2. Develop balance view between interrelated forestry projects and ascertain of promising job market available in the future.

LO3. Provide opportunity for students to compare the project operations and management options between the forestry related (non-extractive) and extractive industries in regard to environment issues.

LO4. Produce final field trip report documents on various natural resources project activities observed during the exposure period.

Syllabus

Project identification, formulation, analysis, documentation, appraisal, implementation, and review; the need for undertaking environmental impact statements (EIS) and social impact assessment (SIA) in forestry development projects, financial analysis of forestry projects; values of other environmental goods and services; and the impact of government regulation.

References

i. Buongiorno, J. (2003). Decision Methods for Forest Resource Management. Academic Press, New York.

ii. Davis, L.S., Johnson, K., (1987). Forest Management. McGraw-Hill, New York.

iii. Duerr, W. A., (1960). Forestry Economics. .McGraw-Hill, New York,

iv. FAO, (1992). Economic assessment of forestry projects impact, Forestry Paper 106. FAO, Rome.

v. Horton, F. W., (1995). Information Management Workbook (4th Ed.). Prentice Hall, New York.

vi. Leslie, A., (1992). Economic Problems in Tropical Forestry. FAO Paper FO: Misc/71/24.

vii. Tietenberg, T., (2000).Environmental and Natural Resource Economics. 5th ed. Addison-Wesley, Massachusetts.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 552: AGROFORESTRY MANAGEMENT

Common Credit: 14

Hours per week: 4 (3 Lecture/1 Practical)

Learning Outcomes

LO1. Able to provide useful information and assistance to community groups who wish to engage in agroforestry activities.

LO2.For different socio-economic and environmental situations, develop realistic plans and strategies for specific agroforestry activities that can contribute to sustainable forest management.

Syllabus

Agroforestry management principles, crop and livestock production systems, fuel wood plantations, shade, shelter, nutrient, soil stability, organic matter, timber sales, processing and sales of small woodlot produce, problems with managing community forests, community consultation and participation, land protection, tree and crop combinations, community forestry, costs and benefits of community forests and support systems for community forest owners.

References

i. Clarke, W.C., & Thaman, R.R., (Eds) (1993). Agroforestry in the Pacific Islands: Systems for Sustainability. United Nations University Press, Tokyo.

ii. Power, A, (nd).Land Group Incorporation: A Management System. A Train-the-Trainer Workbook, Part Two, AusAID.

iii. Ray, G.L., (1976). Extension Communication and Management. R. Publishing Corp., Delhi.

iv. Sharma, N.P., (Ed.) (1992). Managing the World's Forests: looking for the balance between conservation and development. World Bank, Washington, D.C.

v. Unasylva No. 143(36), (1984). Forestry extension, making it work. FAO (various articles).

vi. Village Development Trust [VDT], (nd). Training and Reference Manual 1-8, VDT, Lae.

vii. Young, A. (1991). Agroforestry for Soil Conservation.CAB International, Oxford.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 554: GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING FOR NATURAL RESOURCE MANAGEMENT

Common Credit: 14

Hours per week: 4 (3 Lecture/1 Project)

Learning Outcomes

LO1. Able to demonstrate data input, design, output, analysis and management in Geographic Information Systems,

LO2. Understand remote sensing principles and application including air photo interpretation,

LO3. Understand use of PC vector and raster GIS, able to use PNG geographic datasets and digital mapping sources in forest resource management

LO4. Develop the ability to design and complete a spatial analysis.

Syllabus

Geographic information systems, as in data input, design, output, analysis and management, remote sensing principles and application – including air photo interpretation, use of PC vector and raster GIS, and PNG geographic datasets and digital mapping sources and their applications.

References

i. Amando, A., (1999). GIS Applications in Tropical Forestry. Toowomba Distance Education Centre, Qld.

ii. Atkinson, P.M., (1998). Advances in Remote Sensing and GIS Analysis. Wiley Publications, Chichester.

iii. Berry, J.K., (1995). Spatial Reasoning for Effective GIS.Colo GIS World Books, Fort Collins, USA.

iv. Burrough, P.A., (1986). Principles of Geographical Information Systems for Land Resources Assessment. Clarendon Press, Oxford.

v. Montgomery, G.E., (1993). GIS Data Conversion Handbook.Colo GIS World Books, Fort Collins, USA.

vi. Vatasan, G., and Vatasan, N, (nd). Practical Photo interpretation for Foresters in Papua New Guinea. Forestry Department, Unitech, Lae.

Assessment

Continuous Assessment 60%
Written Examination 40 %

FRP 561: FOREST OPERATIONS

Common Credit: 12

Hours per week: 4 (2 Lecture/2Tutorial)

Learning Outcomes

LO1: Able to understand fully the various operational activities in forestry and able to plan, design and construct logistics of roads, bridges, culverts, drainage structures and other operational infrastructures.

LO2. Conduct resource survey and mapping. Perform complete short term and long term logging plan.

LO3. Understand reduced impact logging and demonstrate impact of logging and road construction and subsequent environmental conservation.

LO4. Learn about safety and ergonomics, and can apply in the operational workplace. Apply the knowledge of impact of operational activities on wood products quality, certification and marketing.

Syllabus

Basic map reading and interpretation for design of resource surveys and preparation of annual, five yearly logging and set up plans, road alignment and construction, use of equipment for harvesting and roading, including some understanding of the operational cost of these equipment, procedures for the monitoring and controlling of timber harvesting in PNG, the PNG Logging Code of Practice, Log Export Procedures, and other guidelines as is current and applicable in PNG and internationally that relates to timber product development and marketing.

References

i. FAO, ECE & ILO (1999). Forest Operations of Tomorrow: Seminar Proceeding on Forest Operations of Tomorrow Held in Pessac, France, 20- 24 Sept., 1999.

ii. FAO (1974). Logging and Log Transport in Tropical High Forest: A Manual on Production and Cost. FAO Forestry Development Paper No. 18. FAO, Rome.

iii. FAO, (1992). Cost control in forest harvesting and road construction. FAO, Forestry Paper No.99, FAO, Rome.

iv. Hammermaster, E.T., and Saunders, J.C., (1995). Forest Resources and Vegetation Mapping of Papua New Guinea. PNGRIS Publication No.4, CSIRO, Canberra.

v. Olsen, E.D., Hossain, M.M. and Miller, M.E (1998). Statistical Comparison of Methods Used in Harvesting Work Studies. College of Forestry, Oregon State Univ., USA, 41p.

vi. PNG Forest Authority (1995). Planning, Monitoring and Control Procedures for Natural Forest Logging Operations under Timber Permit. PNG Forest Authority, Hohola.

vii. PNG Forest Authority and PNG Dept of Environment and Conservation, (1996).PNG Logging Code of Practice.PNG Forest Authority, Hohola.

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 562: HYDROLOGY AND WATERSHED MANAGEMENT

Common Credit: 12

Hours per week: 4 (2 Lecture/2 Tutorial)

Learning Outcomes

LO1: Able to understand hydrology, hydrological cycles and its influence on land and water resources,

LO2: Can explain soil water relation, infiltration, percolation, ground water flow and storage, and ground water recharge,

LO3: Can demonstrate overland flow, stream flow behavior and stream channel design,

LO4: Can understand behavior of catchment, drainage basin and watershed in relation to land, water and plant life,

LO5: Able to demonstrate soil erosion and sedimentation process and their impacts on forested watershed,

LO6: Able to do soil conservation and watershed development planning

Syllabus

Hydrology: Hydrology and forestry, hydrologic cycle, meteorological data, precipitation, infiltration, percolation, soil water relation, ground water table, aquifers, groundwater flow, hydraulics of wells, evaporation, overland flow, stream flow and stream flow hydrograph, flow measurement in streams, stream channel and drainage design.

Watershed: Concepts of watershed and its management, surface and underground features, watershed depth, soil erosion and sedimentation process and their impacts on forested watershed, forest operations vs. soil erosion, principles of soil conservation, mechanical, vegetative, agronomic and management based measures of soil conservation in upland watershed; soil conservation structures, planning for watershed development.

References

i. Chang, M. 2013. Forest Hydrology: An Introduction to Water and Forests, 3rd ed., CRC Press, N.Y., 569pp.

ii. Hamilton, L.S. (edited) 1983. Forest and Watershed Development and Conservation in Asia and the Pacific. West view Press, Boulder, Colorado. 559pp.

iii. Haque, S. M. S. and Myant, M. H. 2011. Watershed Management Extension and Environmental Conservation in Bangladesh, IFESCU and USDA, 188 pp.

iv. Haque, S. M. S. 2013. Watershed Management in Bangladesh, IFESCU and USDA, 224pp.

v. Hewlett, J.D. 1982. Principles of Forest Hydrology, The University of Georgia Press, Athens.

vi. Linsley, R.K. et al. 1982. Hydrology for Engineers. 3rd ed. McGraw Hill International Book Co., New Delhi.

Assessment

Continuous Assessment	60%
Written Examination	40%

FRP 575: SOCIAL ENVIRONMENTAL SOUNDNESS (SES) AND CLIMATE CHANGE

Common Credit: 12

Hours per week: 4 (2 Lecture/2 Tutorial)

Prerequisites: FR 390 Introduction to Climate Change

Learning Outcomes

LO1. Interpret and analyze social and environmental "soundness" and underlying conceptual frameworks, in order to explain how they fit into larger contexts of climate change, climate change mitigation, and climate justice debates.

LO2. Describe, explain the purpose, and apply a variety of relevant tools for addressing soundness.

LO3. Appraise how gender issues relate to REDD+ and cut across various other concepts.

LO4. Explain how safeguard mechanisms and approaches are being used in practice.

LO5. Evaluate social, environmental, and economic costs and benefits, risks and opportunities associated with REDD+ and with other PES or conservation programs and projects.

LO6. Synthesize a range of social, economic, and environmental considerations for application in REDD+ projects and safeguard mechanisms and assess real-world REDD+ and safeguard design and implementation.

Syllabus

Elements of social and environmental soundness and its larger climate change context, introduction and background, relevant, contemporary social and environmental issues related to climate change; techniques to strengthen design and implementation of REDD+ projects; state of the art examples; component synthesis and integration into REDD+ programmes.

References

i. Baggethun, B. M., B. Norton, & M. B. Potschin. 2012. Ethical Considerations in On-Ground Applications of the Ecosystem Services Concept. BioScience. Vol. 62, No. 12, December.

ii. Clugston R. 2011. Ethical Framework for a Sustainable World. Journal of Education for Sustainable Development. 5, September: 173-176.

iii. Corbera, E., Schroeder, H. 2010. Governing and Implementing REDD+. Environ. Sci. Policy, doi: 10.1016/j.envsci.2010.11.002.

iv. Gary W. Luck, Kai M. A. Chan, UtaEser, Erik Gómez- IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker,

v. Jagger P., Sills E.O., Lawlor, K. and Sunderlin, W.D. 2010.A guide to learning about livelihood impacts of REDD+ projects. Occasional paper 56. CIFOR, Bogor, Indonesia.

vi. Rolston. H. 2003. Environmental Ethics. In The Blackwell Companion to Philosophy, 2nd ed. Bunnin. N and Tsui-James. E.P (Eds), Oxford: Blackwell Publishing.

vii. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor,

S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgle (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: http://ipcc.ch/report/ar5/wg1/

viii. Ulvin, Peter. 2007. from the right to development to therights-based approach: how 'human rights' entered development. Development in Practice 17(4-5): 597-606.

ix. World Commission on Environment and Development.1987. Our Common Future. London: Oxford University Press. (The Brundtland Report)

Assessment

Continuous Assessment 60%
Written Examination 40%

FRP 578: LAND USE PLANNING AND CLIMATE CHANGE (LUPCC)

Common Credit: 12

Hours per week: 4 (2 Lecture/2 Tutorial)

Prerequisites: FR 390: Introduction to Climate Change

Learning Outcomes

LO1. Develop an adaptive management framework for land use planning under uncertain climate patterns and policy regimes

LO2. Develop approaches for quantifying drivers of historic land use patterns in a changing climate

LO3. Develop scenario planning and cost-benefit analysis that takes climate adaptation and mitigation strategies (environmental, social and economic) into consideration.

LO4. Describe a process that leads to a negotiated agreement.

LO5. Construct a Monitoring and Evaluation framework for land use planning that is tailored to a changing climate

LO6. Integrate information from multiple disciplines

Syllabus

Institutional framework: Low Emission Land Use Planning Framework (National level scale down to community initiatives); assessment of current conditions (defining drivers); analysis of options; negotiation and prioritization of implementation plan; monitoring and evaluation following implementation.

References

i. GTZ and IUCN (2000) Co-management of Natural Resources

ii. IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

iii. Jagger P., Sills E.O., Lawlor, K. and Sunderlin, W.D. 2010. A guide to learning about livelihood impacts of REDD+ projects. Occasional paper 56. CIFOR, Bogor, Indonesia.

iv. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: http://ipcc.ch/report/ar5/wg1 UNDP Handbook on Monitoring and Evaluating for Results.

Assessment

Continuous Assessment 60%
Written Examination 40%

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

- POSTGRADUATE DIPLOMA IN COMPUTER SCIENCE
- POSTGRADUATE DIPLOMA IN ENGINEERING MATHEMATICS
- POSTGRADUATE DIPLOMA IN MATHEMATICS

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

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Deputy Head of Department
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Technical Officer
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Secretary
Gaiwari, P

Administrative Officer:
Banit, S., Dip HRM (ITI)

Janitors

Koen, R.

Porem, B.

POSTGRADUATE COURSES

The Department offers three Postgraduate Diploma programs:

1. Postgraduate Diploma in Engineering Mathematics
2. Postgraduate Diploma in Mathematics
3. Postgraduate Diploma in Computer Science

The Department provides a range of postgraduate subjects in Mathematics, Statistics, and Computer Science for graduates who are preparing for higher degree studies and for those who require additional courses beyond the scope of their present training and skills.

The Diploma are practical in nature so those students who graduate will have skills, which can be readily used in Papua New Guinea.

Candidates for these programs are normally expected to be graduates in mathematics, engineer-ing, or computer science. Candidates without the prerequisite knowledge will be asked to take undergraduate subjects or formative modules before they start the Diploma.

In order to complete the Postgraduate Diploma candidates must take SIX subjects, and normally take a project equivalent to TWO subjects. In special cases two subjects may replace the project. These six (or eight) subjects can be chosen from the following lists of postgraduate subjects, but subject to the core subjects normally being studied first.

Diploma advisers will help students to select a set of appropriate subjects. Approved postgraduate subjects may be taken with other Departments of the University. The balance of the six courses (particularly the core subjects) and the project area will determine which Diploma is awarded.

The project is equivalent to a double subject and will be related to students' interests and staff availability. Students may propose projects relating to their work place and these may be approved if at the right level.

The Diploma is usually offered part time. Students who have been awarded a Postgraduate Diploma or who satisfy the requirements prescribed by the Papua New Guinea University of Technology may be admitted to a M.Sc. or M.Phil. program. The M.Sc. program involves further course work and a thesis on some area of Mathematics, Computer Science or statistics. The M. Phil. program is entirely by research.

POSTGRADUATE SUBJECTS

MAP161 Mathematics CE (A)
MAP162 Mathematics CE (B)
MAP51 Real Analysis
MAP52 Linear Algebra
MAP53 Operations Research
MAP54 Probability and Statistics
MAP55 Significant Aspects of Computer Science
MAP56 Graph Theory and Applications
MAP57 Special Functions and Methods of Mathematical Physics
MAP58 Numerical Methods
MAP59 Mechanics and Fluid Dynamics
MAP60 Object Oriented Programming
MAP61 Data Communications and Networking
MAP62 Computer Programming
MAP63 Operating Systems
MAP64 Database Development
MAP65 Software Engineering
MAP66 Artificial Intelligence and Expert Systems
MAP67 Analysis of Algorithms
MAP68 Systems Programming with C++
MAP69 User Interface Design
MAP70 Real Time Programming
MAP71 Complex Analysis
MAP72 Algebraic Structures
MAP73 Number Theory
MAP74 Transportation and Network Flow Problems

POSTGRADUATE DIPLOMA IN COMPUTER SCIENCE

Program Outcomes (POs)

On completion of the program, the graduates should be able to:

1. Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.
2. Do research, and critically analyse, through review and analysis of current research literature, and solve complex problems using various tools.
3. Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
4. Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.

5. Develop and utilize advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.

Entry Requirements

Before starting the Post Graduate Diploma in Computer Science students should have a basic knowledge and experience with a modern micro-computer operating system, computer architecture, logic, algorithms and their coding in a higher-level language, and standard computer packages. Subjects for the Diploma include:

MAP60 Object Oriented Programming
MAP61 Data Communications and Networking
MAP62 Computer Programming
MAP63 Operating Systems
MAP64 Database Development
MAP65 Software Engineering
MAP66 Artificial Intelligence and Expert Systems
MAP67 Analysis of Algorithms
MAP68 Systems Programming with C++
MAP69 User Interface Design
MAP70 Real Time Programming

POSTGRADUATE DIPLOMA IN ENGINEERING MATHEMATICS

Program Outcomes (POs)

On completion of the program, the graduates should be able to:

1. Solve some problems using the methods taught
2. Assimilate complex mathematical ideas and arguments
3. Develop abstract mathematical thinking
4. Develop mathematical intuition.
5. Assimilate and communicate detailed technical arguments.
6. Apply skills learnt to problems in engineering and mathematics.
7. Develop problem-solving skills and apply them independently to problems in pure and applied mathematics
8. Communicate effectively in writing about the subject
9. Improve your own learning and performance.

Entry Requirements

Candidates are normally expected to be graduates in Mathematics, Engineering or Science with good performance in mathematics. Subjects for the Diploma include:

MAP51 Real Analysis (Core subject)
MAP52 Linear Algebra (Core subject)
MAP53 Operations Research
MAP54 Probability and Statistics (Core subject)
MAP55 Significant Aspects of Computer Science
MAP56 Graph Theory and Applications
MAP57 Special Functions and Methods of Mathematical Physics
MAP58 Numerical Methods
MAP59 Mechanics and Fluid Dynamics.

POSTGRADUATE DIPLOMA IN MATHEMATICS

Entry Requirements

Candidates are normally expected to have obtained a first degree with mathematics as a major component. Subjects for the Diploma include:

MAP 161: MATHEMATICS CE (A)
MAP 162: MATHEMATICS CE (B)
MAP51 Real Analysis (Core Subject)
MAP52 Linear Algebra (Core Subject)
MAP53 Operations Research
MAP56 Graph Theory and Applications
MAP71 Complex Analysis (Core Subject)
MAP72 Algebraic Structures (Core Subject)
MAP73 Number Theory
MAP74 Transportation and Network Flow Problems

SUBJECT DETAILS

MAP 161: MATHEMATICS CE (A)

Hours per week: 2 (2 Lectures)

Prerequisite: MA 335

Learning Outcomes

1. Derive equations of planes, tangents and normal in 3D,
2. Define functions as one-to-one mappings,
3. Give an epsilon-delta definition of continuity,
4. Perform advanced differentiation and integration,
5. Find Taylor series of functions,
6. Test series for convergence,
7. Perform partial differentiation,
8. Differentiate and integrate numerically,
9. Solve 1st and 2nd order ordinary differential equations with constant coefficients.

Syllabus

Co-ordinate Geometry: simple co-ordinate systems,

planes, tangents, normalize, curve sketching.
Calculus: functions, limits, continuity, advanced differentiation and applications, implicit functions, mean value theorem, l'Hopital's rule, series, convergence tests, Taylor series.
Partial differentiation and applications, integration by parts, substitution, partial fractions and applications. Simple numerical differentiation and integration, Trapezoidal Rule, Simpson Rule, Euler Rule. Ordinary differential equations, formulation from physical problems, first-order and second-order constant coefficient equations, numerical methods.

Textbook
Spencer A.J.M. et al, Engineering Mathematics, Vol.1 (Van Nostrand-Reinhold, 1977).

Assessment
Continuous Assessment - 50%,
Written examination - 50% (1x3 hrs).

MAP 162: MATHEMATICS CE (B)

Hours per week: 2 (2 Lectures)

Prerequisite: MAP 161

Learning Outcomes
1. Solve sets of linear equations using Gauss methods with error and conditioning
2. Manipulate matrices and determine eigen-values and eigen-vectors,
3. Understand complex numbers and their applications to engineering; use of de Moivre's theorem,
4. Find roots of algebraic equations,
5. Use numerical methods to solve problems in one and two variables,
6. Perform descriptive statistics for the centre and spread of data, t- and other statistical tests, correlation and regression.
7. Solve probability problems using Binomial, Poisson and Normal distributions.

Syllabus
Algebra: Sets of linear equations and matrices, matrix manipulation, determinants, linear depend-ence, consistency and solution of simultaneous equations, Gauss elimination, pivoting. Eigen-value problem. Vector algebra, with applications to geometry. Complex numbers, de Moivre's theorem. Roots of algebraic equations, Remainder theorem, basic interaction, Newton-Raphson, secant methods. Finite differences and interpolation. Numerical methods for differential equations.
Statistics: Classification of data, continuous, and discrete variates, histograms, etc. Mode, median, mean, variance/standard deviation. Statistical tests, correlation, regression.
Probability: Introduction to Binomial, Poisson and Normal distributions and their applications in engineering situations.

Textbook
Spencer, A.J.M. et al, Engineering Mathematics, Vol.1 (Van Nostrand-Reinhold, 1977).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 51: REAL ANALYSIS

Hours per week: 4 (4 Lectures)

Learning Outcomes
1. Apply the knowledge of limits to continuity, differential calculus and Integral calculus
2. Determine convergence of Infinite series and infinite integrals.
3. Evaluate line, surface and volume integrals,
4. Evaluate scalar and vector products; gradient, divergence and curl of vectors. Physical applications.
5. Apply the theorems of Gauss, Green, and Stokes to differential geometry, vector calculus and problems in mathematical physics,
6. Use Taylor's theorem with remainder term to solve problems in functions several variables including analytic solutions of partial differential equations.

Syllabus
Countability of rational and real numbers, quadratic surds, The continuum, the subsets of real numbers. Definition of a limit, applications, tests for convergence of infinite series. Applications to series solutions of differential equations.
Limits of functions of a continuous variable, continuous and discontinuous functions, Heine-Borel theorem. Continuous functions of several variables.
Differential calculus, general theorems concerning derivatives, Rolle's theorem, the mean value theorem.
Integral Calculus, general theorems concerning integration, Areas and lengths of plane curves,

definite integrals.
Differentiation of functions of several variable, small increment problems, the mean value theorem for two variables. Taylor's theorem for several variables including remainder, application to maxima and minima.
Infinite integrals, absolutely and conditionally convergent infinite integrals. Infinite products: applications and convergence.
Definition, evaluation and transformations of multiple integrals, curves and arc length, surfaces and surface area; Use of Cartesian, spherical and cylindrical co-ordinates, multiple integration of vector functions. Integrals over curves and surfaces, differential forms, vector analysis, theorems of Green, Gauss and Stokes.
Idea of partial differential equations, total derivative, analytic solutions.

Textbook
Buck R.C., Advanced Calculus (McGraw Hill, 1980).
Spencer A.J.M. et al, Engineering Mathematics, Vol.1 (Van Nostrand-Reinhold, 1977).

Assessment
Continuous Assessment - 40%
Written Examination - 60% (1x3hrs).

MAP 52: LINEAR ALGEBRA

Hours per week: 4 (4 Lectures)

Learning Outcomes
1. Perform standard vector algebra and find inner products,
2. Determine whether a given set of vectors is linearly independent.
3. Find eigen-values and eigen-vectors and apply them to the solution of problems involving differential equations and matrices,
4. Find the matrix associated with a linear transformation.
5. Find a transition matrix with a change of basis,
6. Construct an orthonormal basis for an n-dimensional inner product space.

Syllabus
Review of Matrix Algebra and determinants.
Vector Spaces: Fields, vector spaces, linear dependence, linear independence, basis, dimension, vector norms and inner products.
Linear Transformations: definition, the matrix of a linear transformation, transition matrix and change of basis.
The eigen-value Problem: eigen-values and eigen-vectors, Gram-Schmidt Orthogononalization process, Jordan's canonical form.
Applications chosen from the following plane geometry, equilibrium of rigid bodies, graph theory, theory of games, Markov chains, Leontiff economic models, forestry management, and computer graphics.

Textbook
Anton, H. and Rorres, C., Elementary Linear Algebra, 6th ed (Wiley, 1991).

Reference
Spencer A.J.M. et al, Engineering Mathematics, Vol.1 (Van Nostrand-Reinhold, 1977).

Assessment
Continuous Assessment - 40%
Written Examination - 60% (1x3 hrs)

MAP 53: OPERATIONS RESEARCH

Hours per week: 4 (4 Lectures)

Learning Outcomes
1. Solve single non-linear equations and linear and non-linear systems of equations,
2. Formulate and solve linear and integer programming problems,
3. Determine the minimiser of non-linear multivariate functions both with and without constraints,
4. Simulate both simple and multiple server queues and apply performance measures.
5. Model practical problems using computer applications.

Syllabus
Simple iteration: Secant and Newton-Raphson methods, convergence using the contraction mapping theorem. Acceleration methods, ill- conditioning and induced instability. Systems of linear and non-linear equations, LU decom-position. Vector and Matrix norms. Iterative refinement. Ill-conditioning, induced instability. Direct and iterative methods to be analysed for stability.
Linear and integer programming: simplex method, duality, phase 1- phase 2 methods, sensitivity analysis and economic interpretation of results. Branch and Bound method and applications to scheduling, mining and small business problems. Karmarkar's algorithm.

Optimisation: minimising a function of several variables, search methods (grid, golden section, quadratic) alternating variables, steepest descent. Sensitivity analysis, Newton-Raphson, Davidon-Fletcher-Powell and other quasi- Newton methods.
Minimisation with one or more constraints either inequality of equality constraints. Applications to pipe laying and marine populations.
Simulation: pseudo-random numbers, use of inverse cumulative distribution to sample from a probability distribution. Simple and multiple queues and their simulation using the language SIMIAN; simulation experiments - planning and performing these in relation to specific situations and producing recommendations based on the simulation's results. Performance measures.
The subject will be supported by computer packages in each area. No direct knowledge of programming is needed. The packages run under the GEM environment.

Reference
M371: Computational Mathematics (Open University, 1988).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3hrs).

MAP 54: PROBABILITY AND STATISTICS

Hours per week: 4 (4 Lectures)

Learning Outcomes
1. Use the terms: experiment, outcome, event, relative frequency, probability, independent experiments, conditional probability, and random variable,
2. Calculate probabilities associated with experiments with discrete and continuous outcomes,
3. Construct discrete and continuous probability distributions, and cumulative probability distributions,
4. Derive and use the Binomial, Poisson and Normal distributions, and be able to calculate the moments of these distributions,
5. Use descriptive statistics, and graphical and tabular presentation of data, effectively apply tests of significance for single populations,
6. Apply tests of significance for the difference between means of two or more populations using t-tests and analysis of variance,
7. Construct contingency tables, and perform tests of independence and goodness of fit,
8. Calculate correlation coefficients and linear regression line formulas, and perform tests of hypothesis on them.

Syllabus
Probability: Experiments, outcomes, events, relative frequencies, independent experiments, conditional probability, random variables, discrete and continuous probability distributions, cumu-lative probability distributions, Binomial, Poisson and Normal distributions, moments of distri-butions.
Statistics: Revision of descriptive statistics and graphical presentation of data. Point estimates for mean and standard deviation of Normal populations, tests of significance, the Student's t and Chi-squared distributions, interval estimates of mean and standard deviation, the F-distribution and test, comparison of variances, contingency tables and tests of goodness of fit, analysis of variance, correlation and linear regression. Some relevant applications: Analysis of experiments; Latin squares, comparison of treatments. Survey design, sampling and analysis.

Reference
Miller I. and Freund J.E., Probability and Statistics for Engineers and Scientists (Prentice-Hall, 1994).
Walpole R.E. and Myers R.H., Probability and Statistics for Engineers and Scientists, 5th ed (Macmillan, 1993).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 55: SIGNIFICANT ASPECTS OF COMPUTER SCIENCE

Hours per week: 4 (3 Lectures + 1 Tutorial)

Prerequisite
Working knowledge of a high-level programming language.

Learning Outcomes
1. Use the terminology and basic operating principles of a central processor,
2. Describe how the central processor communicates with peripheral equipment,
3. Demonstrate an understanding of the role of the Operating System,
4. Create algorithms and write programs using a

modern programming style,
5. Develop data structures and use them in programs,
6. Write macros to operate inside an applications program,
7. Demonstrate an understanding of the basics of data base design and development.

Syllabus

Processor architecture: Bits, bytes, words, computer logic, control, memory. Machine code, assembly code, high level languages, 4th generation languages.
Peripheral Equipment: Input and output devices, addresses, interrupts. Fetch-execute cycle.
Operating system: File organisation, single/multi user systems, single/multi tasking.
Program design: Top down design, structure, modularity, scope of variables.
Data structures: Pointers, arrays, strings, lists and operations on them.
Data bases: Flat files and relational databases. Theory of data base design.
Additional topics: Macro programming. Expert systems. Computability.

References

Date C.J., An Introduction to Database Systems, 5th ed (Addison Wesley, 1991).
Stubbs D.F. and Webre, N.W., Data Structures with Abstract Data Types and Pascal (Brooks-Cole, 1985).
Tanenbaum A.S., A structured Computer Organisation (Prentice Hall, 1990).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 56: GRAPH THEORY AND APPLICATIONS

Hours per week: *4* (4 Lectures)

Prerequisite: MAP 52

Learning Outcomes

1. Recognize and model real-life problems using Graph Theory,
2. Select, design and use appropriate graph algorithms to solve the problems so modeled.

Syllabus

Graphs and sub graphs, the graph isomorphism problem, graph representation, trees, bipartite graphs.
Connectivity, Cayle's Formula, The Shortest Path problem, The Connector Problem, Construction of Reliable Communication Networks.
Eulerian Graphs, Hamilton Cycles, The Chinese Postman Problem, The Travelling Salesman Problem.
Matching edge-colourings, The Personnel Assignment Problem, Vizing's Theorem, The Timetabling Problem.
Independent sets, cliques, chromatic number, Brook's Theorem.
Planar graphs, Euler's Formula, Kuratowski's Theorem, The Four Colour Theorem.
Digraphs, di-connectivity, Networks, The Maximum Flow Problem, The Max-Flow Min-Cut Theorem, Minimum Cost Flows.

Textbook

Bondy, J. A. and Murty U.R.S., Graph Theory With Applications (North Holland, 1976).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 57: SPECIAL FUNCTIONS AND METHODS OF MATHEMATICAL PHYSICS

Hours per week: 4 (4 Lectures)

Prerequisite: *MAP 74*

Learning Outcomes

1. Use methods of mathematical physics to solve ordinary and partial differential equations,
2. Use and manipulate special functions of mathematical physics,
3. Use orthogonal expansions to solve differential equations.

Syllabus

Fourier Series and convergence.
Laplace and Fourier transforms, inversion theorem. Dirac delta function. Convolution theorem. Applications to problems in Mathematical Physics. Idea of Asymptotic expansion; Contour Integral solutions of differential equations. Method of steepest descents and stationary phase.
Solutions of Differential Equations: Series solutions

methods. Frobenius case. Bessel function and Legendre functions. Integral forms of these functions. Hyper geometric functions: relations between different types. Solution of differential equations in terms of singularities, regular and irregular singularities. P-scheme.
Partial Differential Equations: Laplace and Wave equation; solutions in terms of cylindrical and polar coordinates.
Applications to problems in heat transfer, waves (on cylinders), potential theory.
Idea of an orthogonal set of functions, expansion in terms of orthonormal functions. Use to solve differential equations.

Textbook
Carrier F. et. al, Functions of a Complex Variable (Mcgraw Hill 1966)

Assessment
Continuous Assessment - 50%
Written examination - 50% (1x3 hrs).

MAP 58: NUMERICAL METHODS

Hours per week: *4* (4 Lectures)

Prerequisite: *MAP 51*

Learning Outcomes
1. Solve non-linear equations and systems of equations,
2. Use numerical methods for approximation and integration,
3. Solve ordinary and partial differential equations by numerical methods,
4. Estimate errors and assess well-and ill-conditioning.

Syllabus
Roots of transcendental and nonlinear equations. Systems of non- linear equations.
Approximation methods; Lagrange, Splines, Chebyshev, minimax. Integration: Newton-Cotes formulae, Gaussian Quadrature, Chebyshev. Adaptive integration.
Matrix methods for eigen-values and eigen-vectors: Power method with shifting and inverse methods. QR methods. Householder transforma-tion.
Differential Equations: predictor corrector methods, Runge-Kutta methods, global and local errors and error propagation. Adams methods.
Partial Differential Equations: five point and nine point formulae for Laplace and Poisson type equations. Crank-Nicholson and other finite difference methods. Solution of practical problems in heat flow, electrostatics and fluid flow problems.
Idea of finite element methods of solution for elliptic and parabolic equations.

Textbook
Curtis G.F. and Wheatley P.O., Applied Numerical Analysis, 5th ed. (Addison Wesley, 1994).

Reference
Atkinson, K.E., An Introduction to Numerical Analysis (Wiley, 1978).

Assessment
Continuous Assessment - 50%,
Written Examination - 50% (1x3 hrs).

MAP 59: MECHANICS AND FLUID DYNAMICS

Hours per week: *4* (4 Lectures)

Learning Outcomes
1. Apply the laws of motion to particles and rigid bodies,
2. Calculate the fluid pressure on bodies inside a liquid,
3. Represent simple flows in terms of sources, doublets, vortices and uniform flows,
4. Apply Bernoulli's and Navier -Stokes equations in practical situations,
5. Use dimensional analysis.

Syllabus
Mechanics: Statics: Definitions, units, equilibrium conditions, friction, virtual work.
Dynamics: Newton's laws of motion, Applications, principle, momentum, impulse, moment of inertia, work and energy. Rotation, general plane motion.
Hydrostatics: hydrostatic forces on plane surfaces, curved surfaces and floating bodies, manometry, pressure distribution in a liquid, centre of pressure.
Fluid properties: viscosity, compressibility, surface tension. Velocity field, continuity, pressure, density, 2-dimensional flow of incompressible, inviscid fluids, Bernoulli's equation of motion, boundary conditions, stream function, stream lines, velocity potential, Flow past solid bodies, use of uniform flow, source and doublet elements to model flows.
Flow through pipes, open channels, weirs and apertures. Vortex flows and effects of viscosity;

vorticity theorem and circulation, applications.
Navier-Stokes equations, introduction to viscous flow, special solutions of viscous flow problems. Use of dimensional analysis, Reynolds number. Compressible fluid flows, idea of lift and drag of aerofoils.
Waves: introduction to waves on strings, standing waves, D'Alembert's solution, gravity waves, waves on beaches, tsunami's.

Textbook
Patterson A., A First Course in Fluid Dynamics (C.U.P., 1982)

Reference
Robertson J.A. and Crowe, C.T., Engineering Fluid Mechanics, 2nd ed (Houghton-Mifflin, 1980).

Assessment
Continuous Assessment - 50%,
Written Examination - 50% (1x3 hrs).

MAP 60: OBJECT ORIENTED PROGRAMMING

Hours per week: *4* (3 Lectures + 1 Lab)

Prerequisite: *MAP 62*

Learning Outcomes
1. Demonstrate an understanding of the ideas of object oriented programming,
2. Develop data structures using objects and classes,
3. Design and write programs using the idea of object oriented programming,
4. Understand the object oriented software technology.

Syllabus
Object-Oriented Programming Basics: basic concepts, classes and objects, messages, methods.
Advanced issues: dynamic objects and methods, constructors and destructors, dynamic versus static objects, dynamic binding and polymorphism, exporting classes, assigning objects, arrays of objects, compound classes and objects, accessing subclasses.
Illustration of object oriented programming using classes that model objects familiar to the computer user, such as the screen, windows, the cursor. Data structures with objects: file objects, array objects, list objects, stack objects, applications of inheritance, vector and matrix objects, polynomial objects.
One of the following three examples as an illustration of advanced object oriented programming issues and data structures with objects.
Linear regression objects: linearized regression, regression classes, enhanced-precision class, linear regression class.
Electrical circuit objects: the simplest circuit, series of resistors, mixing series and parallel resistors, circuit objects.
Calculator objects: the basic calculator, the scientific calculator and financial calculator objects.

Textbook
Bar-David T., Object Oriented Design for C++ (Prentice-Hall 1993)

References
Shammas N.C., Object-Oriented Programming With Turbo Pascal (Wiley, 1990).
Collins W.J., Data Structures: An Object-Oriented Approach (Addison-Wesley, 1992)
Ezzell B., Object-Oriented Programming in Turbo Pascal 5.5 (Addison-Wesley, 1989).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 61: DATA COMMUNICATIONS AND NETWORKING

Hours per week: *4* (4 Lectures)

Learning Outcomes
1. Specify the advantages of networking,
2. Understand the ISO Open Systems Interconnection 7 layer model,
3. Choose, set up, evaluate, and manage a local area network,
4. Use local area and Internet network services.

Syllabus
The Telephone Network principles and topologies, Exchanges, PABX. Synchronous and asynchro-nous communication modes.
Packet Switching, Packet assemble and dis-assemble.
International Standards Organisation Open Sys-tems Interconnection 7 Layer Model. Physical, Data Link, Transport, Network, Session, Presen-tation, and Application layers.
Network Security principles, Network Topologies,

Local Area Networks, Wide Area Networks.
Novell network and its services. System configuration, file transfer, users, accounts, appli-cations, integrity, e-mail.
The Internet and it services: History, gopher, TCP-IP, World Wide Web, Wide Area Information Service,

Textbook
Black U., Data Networks, 2nd ed. (Prentice-Hall, 1992).

Assessment
Continuous Assessment - 50%,
Written Examination - 50% (1x3 hrs).

MAP 62: COMPUTER PROGRAMMING

Hours per week: 4 (2 Lectures + 2 Labs)

Learning Outcomes
1. Use all of the features of standard Pascal in the solution of programming problems,
2. Understand and use recursion, abstract data structures, and access external libraries - including O.S. routines,
3. Program and run simple programs using functional (lisp), declarative (Prolog), and object oriented programming (Turbo Pascal) models.

Syllabus
Revision of basic Pascal features. Introduction to further Pascal constructs: functions, sets, and pointers.
Use of mini project to consolidate programming ideas, and provide basis for discussing the needs of "programming in the large".
Concepts of modularity: data hiding, data abstraction, libraries, modular programming, and finally simple object oriented programming - implementation using Turbo Pascal units.
Implementation of abstract data structures using different implementation methods (including stacks, queues, lists and trees).
Implementation of pure functional programs using Pascal, followed by implementation of the same programs in Lisp. Implementation of simple declarative programs using Prolog.

Textbook
Buchanan W., Mastering Pascal and Delphi Programming (Macmillan, 1998).
Reference
Dale N. and Lilly S., Pascal plus data structures, 2nd ed. (Heath, 1985).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 63: OPERATING SYSTEMS

Hours per week: *4* (3 Lectures + 1 Lab)

Learning Outcomes
1. Demonstrate an understanding of operating system kernel structure,
2. Write batch files,
3. Exploit memory management,
4. Appreciate job and process scheduling,
5. Distinguish between single-user and multi-user operating system services and requirements.

Syllabus
Single and Multi-user kernel Structures, hardware software interface, instruction interpreter, job scheduling, I/O, virtual memory, memory management, paging.
Search paths and environment variables, virus protection, disk caching, memory management, high and extended memory. Script programs.
LAN operating systems: Security considerations, directory conventions, resource sharing.
Operating system shells: The Windows graphical interface, multi-tasking.
WAN: UNIX file structure, directories, processes and scheduling, shells, e-mail, writing shell scripts.

Textbook
Silberschataz A. Peterson,J. and Galvin P., Operating Systems Concepts, 5th ed (Addison-Wesley, 1991).

Reference
Dietel H.M., An Introduction to Operating System, 2nd ed. (Addison-Wesley, 1992).

Assessment
Continuous Assessment - 50%,
Written Examination - 50% (1x3 hrs).

MAP 64: DATABASE DEVELOPMENT

Hours per week: 4 (3 Lectures + 1 Lab)

Learning Outcomes

1. Identify information necessary for the application,
2. Construct Entity-Attribute Relation (EAR) models and on-line Database files,
3. Normalise an EAR model,
4. Create queries and reports on the data,
5. Design and write database programs using a database programming language, SQL.

Syllabus

What is a database? Motivation for using a database. Entities, attributes and relations between them. Converting user requirements to an EAR model. External, conceptual and internal levels of architecture. Normalising the EAR model. Data manipulation by means of SQL instructions.
Queries and reports, use of FoxPro to create and manipulate relations within a database. Other packages: Oracle, Paradox, CASE tools.
Database administration, data integrity and security, data dictionary, distributed database.

Textbook

Date C.J., An Introduction to Database Systems Vol. 1, and Vol 2, 5th ed (Addison Wesley, 1991).

Reference

Gorman J. and McDonald C., A Tutorial Introduction to FoxPro (1991).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 65: SOFTWARE ENGINEERING

Hours per week: 4 (3 Lectures + 1 Tutorial)

Prerequisite: MAP 62 or equivalent

Learning Outcomes

1. Describe the concept of software engineering, the phases of the software life cycle, and the different tasks that are carried out during a software project,
2. Use software engineering techniques to develop requirements documents, write specifications, analyse and design medium-scale pieces of software,
3. Demonstrate skill in the use of software tools to support the different stages of the software life cycle,
4. Describe different ways of achieving, verifying and testing the quality of a piece of courseware.

Syllabus

Life cycle: The stages of the software life cycle, different techniques used at each stage, and outline problems typical of each stage.
Requirements analysis: purpose, levels and approaches to analysis, prototyping, specification, practical exercises.
Types of analysis and design: The purpose of analysis and design, tree and graph notations, structured analysis and design (e.g. SSADM, Yourdon), object oriented analysis and design (Coad and Yourdon), data driven analysis and design (Jackson). Use of case studies to support understanding and application of these techniques. Discussion of software tools to support analysis and design.
Implementation, testing and maintenance: Modularity, coupling, cohesion, data abstraction, procedural abstraction. Testing techniques and strategies. Practical exercises to test a large system. Management of maintenance projects.
Project management: purpose of project management, estimating techniques, monitoring techniques, human resource issues, quality assurance, and quality control. Use of project management software.

Textbook

Pressman R., Software Engineering: A practitioner's approach (1992).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 66: ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Hours per week: *4* (3 Lectures + 1 Lab)

Prerequisite: *MAP 62*

Learning Outcomes

1. Decide on the suitability of a KBS solution for a given problem,
2. Design knowledge representations and an inference engine for a given task,

3. Implement a knowledge-based solution in a shell,
4. Discuss AI techniques and their implementation using Prolog,
5. Describe typical AI applications and the potential of AI in the future.

Syllabus

Overview: What is knowledge? What is AI? Scope and limitations of knowledge-based techniques. Life cycle of KBS.
Knowledge Acquisition: Observation, interviews, use of protocols, selection of problems, expert program solutions, verification. Problems in knowledge acquisition.
Knowledge Representation: Decision trees, rules, semantic nets, frames, uncertainty, fuzzy logic, constraints, meta rules.
Search and Inferencing Techniques: Forward and backward chaining, tree and graph searching (simple searches, hill climbing, means end), constraints, case-based reasoning, machine learning.
Implementation: Use of a rule-based shell. Examination of the pros and cons of Prolog and Lisp, KRLs. Use of Prolog.
Applications: Examples will be taken from games, education, design support, customer support, medicine, geology, equipment configuration will be used to demonstrate search, classification, intelligent checklists, decision making/advice and problem solving. The future of KBS.

Textbook

Turban E., Expert Systems and Applied Artificial Intelligence (Macmillan, 1992).

Reference

Ginsberg M., Essentials of AI (Morgan Kaufmann, 1993).
Jackson P. Introduction to Expert Systems (Addison Wesley ,1991).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 67: ANALYSIS OF ALGORITHMS

Hours per week: *4 (*4 Lectures)

Prerequisite: *MA 463 or equivalent*

Learning Outcomes

1. Distinguish polynomial time from exponential time algorithms,
2. Bound the complexities of their own algorithms,
3. Appreciate the complexity classes P, NP, co-NP, NP-complete and the significance of the P = NP question.

Syllabus

Decision problems, Languages and Turing machines. Time and space complexity of algorithms, the classes P and NP, polynomial transformations, NP-completeness.
Proving NP-completeness, standard NP-complete problems.
Complements of NP-complete problems, the class co-NP, the NP = co-NP question.
Coping with NP-completeness, performance guarantees for approximation algorithms.

Textbook

J. van Leeuwen (Ed.), Handbook of Theoretical Computer Science, Vol. A, Algorithms and Complexity, (Elsevier, Amsterdam, 1990).

Reference

Aho A.V. et al, The Design and Analysis of Computer Algorithms (AddisonWesley, 1974).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 68: SYSTEMS PROGRAMMING WITH C++

*Hours per week: 4 (*2 Lectures + 2 Labs)

Prerequisite: *MAP 62*

Learning Outcomes

1. Write C++ programs incorporating functions and pointers,
2. Define and incorporate objects, private and public data and functions into an object oriented program,
3. Write shell scripts

Syllabus

C Programming: sequence, selection, iteration. Bit-wise operators, arrays, structures, pointers. Functions. Files. Libraries.
C++: Enhancements to C, Streams, Objects, Public and Private data. Public and Private member functions. Inheritance. Reusability and libraries.

Scripts: UNIX C shell and Shell scripts.

Textbook
Nagler E., Programming in C++ (West, 1993).

Reference
McDonald C., Introduction to C Programming (Unitech, 1994).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 69: USER INTERFACE DESIGN

Hours per week: 4 (2 Lectures + 2 Labs)

Prerequisite: MAP 62

Learning Outcomes
1. Explain the problems of developing an effective user interface,
2. Analyze a problem for user interface requirements,
3. Describe the different development methodologies used in human computer interface design,
4. Apply user interface design techniques to a range of sample problems,
5. Test and assess a user interface for usability,
6. Use a prototyping tool.

Syllabus
Psychological characteristics of users, types of user-computer interaction, interface models (analogies and metaphors), types of usability problem.
User population analysis, data flow analysis, data modelling, task analysis, context analysis.
User participatory design. Iterative development methods, evolutionary developments, prototyping, brainstorming. User support mechanisms (on-line help, documentation, etc).
Usability testing: timing, participants, metrics, checklists. Objective testing versus comparative testing.
Guidelines and standards for screen design, menus, dialogue box design etc.
Implementation: Use of a suitable prototyping tool such as Visual Basic, Toolbook, Macromind Director, or Authorware Professional.

Textbook
Cox K. and Walker D., User Interface Design, 2nd ed (Prentice-Hall, 1993).

Reference
Preece J. et al, Human Computer Interaction (Addison-Wesley, 1994).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 70: REAL TIME PROGRAMMING

Hours per week: *4* (3 Lectures + 1 Lab)

Prerequisite: *MAP 68*

Learning Outcomes
1. Explain the characteristics of real time systems,
2. Specify the requirement of a real time system,
3. Design a real time system,
4. Use concurrency classical solutions to solve data and resource sharing problems,
5. Write device driver software.

Syllabus
Real Time System attributes and issues, embedded systems, process control, reliability, verification, timing constraints, areas of application.
Design activities, Yourdon Systems Design Method for Real Time Systems: Concurrency and resourcing, Mutual exclusion, semaphores, monitors.
Device drivers, interrupts and polling.

Textbook
Axford T., Concurrent Programming (Wiley, 1989).

Reference
Goldsmith S., Real Time Systems Deveopment (Prentice-Hall, 1993).

Assessment
Continuous Examination - 50%
Written Examination - 50% (1x3 hrs)

MAP 71: COMPLEX ANALYSIS

Hours per week: 4 (4 Lectures)

Prerequisite: MAP 51

Learning Outcomes
1. Apply the concepts of limits and convergence to

complex sequences. Perform tests, to determine convergence of infinite series,
2. Determine whether a complex function is differentiable and make use of analytic functions and their properties,
3. Use the theory of Riemann Integration to evaluate integrals of functions of a complex variable,
4. Represent integral and meromorphic functions as power series using Taylor's theorem and Laurent's theorem,
5. Apply the theory of residues to evaluate various complex integrals,
6. Construct integral functions with given zeroes,
7. Manipulate some important complex functions; Gamma and Elliptic functions.

Syllabus

Complex Numbers, Basic operations, Fundamental ideas of complex analysis, limits and convergence of complex sequences, Cauchy's principle of convergence, double sequences, double series and absolute convergence of double series.

Continuity and uniform continuity, differentiability of functions of a complex variable, analytic functions, Cauchy-Riemann equations, necessary and sufficient conditions for regular analytic functions.

Conformal mapping and homographic transformations, elementary functions and their Riemann surfaces.

Integral representations of a regular function, Fundamental integral theorem of Cauchy, regularity of continuous functions in a simply connected domain, Formula of Newton and Leibnitz for regular functions, Cauchy's Integral formula, Properties of regular functions. Applications to harmonic functions. Dirichlet's first boundary value problem.

Representations of regular functions by series, Taylor and Laurent series, isolated and removable singularities, essential singularities, behaviour at infinity.

Integral functions, theory of residues and its applications.

Gamma functions, Inverse Laplace transforms and applications, Jacob's Elliptic functions

Textbook

Wunsch A.D., Complex Variables With Applications, 2nd ed. (Addison-Wesley, 1994).

Reference

Ahlfors K., Complex Analysis (Van Nostrand, 1961).

Copson E.T., Theory of Functions of a Complex Variable (O.U.P., 1962).

Fuchs B.A. and Shabat B.V., Functions of a Complex Variable and their Applications, Vols.1 and 2 (1964).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 72: ALGEBRAIC STRUCTURES

Hours per week: 4 (4 Lectures)

Prerequisite: *MAP 52*

Learning Outcomes

1. Define all the algebraic structures covered in the subject, e.g. group, ring, field and module,
2. Find all substructures of a given structure, i.e., find all subgroups of a given group, find all subrings of a given ring, etc,
3. Construct all quotient structures, e.g. quotient groups and quotient rings,
4. Identify the structure, from a given set of sufficient conditions,
5. Perform factorisation in commutative rings.

Syllabus

Preliminaries: set operations and functions, partitions and equivalence relations, binary operations, the integers.

Groups: groups and subgroups, homomorphisms, Lagrange's Theorem and the Quotient set, Normal subgroups and the Quotient group, Group actions and solvable groups. Sylov theorems.

Rings: rings and subrings, homomorphisms, ideals, Quotient rings, Maximal Ideals and the Chinese Remainder Theorem, Prime Ideals, Integral Domains, and the Fraction Field.

Factorisation in Commutative Rings: Euclidean Rings and Principal Ideals, Rings, Primes and Unique Factorisation, Noetherian Domains.

Introduction to Modules. Idea of Galois theory.

Textbook

Crown G.D. et al, Abstract Algebra (Marcel Dekker, 1986).

Reference

Durbin J.R., Modern Algebra (Wiley, 1979).

Allenby R.B., Rings, Fields and Groups (Arnold, 1983).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 73: NUMBER THEORY

Hours per week: 4 (4 Lectures)

Prerequisite: MAP 51

Learning Outcomes

1. Use the fundamental theorem of divisibility of numbers as products of prime factors, infini-tude of primes, congruent numbers. Apply this to the theory of residues,
2. Apply the theory of congruences to Chinese remainder theorem, Number of roots, residual polynomials and congruences,
3. Prove the quadratic reciprocity law and apply it to integral solutions of diaphantine equa-tions,
4. Define binary quadratic forms and their equivalence, Definite and reduced forms; to represent numbers as a sum of two squares,
5. Solve problems related to integral solutions of diaphantine equations using the methods of Euler and Lagrange,
6. Define Jacobi, Legendre, and Kronecker symbols and apply them to the theory of indefinite quadratic forms.
7. Define arithmetical functions and apply them to generate Dirichlet series,
8. Represent numbers as sums of cubes and higher powers and apply this to Waring's problem and existence of G (3) and g (3),
9. Use geometry of numbers and theory of lattices for applications to Kronecker's theory,
10. Define algebraic number fields and extend the fundamental theorem of arithmetic to the ring of algebraic integers.

Syllabus

Prime numbers, Greatest common divisors, relatively prime integers, infinitude of primes, fundamental theorem of divisibility, congruent numbers, least residues, Fermat's theorem and Euler's generalisation, Euler's function, Gauss' lemma, Quadratic reciprocity law, Legendre's and Jacobi's symbols. Introduction to Diaphantine equations, equations having rational and integral solution.

Binary quadratic forms, equivalent forms, definite and reduced forms, determination of all integral and reduced forms, automorphic transformations, numbers as sums of two squares, Kronecker's symbol, positive forms, number of representation by positive forms. Discriminant and Genus of quadratic forms.

Special diaphantine equations, methods of Euler and Lagrange, Arithmetic functions f(n), m(n), s(n), d(n), t(n) Definition of Dirichlet's series, order of magnitudes of arithmetic functions.

Representation of numbers by cubes and higher powers, definition of G(3) and g(3), lower bounds for G(k) and g(k), Further problems of Dia-phantine analysis.

Geometry of numbers, theorem of Minkowski, simple applications to lattice theory in n-dimensions, arithmetic proof of Kronecker's theorem.

Theory of algebraic number fields, algebraic numbers, algebraic integers, irreducible equations, degree of an algebraic number field, ring of algebraic integers, prime ideals. Generalisation of fundamental theorem of divisibility to algebraic number fields and applications to Quadratic fields.

Textbook

Hardy G.H. and Wright E.M., An Introduction to the theory of numbers, 4th ed (O.U.P., 1959).

Reference

Zuckermann, An Introduction to the theory of numbers, 2nd ed. (Wiley, 1968).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).

MAP 74: TRANSPORTATION AND NETWORK FLOW PROBLEMS

Hours per week: 4 (4 Lectures)

Prerequisite: Degree with mathematics as a major component.

Learning Outcomes

1. Use the Network Simplex Algorithm to solve transhipment problems,
2. Use network flow theory to solve unweighted bipartite matching problems,
3. Use bipartite matching theory to solve aircraft scheduling problems,
4. Apply the Critical Path Method to solve project management problems,
5. Use the Primal Dual Algorithm to solve minimum cost flow problems,
6. Apply network flow theory to optimal project selection problems.

Syllabus

Maximum Flow Problems: Feasible flows, Cuts in networks, Flow augmenting paths.

Proof of the Max-flow Min- cut Theorem, Dinic's Algorithm. Applications to project selection and to job scheduling.
The Transportation and Transhipment Problems: An economic motivation and an algebraic description of the Network simplex Method, Decomposition into sub problems, cycling in the Network Simplex method and its prevention by Cunningham's Method, Applications to the scheduling of production and inventory.
Minimum Cost Flows: A linear programming formulation, The Shortest Path, Assignment and Transportation problems as special cases of the Minimum Cost Flow Problem, The Primal Dual algorithm for the Minimum Cost Flow Problem.
Activity Digraphs, the Critical Path Method (CPM and PERT) in project management.

Textbook

Taha H.A., Operations Research, 4th ed (MacMillan, 1987).

Reference

Lawler E.L., Combinatorial Optimisation: Networks and Matroids (Holt, Rinehart and Winston, 1976).
Papadmitriou C.H. and Steiglitz K., Combinatorial Optimisation: Algorithms and Complexity (Prentice Hall, 1982).

Assessment

Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)

DEPARTMENT OF MECHANICAL ENGINEERING

MASTER OF ENGINEERING (M. Eng) IN MECHANICAL ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

Head of Department
Shoeb A. Syed., Ph.D., M.S., (Wichita State University (WSU), USA), B,Tech., (JNTU), India), AIAA member, ASME member.

Deputy Head of Department
N'Drelan. B. J., MEng. (ITB, Indonesia), BEng (QUT, Aust.), BEng (Mech) PNGUoT.

Professors
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Associate Professors
Muduli, K., Ph.D. (Industrial Engineering) Indian Institute of Technology Bhubaneswar, Fellow Institute of Engineers (India), SMIIIE

Wahid, S. Ph D (UNSW, Australia), CEng MIMechE (UK), CEng MEI (UK)

Senior Lecturers
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Mohamed, A., Ph.D., MSc., BSc. (Mech), University of Minotoba, Canada. Postdoctoral (Faculty of Medicine Health Science Center, Winnipeg, Canada), Associate Research and Instructor (Memorial University, St. John's, Canada.

Lecturers
Fono-Tamo, R.S, PhD., MSc., BSc. (Mechanical Engineering), OAU, Ile-ife, COREN, IAENG, SAIMechE

Ales, S. K., MSc (Shenyang Aerospace University - China), MTech (Mech.) PNGUoT, BEng (Mech.) PNGUoT.

Principal Technical Instructors
N'Drelan. B. J., MEng. (ITB, Indonesia)

Staff on Study Leave
Khallahle, J. B., MSc. (UNSW), BEng (Mech.) PNGUT, MIEAust.

Laboratory Manager
Paul, K., B.Eng (Mech), PNGUoT, Laboratory training Level I-V (Western Australia, Perth).

Engineer
Kamit, J., BEng (Mech) PNGUoT, MIEPNG, USFAA ADX.

Principal Technical Officer
Kami, P. Diploma in Mech. Eng, (Lae Polytech)
Eric Eng., Air Conditioning and Refrigeration (PETT)

Senior Technical Officer
Dirua. J. BSc (Physics) UPNG

Technical Officer
Kasir, M. E., Tradesman Mechanic (PETT)

Kamuai, Z. Trade Certificate (Fitter Machinist), Certificate III Mech. Eng (APTC)

Technical Assistant
Sahumlal, P., National Certificate II in Fitting and Machining (Lae Polytech)

Peruka Jnr, M., Certificate in Fitting and Machining (Lae Polytech)

Senior Storeman
Yamang, F., Grade 12 with experience

Senior Secretary:
Kapipi, G. Certificate in Stenography

Secretary I:
Ilo, D. Basic Secretarial Training

MASTER OF ENGINEERING IN MECHANICAL ENGINEERING

INTRODUCTION

The Department of Mechanical Engineering offers courses leading to Bachelor of Engineering, Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) in Mechanical Engineering. The department shares the view with others that there is a need to develop postgraduate training facilities in Mechanical Engineering to meet the manpower requirements of industries, government departments and academic institutions. This postgraduate course, that combines both formal lectures and self-motivated research, aims to meet the present need. The Department has a highly qualified and enthusiastic team of academics with proven track record of research performance. This would be an asset to efficiently offer the proposed course in a very professional way. The research programs of the Department are aligned with the PNGUoT Corporate Plan 2019-2023 and the PNG Vision 2050 in achieving their objectives towards nation building. The Department is committed to produce highly skilled and qualified manpower for the various sectors of PNG as well as of the Pacific Island countries. The Department is also in touch and collaboration with the industries through the "Departmental Industrial Advisory Committee" to enrich the curricula.

The Syllabus of the MEng (Mech) is revised and updated to meet the needs of the industry as well as to bring the standard to at par to the overseas universities. In order to facilitate greater participation of practising engineers in industries and government departments, the course has been structured to have built-inflexibility.

RATIONALE

Department of Mechanical Engineering, PNG University of Technology, currently, offers Master of Technology (MTech) in Mechanical Engineering. Master of Technology is a broader term that may include disciplines, such as sciences and information technology, etc. However, Mechanical Engineering wants to focus only on engineering disciplines. Moreover, the proposed MEng (Mech) is in uniformity with most of the overseas institutions' degree awarding systems. The proposed MEng

(Mech) shall be in line with the Bachelor degree that recently been renamed by the PNG University of Technology authority as BEng (Mech) from Bachelor of Engineering Mechanical Engineering. Additionally, the increased number of subjects and more closely monitored research in MEng (Mech) will also enable students to develop problem solving skills and will help them in communicating the research findings to the stakeholders. Once this proposed program is approved, it would replace the current MTech in Mechanical Engineering.

PROGRAM OUTCOME

On completion of the MEng (Mech) program, the students will be able to:

PO1	Use knowledge of mathematical and scientific modelling to critically analyse, develop, design, build and maintain mechanical engineering systems.
PO2	Develop the experimental methodologies.
PO3	Draw well informed conclusions through the application of research-based knowledge and methods such as design of experiments, results, analysis and data interpretation.
PO4	Effectively communicate scientific and engineering concepts in a multi-disciplinary and multi team environment.
PO5	Perform professionally and ethically, with an appreciation of the values of lifelong learning, appreciate the value of social well-being and environmental issues of all engineering activities.
PO6	Develop and apply leadership, entrepreneurial and negotiation skills to all engineering activities.

ENTRY REQUIREMENTS

i. Candidates with a bachelor degree in any engineering or equivalent from a recognised institution.
ii. Minimum weighted average of 65% marks in a Bachelor program or a GPA of 2.6 out of 4.
iii. No 'Fail' in any subject of the completed Bachelor program

SUMMARY OF THE PROPOSED COURSE

The proposed MEng (Mech) degree program is a two-year full-time normal mode program of study. It offers four (4) compulsory core subjects and four (4) elective subjects, each with four (4) hours of teaching per week. The student shall satisfactorily complete four (4) core subjects and four (4) elective subjects during the first year of the studies. The whole of second year shall be reserved for research work. At the end of semester 1 and semester 2 of second year, the student shall satisfactorily present the work in the form of seminar and a panel of academics shall evaluate the student's work. MEng (Mech) Thesis shall be evaluated by two external examiners.

PROGRAM SCHEDULE

YEAR 1	Contact Hours/week	Common Credit
SEMESTER 1		
Three (3) Core subjects each 4 hrs per week	*12 (12/0/0)	54
One (1) Elective Subject	4 (4/0/0)	18
SEMESTER 2		
One (1) Core Subject at 4 hrs per week	4 (4/0/0)	18
Three (3) Elective Subjects at 4 hrs per week	12 (12/0/0)	54
DISSERTATION	4 (0/0/4)	6
YEAR 2		
SEMESTER 1		
DISSERTATION	20 (0/0/20)	30
SEMESTER 2		
DISSERTATION	20 (0/0/20)	30

*Lecture / Tutorial / Project

SCHEDULE OF SUBJECTS

Name of Subjects	Semester
MM 501: Advanced Engineering Mathematics I (Core)	I
MM 502: Advance Engineering Mathematics II	II
MM 503: Numerical Methods (Core)	I
MM 504: Research Methodology & Computation (Core)	I
MM 505: Dissertation	I & II
ELECTIVE SUBJECTS [SUBJECT TO AVAILABILITY OF RESOURDESS]	
GROUP- A: ELECTIVE SUBJECTS	
MM 510: Advance Machine Design	I or II
MM 511: Materials Handling System	I or II
MM512: Computer Aided Design	I or II
MM513: Finite Element Method	I or II
MM514: Advanced Vibration	I or II
MM515: Noise Control Engineering	I or II
GROUP.B: ELECTIVE SUBJECTS	I or II
MM 520: Computer Integrated Manufacturing	I or II
MM 521: Conventional Manufacturing	I or II
MM 522: Robotics in Manufacturing	I or II
MM 523: Just-in-Time Systems	I or II
MM 524: Advanced Quality Control	I or II
MM 525: Planned Preventive Maintenance	I or II
GROUP.C: ELECTIVE SUBJECTS	

MM 530: Internal Combustion Engines	I or II
MM 531: Gas Turbines	I or II
MM 532: Hydraulic Machines	I or II
MM 533: Advanced Heat Transfer	I or II
MM 534: Renewable Energy	I or II
MM 535: Fossil Fuels & Combustion Technology	I or II
MM 536: Refrigeration & Air-Conditioning	I or II

DETAILED SYLLABUS

MM 501: ADVANCED ENGINEERING MATHEMATICS I

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the students should be able to:

1. Master first, second and higher order differential equations and systems of ODE
2. Acquire advanced knowledge regarding series solutions of ODE: Legendre's equation and Legendre's polynomials, power series method, extended power series method, Bessel functions.
3. Acquire advanced knowledge in Laplace transform and its applications in control engineering
4. Acquire advanced knowledge in linear algebra and vector calculus
5. Acquire advanced knowledge in matrix eigenvalues problems, including the determination of eigenvalues and eigenvectors

Syllabus

Ordinary differential equations and systems of differential equations. Series solutions to ordinary differential equations. Legendre's equation and polynomials, power series and Bessel functions. Laplace transform and its applications. Vector Calculus. Matrices and matrix eigenvalues and eigenvector problems.

Textbooks

Kreyszig, Erwin - Advanced Engineering Mathematics, John Wiley, 2011

Zill, D.G. and Cullen, M., Advanced Engineering Mathematics, 3rd ed., Jones & Bartlett Publishers Inc., 2006

References

Zill, D.G., Cullen, M. - Advanced Engineering Mathematics, 6th Edition, Jones & Bartlett Publishers, 2016.

Steward, James – Calculus, Early Transcendentals, Seventh Edition, Brooks Cole, Toronto, 2012

Mauch, Sean – Advanced Mathematical Methods for Scientists and Engineers, California Institute of Technology, 2002

Anton, Howard – Calculus, Sixth Edition, John Willey and Sons, New York, 1999

Assessment

Continuous Assessment:	60%
Final Examination:	40%

MM 502: ADVANCED ENGINEERING MATHEMATICS 2

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Proficient in vector differential calculus, including: vector and scalar functions and their fields. Curves, arc length, curvature, torsion. Gradient and divergence of scalar fields. Curl of vector fields.
2. Acquire knowledge in vector integral calculus, including integral theorems. Double integrals and Green's theorem in plane. Surface integrals. Triple integrals and Gauss theorem of divergence. Stokes's theorem.
3. Acquire knowledge in Fourier analysis and partial differential equations
4. Acquire knowledge in complex analysis. Cauchy-Riemann equations. Laplace equation.
5. Acquire knowledge in complex integration. Cauchy integral theorem and Cauchy integral formula. Power series, Taylor and MacLaurin series. Residue integration. Riemann surfaces.
6. Acquire knowledge in advanced probabilities and statistics

Syllabus

Vector differential calculus. Curves, arc length, curvature, torsion. Gradient and divergence of scalar fields. Curl of vector fields. Vector integral calculus, including integral theorems. Fourier analysis and partial differential equations. Complex analysis. Cauchy-Riemann equations. Laplace equation. Complex integration. Cauchy integral theorem and Cauchy integral formula. Power series, Taylor and MacLaurin series. Residue integration. Riemann surfaces. Conformal mapping, Schwarz-Christofel transformation, Joukowski transformation. Advanced

probabilities and statistics. Probability distributions. Binomial, Poisson, hyper geometric and normal distributions

Textbook
Kreyszig, Erwin - Advanced Engineering Mathematics, John Wiley, 2011

References
Zill, D.G., Cullen, M. - Advanced Engineering Mathematics, 6th Edition, Jones & Bartlett Publishers, 2016.
Steward, James – Calculus, Early Transcendentals, Seventh Edition, Brooks Cole, Toronto, 2012
Mauch, Sean – Advanced Mathematical Methods for Scientists and Engineers, California Institute of Technology, 2002
Anton, Howard – Calculus, Sixth Edition, John Willey and Sons, New York, 1999

Assessment
Continuous Assessment: 60%
Final Examination: 40%

MM 503: NUMERICAL METHODS (4/0/0)

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes
On completion of the subject, the student should be able to:

1. Find roots of equations and polynomial equations and polynomial equations of higher order
2. Solve linear and nonlinear differential equations
3. Find eigen values, approximations of functions and their integration
4. Solve common partial differential equations
5. Interpolate polynomials

Syllabus
Roots of a function: Bisection, fixed point, Newton methods, Secant and Regula Falsi. Roots of polynomial equations.
Polynomial Interpolation: Lagrange polynomial, Neville's method, divided differences, Hermite polynomial and splines.
Numerical differentiation and Numerical Integration: Richardson's extrapolation, Trapezoidal rule and Simpson's rule, Newton-Cotes Integration Formulas, Gaussian quadrature.
Solution of linear systems of equations: Gauss elimination method, computation of matrix inverse, LU decomposition.
Eigen value problems: Power method, Householder algorithm, QR algorithm.
Approximation of Functions: Taylor polynomial, Chebyshev polynomial, least square approximation, rational approximations.
Numerical solution of ordinary differential equations: Euler algorithm, Taylor algorithms, Runge-Kutta Methods, predictor-corrector method.
Solution of Partial Differential Equations: Hyperbolic equations, parabolic equations, elliptic equations.

Textbook
Richard L. Burden and J. Douglas Faires, Numerical analysis, 10th Ed., Brooks/Cole Cengage Learning, Boston, 2015.

Reference
Chapra, S.C. and R.P. Canale, Numerical Methods for Engineers, 7th Ed, McGraw-Hill, Inc., 2015.

Assessment
Continuous assessment 60%
Written Examination 40%

MM 504: RESEARCH METHODOLOGY AND COMPUTATION

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes
On completion of the subject, the student should be able to:

1. Apply research methodology
2. Use the computer applications for use in independent study and research
3. Acquire knowledge and skills in designing experiments, simple comparative experiments, sampling and confidence Intervals
4. Acquire skills in factorial design of experiments, including fitting regression models
5. Develop knowledge and skills regarding numerical approaches in research methodology

Syllabus
Elements of an experimental test set-up. Basic instrumentation. Data acquisition system. Data

analysis. Hypothesis formulation. Designing questionnaire. Hypothesis testing. Statistical analysis and interpretation of data. Writing and presentation of technical reports. Bibliography and references. Presentation techniques to an audience.
Different types of computers: Computer types, micro-processors and their principle of operation. Different input/output devices. Different types of computer memory. Disk operating systems. High-level languages. Software. Application of computers in solving engineering problems. Computer-Aided Engineering.

Textbook
Holman, J.P., Experimental Methods for Engineers, 8th ed., McGraw-Hill, 2012.

Reference
Mitra, A., Fundamentals of Quality Control and Improvement, 4th Edition, Wiley, 2016.

Assessment
Continuous assessment 60%
Written Examination 40%

MM 505: DISSERTATION

Total Hours 44

Common Credit: 66

Learning Outcomes
On completion of the Research Project, the student should be able to:

1. Identify the main activities of a typical engineering product, process or system
2. Plan a detailed schedule of activities to complete and meet the project deadline
3. Apply the engineering principles learnt in other subjects in the development of the project work
4. Develop effective communication skills including listening, oral and written presentations and the ability to handle Q/A sessions
5. Write a dissertation on the project work

Syllabus
This course involves a project given to each student as an independent study for which lecturers will provide guidance. Topics of research project will be chosen in consultation with supervisors in areas relevant to PNG conditions. Candidates are expected to prepare objectives of the project, review the literature, propose the methodology of research, and initiate and conduct the research work required. The candidate is expected to present results of the research in the form of a dissertation.

Assessment
Continuous assessment and submission of a dissertation - 100%

MM510: ADVANCED MACHINE DESIGN (4/0/0)

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes
On completion of the subject, the student should be able to:

1. Develop analytical skills in machine element design
2. Design simple machines and components
3. Apply the fundamentals of product planning development
4. Acquire knowledge on material selection and Static Stresses on elements of machinery, finite element modelling and experimental approaches on fracture mechanics
5. Familiarize with failure theories, safety factors and reliability in machine design

Syllabus
The scope of design: fundamentals of engineering systems and systematic approach; the design process;
product planning; product specification; conceptual design; search for solutions; methods of analysis; choosing the best design; product design; reliability; design project (preferably from industry).

Textbook
Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H. Engineering Design, Springer-Verlag, 3rd Edition, 2007

Assessment
Continuous assessment 60%
Written Examination 40%

MM511: MATERIALS HANDLING SYSTEMS

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Analyse and design integrated material handling systems for automatic storage and retrieval of unit loads
2. Specify key parameters for such systems
3. Analysis on manufacturing cycle time
4. Knowledge on delays and damage
5. Promote safety and improve working conditions
6. Promote productivity

Syllabus

Analysis and design of integrated material handling systems; automatic storage and retrieval of unit loads, and identifying and establishing boundary conditions on key parameters required to specify the desired system required for equipment vendors to design appropriate hardware.

Textbooks

Roger L. Brauer, Safety and Health for Engineers Tolono, Illinois, 2nd Edition, A John Wiley & Sons, Inc, Publication.

Assessment

Continuous assessment	60%
Written Examination	40%

MM512: COMPUTER-AIDED DESIGN

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Describe the key characteristics of a feature-based, parametric solid modeler. Identify the principal components of a modern 3D CAD software user interface. Explain how different dimensioning methodologies serve different design intents. Creation of fully defined sketches.
2. Create a new part. Insert a new sketch and add sketch geometry. Establish sketch relations between pieces of geometry. Understand the state of the sketch. Creation of fully defined sketches. Use sketch tools to add fillets. Extrude the sketch into a solid.
3. Perform basic part modeling. Boss and cut extrusions. Hole wizard, fillets, basic drawings, dimension changes. Associativity between solid models and drawings.
4. Perform solid modeling for casting and forging. Feature parameter editing.
5. Create linear, circular and mirror patterns.
6. Create revolved and sweep features. Select materials for solid models and calculate physical properties of solid models: mass, center of gravity, inertial moments.
7. Create shellings and ribs. Edit for repairs and design changes. Edit part configurations.
8. Create design tables and equations. Use existing design tables to create families of parts.
9. Create bottom–up assemblies. Add mating relationships between parts in assembly. Explore mass properties and detect interference. Create exploded views. Create bills of materials for assemblies.

Syllabus

The subject introduces students to the modern approach of 3D CAD for generating and analysing solid models and assemblies on computers. The included topics address theoretical and practical aspects encountered in the creation, modification, analysis, and optimization of mechanical engineering design. Also included are topics dealing with the creation of technical drawings, generation of bills of materials.

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Textbook

Dassault Systems – SolidWorks Fundamentals, Concord, Massachusetts, United States, 2012.

Assessment

Continuous assessment	60%
Final Examination	40%

MM 513: FINITE ELEMENT METHOD

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to understand and apply:

1. Partial differential equations governing the behavior of deformable bodies.
2. Fundamental relations for linearly elastic solids and the importance of stress matrix in finite element method.
3. The finite element method. Interpolation functions. Isoperimetric elements.
4. Numerical and reduced integration. Solutions for simultaneous linear equations and stress calculations
5. Vibration modes and frequencies. Variational principles. Solution for linear eigenvalues problems. Buckling and variational principles for buckling.
6. Matrix form for heat transfer equations. Variational statement and the finite element method. Numerical solution for transient heat conduction.
7. Physical capabilities of flow simulation
8. Governing equations in CFD. Navier-Stokes equations. Conjugate heat transfer. Radiation heat transfer between solids.
9. Flows in porous media and Boundary conditions

Syllabus

Partial differential equations in governing the behavior of deformable bodies. Fundamental relations for linearly elastic solids and the importance of stress matrix in finite element method. Strain matrix and stress-strain relationships. The principle of minimum potential energy. Strain energy relationships for beams, plates and shells. The finite element method. Interpolation functions. Isoparametric elements. Numerical and reduced integration. Solutions for simultaneous linear equations and stress calculations. Vibration modes and frequencies. Variational principles. Solution for linear eigenvalues problems. Buckling and variational principles for buckling. Matrix form for heat transfer equations. Variational statement and the finite element method. Numerical solution for transient heat conduction. FEM libraries. Physical capabilities of flow simulation. Governing equations in CFD. Navier-Stokes equations. Conjugate heat transfer. Radiation heat transfer between solids. Flows in porous media. Boundary conditions. Numerical solution technique. Examples and validation problems

Textbooks

Dassault Systems – SolidWorks Simulation, Concord, Massachusetts, United States, 2012.
Reddy, J.N. - Introduction to Finite Element Method, Third Edition, McGraw-Hill, Inc., 2006.

Reference

Logan, D. L., A First Course in Finite Element Method, 6th Ed., Cengage Learning US, 2016

Assessment

Continuous assessment	60%
Final Examination	40%

MM514: ADVANCED VIBRATION

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Explain principles of mechanical vibrations.
2. Define and describe the concepts of vibration modes and natural frequencies and their measurement and estimation for multi-degree-of-freedom systems
3. Analyse mechanical vibration in random vibration, non-linear vibrations and vibration of continuous systems
4. Model free vibrations of single degree of freedom systems
5. Acquire proficiency in analysing harmonically excited vibrations
6. Recognise difficulties in modelling multiple degrees of freedom vibrations
7. Determine natural frequencies, mode shapes, vibration, measurement and analysis.

Syllabus

This course may be offered in any of the following topics depending on the requirements of attending students:

Mechanical Vibrations and Experimental Methods in Vibrations: Linear theory of

Vibrations of finite number of degrees of freedom systems via languages equations Sensors, instruments, measurements techniques data acquisition methods; data reduction methods for vibration measurement and modal analysis; applications including turbo machinery blades, vanes, gears, bearings and rotors; structures such as beams, frames and machine foundations.

Continuous systems: Introduction to continuous systems; vibration of strains, longitudinal vibration of rods, torsional vibration of rods; beam vibration, effect of rotary inertia and shear de-function; vibration of the plates.

Random vibrations: Random phenomena, defining expected value, frequency responses function, probability distribution, correlation of signals, power spectrum, power spectral density, Fourier Transform, response of single and multi-degree systems to stationary random excitations.

Nonlinear vibrations: Introduction to nonlinear vibration, exact methods of solution, approximates analytical methods, graphical methods, stability of equilibrium, numerical methods.
Vibration measurement and control common to all topics.

Textbook
Rao, S. – Mechanical Vibrations, 5th Edition, Prentice Hall, New York, 2011

References
Gans, R.- Mechanical Systems - A Unified Approach to Vibrations and Controls, Springer, 2015
Thomson, W., Dahleh, M. - Theory of Vibrations with Applications, 5th Edition, Prentice Hall, 1998

Assessment
Continuous assessment 60%
Written Examination 40%

MM515: NOISE CONTROL ENGINEERING

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes
On completion of the subject, the student should be able to:

1. Apply basic concepts of the nature of sound and noise to engineering students
2. Conduct measurements and analyses required to diagnose noise and vibration problems and develop meaningful solutions;
3. Develop and apply methods for the control of noise and vibration in most situations;
4. Know when outside consultation is required for solving complex noise and vibration control problems and how to utilize consultants effectively

Syllabus
The nature of sound; units; sound measurements; instruments; effects of noise on people; hearing loss; noise and law; near and far field noise; acoustics of rooms and enclosures, noise analysis; noise criteria; damping of panels; principles of noise control: vibration isolation, noise source identification and their relative importance, noise control procedures applicable to source, path and receiver; case studies: cooling fan, mine ventilation fan noise, duct noise, material handling impact noise, engine noise, turbine noise, jet noise; factory noise, industrial noise control programme.

Textbook
David A. Bies and Colin H. Hansen, Engineering Noise Control, Theory and Practice, 3th Edition University of Adelaide, Australia, 2003.

Reference
Lord, H.W.,et. al., Noise Control for Engineers, McGraw Hill Book Company, 1980.

Assessment
Continuous assessment 60%
Written Examination 40%

MM520: COMPUTER-INTEGRATED MANUFACTURING

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Understand the concepts of computer integrated manufacturing
2. Recognise constituent parts of CIM systems and integration of the parts to form a system
3. Achieve Advanced Understanding Regarding CNC Systems in Advanced Precision Manufacturing
4. Master Software Platforms for CNC Manufacturing, Including Tool Path Optimization of 3D CAD Models of Parts
5. Acquire Advanced Understanding Regarding Maintenance Issues in Computer Integrated Manufacturing Develop an understanding of classical and state-of-the-art production systems, control systems, management technology, cost systems, and evaluation techniques.
6. Develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.

Textbook

Kalpakjian, S. and S. Schmid, Manufacturing Engineering and Technology, 6th ed., Prentice Hall, 2010.

Assessment

Continuous assessment 60%
Written Examination 40%

MM521: CONVENTIONAL MANUFACTURING TECHNOLOGY

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Understand relevant fundamentals and real-world practices of advanced manufacturing process
2. Understand inter relationships among technical and economic factors involved
3. To acquire knowledge gain on forming processes for engineering materials
4. Develop strategies for the safe and effective utilizations of human resources materials, and manufacturing methods.

Syllabus

Powder metallurgy; forming and shaping plastics and composite materials; non-traditional machining processes - chemical machining, electrochemical machining, electrochemical grinding, electrical-discharge machining, travelling-wire electrical- discharge machining, laser-beam machining, electron-beam machining, hydrodynamic machining; economics of non-traditional machining processes; joining processes and equipment - oxyfuel gas welding, arc-welding processes, consumable and non-consumable electrodes, resistance welding processes; surface technology; competitive aspects and economics of manufacturing - selection and substitution of materials, selection of manufacturing processes, manufacturing costs and value engineering.

Textbook

Kalpakjian, S. and S. Schmid, Manufacturing Engineering and Technology, 6th ed., Prentice Hall, 2010.

Assessment

Continuous assessment 60%
Written Examination 40%

MM522: ROBOTICS IN MANUFACTURING

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Understand industrial robots
2. Understand their mechanical elements, sensory systems, and control systems and their use in manufacturing

3. Acquire advanced knowledge on impact of robots, control engineering systems and mechatronics in engineering and economy
4. Understand the relationship between software development, component design, sensor and servo system in both stationary and autonomous robots.
5. Acquire skills and experience in developing autonomous robots, including visual programming development, sensor and servo system selection and component design
6. Acquire advanced knowledge on applications of robots in industrial engineering and operations management

Syllabus

Robotic mechanical systems and their general architecture. Types of robots by function, size and application. Manipulators: robotic arms and hands. Motion generator. Parallel and SCARA robotic systems. Locomotors: Legged and wheeled robots. Swimming and flying robots. Mathematical background in robotics. Fundamentals of rigid-body mechanics. Geometry and kinetostatic of serial robots. Trajectory planning. Pick and place operations. Dynamics of serial robots. Dynamics of complex robots. Visual programming of robots.

Textbooks

Angeles, J. – Fundamentals of Robotic Mechanical Systems, Mechanical Vibrations, 3rd Edition, Springer Science, New York, 2007

James A. Rehg, Introduction to Robotics in CIM Systems, 5th edition, Upper Saddle, River, NJ: Prentice Hall, 2003.

References

Corke, P. – Robotics, Vision and Control. Fundamental Algorithms in Matlab, Springer Science, Heidelberg, Germany, 2011

B. Benhabib, Manufacturing: Design, Production, Automation and Integration, New York: Marcel Dekker, 2003.

Assessment

Continuous assessment 60%
Written Examination 40%

MM523: JUST-IN-TIME SYSTEM

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Understand the basic philosophies of JIT system
2. Gain sufficient understanding for implementation of JIT in a manufacturing industry.
3. Apply JIT principles to reduce lead time in any organization.
4. Propose methods to eliminate obstacles of JIT for any organization

Syllabus

Brief history of Just-In-Time system; definition, objectives and benefits of JIT; basic philosophies; key elements of JIT; Push and Pull Systems; Kanban; Kanban rules; inventory control under JIT; reduction of lead time, reduction of set-up time, standard operations; machine layout in JIT, multifunctional workforce, job rotation, training requirements; improvement activities; Autonomous defects control; functional management and its organization; adapting to JIT system, obstacles; future development of JIT system. Applications of Lean Approaches and Methodologies.

Textbook

Louis. R.S., Integrating Kanban with MRP II: Automating a Pull System for Enhanced JIT Inventory Management, 1st Edition, CRC Press, 2005

Reference

Monden, Y., Toyota Production System: An Integrated Approach to Just-In-Time, 4th Edition, CRC Press, 2011

Assessment

Continuous assessment 60%
Written Examination 40%

MM524: ADVANCED QUALITY CONTROL

Hours per week: 4 (4/0/0)

Common Credit: 18

Prerequisite: Knowledge of statistics.

Learning Outcomes

On completion of the subject, the student should be able to:

1. Understand both classical and advanced acceptance sampling methods
2. Gain in depth understanding of statistical process control methods
3. Understand, conduct and analyze comparative experiments
4. Understand and apply control charts for analysis of observational data
5. Design and conduct screening experiments, including graphical analysis.
6. Design, conduct and analyse complete factorial

Syllabus

Advanced methods applied to quality control. Acceptance sampling plans from the classical lot attribute plan to sophisticated multi-lot dependent plans. Classical treatments and recent developments in process control. Evaluation, design and maintenance of quality control programs.

Textbook

Montgomery D.C, Introduction to Statistically quality control, John Wiley & Sons, Inc. 7th Edition, 2015

Reference

Mitra, A., Fundamentals of Quality Control and Improvement, 4th Edition, Wiley, 2016.

Assessment

Continuous assessment 60%
Written Examination 40%

MM 525: PLANNED PREVENTIVE MAINTENANCE

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. Explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
3. Design a maintenance schedule for some maintenance activities.
4. Analyse and develop cost effective maintenance alternatives
5. Understand the use of simple instruments used for condition monitoring in industry

Syllabus

Maintenance fundamentals; systematic approach to maintenance; maintenance economics; maintenance organization; origin of maintenance problems; inspection and maintenance tools; inspection and lubrication schedules; condition monitoring; repair methods for basic machine elements; repair methods for material handling equipment; maintenance records; maintenance inventory examples of maintenance of elements and machines; maintenance planning; scheduling; manual vs computer assisted maintenance; motivation of workforce; implementation of maintenance programme.

Textbooks

Davies A., Handbook of Condition Monitoring: Techniques and Methodology, Springer, 2018
Mobley K., Maintenance Engineering Handbook, 8th Edition, McGraw Hill, 2013

References

Richard Palmer, «Maintenance Planning and Scheduling Handbook», 2013, McGraw-Hill.
Patton., J.D. Preventive Maintenance, 3rd Edition ISA-The Instrumentation, Systems, and Automation Society, 2004

Assessment

Continuous Assessment 60%
Final Examination 40%

MM530: INTERNAL COMBUSTION ENGINES

Hours per week: 4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Apply principles of relevant fields of study in basic design considerations of the system
2. Demonstrate ability to modifications to the design of some systems

4.Understand advanced concepts of the combustion process
5.Perform calculations for the design of engines and selection of equipment

Syllabus

Types and arrangements; theoretical gas cycles; combustion thermodynamics; actual gas cycles - dynamometers, fuel and air flow, exhaust gas analysis; air, fuel, and exhaust flows - pumping and scavenging work, carburetion, fuel injection, measurement techniques; combustion and emissions - auto ignition, nitrogen oxides, carbon monoxide, hydrocarbons, particulates, emission control and legal requirements; fuel technology - gasoline, diesel fuel, fuel additives; engine performance - criteria, testing, critical factors.

Textbook

Ferguson, C.R, Kirpatrick., Internal Combustion Engines: Applied Thermosciencess, 3rd Ed, 2015 , Wiley.

Assessment

Continuous assessment 60%
Final Examination 40%

MM 531: GAS TURBINES

Hours per week: 4 (4/0/0)
Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Demonstrate thorough knowledge on different types of compressors
2. Estimate performance parameters for different types of gas turbines and gas turbine arrangements
3. Demonstrate a thorough knowledge of gas turbines on power plants, air and marine transportations.
4. Demonstrable knowledge on combustion chamber
5. Demonstrate a thorough knowledge on gas turbine limitations. Selection of materials, parts and components

Syllabus

Gas turbine principles of operation. Single-shaft and multi-spool arrangements. Aircraft propulsion. Shaft power cycle (ideal). COGAS cycles and cogeneration schemes. Gas turbine cycle for aircraft propulsion: simple turbojet cycle, turbofan engine, turboprop engine, thrust augmentation. Axial and centrifugal compressors: theory, factors affecting pressure ratio, degree of reaction, compressor map and characteristic. Combustion systems: Factors affecting combustion, combustion process, combustion chamber performance. Prediction of performance of simple gas turbines. Gas turbines, components and their principles of operation. Industrial gas turbine engines.

Textbook

Cohen, H., et al, Gas Turbine Theory, Saravanamuttoo H I Rogers G F C, Cohen H, Straznicky,6th Ed. 2009, Pearson Education Ltd.

Assessment

Continuous assessment 60%
Final Examination 40%

MM532: HYDRAULIC MACHINES

Hours per week:4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Analyse the fluid flow in hydraulic machines
2. Design rotodynamic machinery and their components
3. Select pumps and turbines for industrial applications
4. Demonstrate thorough knowledge on vibration and noise and causes in hydraulic machines
5. Acquire knowledge on controls of power, pressure and flow in hydraulic machines

Syllabus

System analysis for pump selection, specific speed and modelling laws, specific speed charts; design considerations for various applications; impeller design - impeller layout, development of impeller vane; volute design, double and triple volute casing design, circular volute; design of multi-stage casing; double-suction pumps and side-suction design; pump applications - vertical pumps, wet-pit pumps, barrel-mounted pumps, slurry

pumps, pumps for chemical processes; hydraulic turbines - selection process, turbine performance prediction, fixed guide vane turbines, variable guide vane turbines; pump and turbine components - mechanical seals, bearings and lubrication; gear pumps and vane pumps; compressors - types and design considerations; vibration and noise - causes of vibration, cavitation, diagnosis of pump vibration problems; controls - constant power control, constant pressure control, constant flow control.

Textbook
Wright, T, Gerhart, P, Fluid Machinery: Application, Selection and Design, 2nd Ed. 2009, CRC Press.

Reference
Lobanoff, V.S., & Ross, R.R., Centrifugal Pumps - Design & Applications, Gulf Publishing Company, 1992.

Assessment
Continuous assessment 60%
Final Examination 40%

MM533: ADVANCED HEAT TRANSFER

Hours per week:4 (4/0/0)

Common Credit: 18

Learning Outcomes
On completion of the subject, the student should be able to:

1. Demonstrate the ability to solve heat exchanger problems
2. Solve multi-dimensional conduction problems
3. Demonstrate the ability to solve problems involving one or more modes of heat transfer
4. Make right assumptions and approximations for tackling practical situations
5. Analyse complex heat transfer problems

Syllabus
Steady-state heat conduction in one, two, and three dimensions - graphical and numerical methods; unsteady-state heat conduction - chart and numerical methods; convection - review, dimensional analysis, boundary layer analysis, Reynolds' analogy, free convection, forced convection inside tubes and over exterior surfaces; heat exchangers - types and arrangements, LMTD and effectiveness methods of analysis, fouling factors, selection; radiation - review, gas-filled enclosures, combined modes with conduction and convection; boiling heat transfer, condensing heat transfer.

Textbook
Incropera F. P., DeWitt D. P., Bergman T. L. and A. S. Lavine, Fundamentals of Heat and Mass Transfer, 8th Ed., 2017 Willie Plus

Assessment
Continuous assessment 60%
Final Examination 40%

MM534: RENEWABLE ENERGY

Hours per week:4 (4/0/0)

Common Credit: 18

Learning Outcomes
On completion of the subject, the student should be able to:

1. Discuss different types of renewable energy sources
2. Discuss the technologies for renewable energy utilisation and conversion
3. Explain the economics of renewable energy conversion devices
4. Conduct feasibility and design studies for selected renewable energy technologies
5. Discuss national and international trends and protocols

Syllabus
Range of renewable energy resources and its potential; selected technologies generally recognized as being the most feasible technically and economically, e.g., solar (both thermal and photo-voltaic), wind, hydro, tidal, waste and bio-mass; methods of harnessing and using energy from these sources, including hybrid systems; limitations of renewable energy harnessing; principles of energy conversion; storage and transfer for renewable energy systems; feasibility and design studies for selected renewable energy technologies; national and international trends.

Textbook
Jefferson W Tester, Elizabeth M Drake, Michail J Discoll, Michael W Golay, William A Peters,

Sustainable Energy: Choosing Among Options", 2nd Ed 2012, MIT Press.

References

Godfrey Boyle, Renewable Energy Power for a sustainable Future, 2004, Oxford University Press, in association with the Open University.

Dunn, P.D., Renewable Energy Sources, Conservation & Application, Peter Peregrinns Ltd, 1986.

Assessment

Continuous assessment 60%
Final Examination 40%

MM535: FOSSIL FUELS & COMBUSTION TECHNOLOGY

Hours per week:4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Discuss different types of fossil fuels and methods for their exploration and production
2. Acquire knowledge of combustion equipment
3. Apply combustion technology to combustion equipment to improve efficiency
4. Discuss limitations of solid fuels to be used on gas turbine applications and the importance of updating on latest technological developments
5. Discuss Impacts of products of combustion to the environment and its mitigation

Syllabus

Different types of fossil fuels, geographic spread of reserves, life-span, processes involved from exploration to production; grades of fuels; impurities; processes involved in refining the fuels; thermochemical reactions and combustion of fossil fuels on theoretical and practical bases; theory of combustion and brief introduction to combustion kinetics; air supply in combustion; by-products of fuel production and combustion; control of combustion processes; pulverized fuel combustion; fluidized-bed combustion; environmental control systems; particulate emissions; particulate and sulphur dioxide removal; scrubbers.

Textbook

Sarkar S, Fuels and Combustion, 3rd Ed., 2009, Universities Press, India

Reference

Fransis, W, Peters M C, Fuels and Fuel Technology, 1980, 2nd Ed., Elservier

Assessment

Continuous assessment 60%
Final Examination 40%

MM536: REFRIGERATION & AIR-CONDITIONING

Hours per week:4 (4/0/0)

Common Credit: 18

Learning Outcomes

On completion of the subject, the student should be able to:

1. Acquire knowledge on energy conservation and its incorporation in refrigeration and air conditioning industries
2. Demonstrate the ability to make right assumptions and approximations for tackling practical problems
3. Describe air conditioning and refrigeration materials and equipment
4. Demonstrate the ability to perform heat load calculations and select appropriate A/C devices
5. Demonstrate the ability to perform ducting requirements and designing a complete air conditioning and distribution systems

Syllabus

Air cycle; body comfort; psychometric chart and processes; principles of heat load estimation for air-conditioning systems; types of air-conditioning equipment; air distribution; ducts; residential and commercial air-conditioning; air-conditioning equipment; refrigerants; types of refrigeration systems; food, and growth of micro-organisms; basic principles of heat transfer; latent heat; calculation of heat load; insulation; evaporator; condenser design; compressors; charging and testing of refrigeration systems; basic refrigeration controls; electrical components.

Textbook

Australian Refrigeration and Air Conditioning Vol 1 and 2, AIRAH 2016.

References

Jones, W.P., Air-conditioning Engineering, 5thEd., 2001 Spon Press.
DA09 Air Conditioning Load Estimation, AIRAH, 1998 [AIRAH Document]

Assessment

Continuous assessment	60%
Final Examination	40%

DEPARTMENT OF SURVEYING AND LAND STUDIES

- MASTER OF SCIENCE IN REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

- MASTER OF SCIENCE IN URBAN AND REGIONAL PLANNING

DEPARTMENT OF SURVEYING AND LAND STUDIES

Head of Department & Professor

Babarinde J A., PhD Urban & Reg. Planning (Ibadan); Master of Urban & Reg. Planning (Ibadan); BSc Estate Management & Valuation (UEL, London, UK); Ontario Licensed Realtor (Toronto); Cert. Ed. (London Metropolitan, UK); C & G Numeracy Specialist (London), FRICS; FISDS, MCIP/RPP; Chartered & Registered Valuation Surveyor; Ontario Registered Professional Planner; Certified Publons Academy Peer Reviewer

Deputy Head of Department

Kari L., MSST (USQ), B. Tech. Cart. (PNGUoT)

Associate Professors

Samanta S., PhD Climatological Modelling (VU), M.Sc. Remote Sensing and GIS (VU), B.Sc Geography (VU)

Jana S K., PhD. (VU); M.Sc. (VU); B.Ed. (VU)

Senior Lecturer

Suat J., MGIS, PG Dip Map Surv. (UQ), PGDLS, B. Tech. Surv. (PNGUoT), MASPNG, MIMSSIPNG

Lecturer-II

Koloa, C., PhD Geomatics (PNGUoT); MPhil Geomatics (PNGUoT); B.Tech. GIS (PNGUoT)

Antonio W., MSIS. (UTAS), PGD Surv. Science (UTAS), PGDLS (PNGUoT), B. Tech. Cart. (PNGUoT), MIMSSIPNG (PhD Candidate)

Pai A., PhD (QUT); M.Sc. (UQ), B.Tech. Land Mgmt. (PNGUoT), Reg. Val. (PNG), MPNGIVLA

Holis S. S., M.Sc. (UTS), B. Tech. Land Studies (PNGUoT), Reg. Val. (PNG) MPNGIVLA

McVie R. A. (on study leave) MUD (QUT), B. Land Studies (PNGUoT), MPNGIVLA

Karigawa L, M.Phil. Property Studies, (PNGUoT), B. Tech. Land Mgmt. (PNGUoT), MPNGIVLA

Kari L., MSST (USQ), B. Tech. Cart. (PNGUoT)

Sekak, T., PhD Geomatics (PNGUoT), M.Phil Geomatics (PNGUoT), B. Tech. GISci. (PNGUoT)

Lecturer-I

Kapi, N. V., M.Phil Geomatics (PNGUoT), B.Tech. Surv. (PNGUoT), Candidate Registered Surveyor

Mille, J., M.Phil. Property Studies, (PNGUoT), B. Tech. Land Mgmt. (PNGUoT), PGD in Education (UOG); MPNGIVLA

Seniela, J., MPhil Property Studies (PNGUoT); B. Tech. Property Studies (PNGUoT)

Motoro, P., MPhil Property Studies (PNGUoT); B. Tech. Property Studies (PNGUoT)

Yali, G. MPhil Geomatics (PNGUoT); B. Tech. GIS (PNGUoT)

Senior Technical Instructors

-.

Technical Instructor

Honeaki H., B.Surv. (PNGUoT)

Laboratory Manager

Napitalai A. Diploma in Electronics Engg. (PNGUoT)

Principal Technical Officers

Yanabis C. B. Tech. Cart. (PNGUoT); MPhil (PNGUoT)

Buidal, E. B.Tech. Surveying (PNGUoT)

Senior Technical Officer II

Yapakae, J. Dip. Surveying (PNGUoT), Licensed Measurer

Technical *Officer I*

Karipal R., B.Tech. Surv., (PNGUoT)

Secretarial /Administrative Staff

Nasusu, C., Senior Secretary

Technical Officer I
Bonga, M., B. Tech. Surv. (PNGUoT)

Survey Stores Person
Matilda Naiawi (Temporary)

MASTER OF SCIENCE IN REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

OBJECTIVES

This beautiful country – often referred to as 'the paradise on earth' by the philanthropists – deserves a befitting management of her enormous natural resources. The sustainable development of her natural resources and eco-friendly exploitation of the resources can only be achieved by the enlightened citizens. The program aims to create the human resources that will be adept in optimal management and development of natural resources by the state-of-the-art space technology. In nutshell, this program is slated to churn out qualified professionals who, using space technology, will be instrumental in developing, managing, exploiting all sorts of natural and man- made resources in a sustainable manner in order to realize the country's mid-term and long-term development aspirations.

The discipline aims at integrating the emerging state-of-art technologies of space-borne and air- borne data acquisition - remote sensing and digital photogrammetry, digital cartography and mapping, geographic information systems, Global Positioning System (GPS) and information technology, thereby creating specialists in optimal resources management.

Moreover, the department foresees - this course could draw a substantial interest from a large section of PNGian who earnestly yearn for attaining a postgraduate degree from the ace institution of PNG. Commenced in 2013, the course has been very popular amongst the PNGians. Barring economic recession, the country is facing in recent years, the program continues to be self-sustained.

The program is being exclusively offered from this department, departmental faculties duly completed all the modules preparation and this is a full- fledged ongoing program of the department with the first batch admitted in 2013.

ENTRY REQUIREMENTS

GRADUATE DEGREE in any SCIENCE and ENGINEERING discipline from a recognized university.

RESOURCE REQUIREMENTS

The department is in possession of all the material resources, space, and human resources etc. to undertake the proposed program.

COURSE DETAILS AND SCHEDULING

The program 'Master of Science in Remote Sensing and Geographic Information System (M.Sc. in RS & GIS)' offered in DISTANCE MODE has four semesters with the session starting from November and end in December after 2 years (eg. start: Nov'13, end: Dec'15 nominally). The direct contact is proposed to be in the month of November-December compulsorily, while depending upon the situation another session of contact can be given in the month of June. The entire study modules, lectures, examinations, etc. are being conducted exclusively from the Department of Surveying and Land Studies.

Year 1: First Semester

Code	Subject	Hours per week	CCC
RGS501	Introduction to Map Projection & Field Survey	2	(2-0-0)09
RGS503	Geodesy	3	(3-0-0)13
RGS505	Aerial Photography	2	(2-0-0)09
RGS507	Photogrammetry	2	(2-0-0)09
RGS509	Concept and Foundation of Remote Sensing	3	(3-0-0)13
RGS511	Orbital Characteristics of Remote Sensing Satellites	3	(3-0-0)13
RGS513	Ground Based Observation Equipment & Study of Topographical Map	3	(3-0-0) 13
RGS515	Image Interpretation & Map Scales	2	(2-0-0)09
Total:		20	(20-0-0) 88

Second Semester

Code	Subject	Hours per week	CCC
RGS502	Image Interpretation for Earth Science and Terrain Evaluation	2	(2-0-0)09
RGS 504	Interpretation of Remote Sensing Data for Thematic Mapping	4	(4-0-0)18
RGS506	Thermal Infrared and Hyperspectral Remote Sensing	3	(3-0-0)13
RGS508	Microwave Remote Sensing	2	(2-0-0) 09
RGS510	Digital Image Processing System – Basics & Characteristics	2	(2-0-0)09
RGS512	Image Restoration & Manipulations	2	(2-0-0)09
RGS514	Multi-Image Manipulation – Information Extraction	2	(2-0-0)09
RGS516	Geo-Statistics	3	(3-0-0)13
Total:		20	(20-0-0) 89

Year 2: First Semester

Code	Subject	Hours per week	CCC
RGS601	Practical on DIP – Introduction to RS with ERDAS Imagine	4	(1-0-3) 09
RGS603	Practical on DIP – Introduction to Digital Image Processing	4	(1-0-3) 09
RGS605	Practical on DIP– Satellite Image classification, 3D modeling and mapping	4	(1-0-3) 09
RGS607	Practical on Photogrammetry, Visual Analysis of Airphoto & Satellite Image	4	(0-0-4) 06
RGS609	Components of Geographic Information System (GIS)	2	(2-0-0)09
RGS611	Data Organisation & Data Models in GIS	2	(2-0-0)09
RGS613	Data Encoding & Data Manipulation	2	(2-0-0)09
RGS615	GIS–Applications & Some Case Studies	2	(2-0-0)09
Total:		24	(11-0-13) 69

Second Semester

Code	Subject	Hours per week	CCC
RGS602	Practical on GIS - Introduction to ArcGIS Basics	4	(1-0-3) 09
RGS604	Practical on GIS – Creation of new vector coverage, d base and theme mapping	4	(1-0-3) 09
RGS606	Practical on GIS – Spatial data analysis and 3D modeling	4	(1-0-3) 09
RGS608	Application of Geoinformatics	4	(4-0-0) 18
RGS610	Dissertation	10	(2-8-0) 27
Total:		26	(9-8-9) 72

Total subjects: 29; Total CCC : 318

PROGRAM OUTCOMES (POs)

PO1: Have a sound knowledge and understanding of the use and application of geospatial technologies in solving geographic problems of various domains, e.g., environmental, natural resources, land management and administration, government, health, utilities, transport, etc.

PO2: Be competent in the foundation of Remote Sensing and GIS operations and demonstrate sound knowledge on the nature and properties of geospatial data.

PO3: Be able to choose and perform data collection for RS and GIS analyses, including GPS, satellite imagery, and handling collateral data like topographic maps, scanned photographs, etc.

PO4: Demonstrate advanced knowledge of physics of remote sensing and techniques of GIS including sensor systems, basic radiative transfer, cartographic projections and display, and spatial databases, and of fundamental concepts in geospatial analysis and modeling techniques.

PO5: Know how to design, develop and manage GIS and remote sensing application projects from the numerous possible applications including, land and natural resource developments, environmental monitoring and management, disaster risk reduction and disaster risk management.

PO6: Be knowledgeable of the various methods of Geospatial Analysis, GIS and Cartographic Modelling using spatial and aspatial data in solving geographic problems.

PO7: Be able to differentiate between various forms of remote sensing data – optical IR, thermal, microwave, hyperspectral; sensors, resolution; apply appropriate data processing and design expedient strategies for storing, managing and accessing these large volumes of data.

PO8: Quantitatively analyze data to evaluate scientific hypotheses and arguments in remote sensing and geographic information science.

PO9: Communicate effectively, both verbally and in writing, advanced concepts in remote sensing and geographic information systems.

PO10: Demonstrate understanding of the broader impacts and applications of remote sensing and GIS for natural sciences, social sciences, limitations of the technology, ethical use of the technology for the society at large.

PO11: Apply a range of geospatial analysis techniques using remote sensing and GIS tools toward solving quantitative problems in one or more core disciplinary areas such as geography, ecology, environmentalsciences, biogeosciences, urban planning or natural resources management.

DETAILED SYLLABUS

RGS501: INTRODUCTION TO MAP PROJECTION & FIELD SURVEY

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Describe the concept of Map Projection

LO2-Recognize the various systems of Projections – the Polyconic Projection, the Mercator's Projection, and the Universal Transverse Mercator Projection and use it.

LO3-Demonstrate the use of instruments used for measuring angle, direction, area, height and distance of objects on ground

LO4-Operate Theodolite to measure vertical angle, horizontal angle, height and distance

Syllabus

Introduction to Map Projection System and their Classification, Map Scale, Map Detail, Map Accuracy, Map Resolution, Map Projections – properties, Construction of Zenithal, Cylindrical,

Conic group Polyconic and Universal Transverse Mercator projections.

Conventional Field Survey, Survey Instruments to Measure Angle, Direction, Area, Height and Distance of Objects on Ground, Prismatic Compass, Theodolite, Measurement of Vertical Angle, Measurement of Horizontal Angle, Measurement of Height and Distance, Contouring; Trigonometric Leveling, Plane Table Survey, The Plane Table and it Accessories.

Text Books

1. Barry F. Kavanagh (2000), Surveying: Principles and Applications, 5th Edition,Prentice Hall, ISBN 13: 9780130227331.
2.Charles D. Ghilani, Paul R. Wolf (2014), Elementary Surveying, Pearson, 14th Edition, ISBN-13: 978-0133758887
3.Lieut. R. P. Rodgers, Lt. Commander Harrington,Commodore Danl. Ammen (2005), A text book on surveying, projections, and portable instruments, Scholarly Publishing Office, University of Michigan Library, ISBN 13: 9781425513283.

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS503: GEODESY

Hours: 3 (3-0-0) (Lecture-Tutorial-Lab)

Credit: 13

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Describe the various applications of geodesy
LO2-Identify the various coordinate systems used in geodesy
LO3-Illustrate the WGS 84 ellipsoid and PNG geodetic datum
LO4-Illustrate satellite geodesy

Syllabus

Spherical Coordinates, Applications of Geodesy, Description of Related Terms, Coordinate Systems in Geodesy, Cartesian System, Right Handed System, Curvilinear Coordinates, The WGS 84 Coordinate System, WGS 84 Ellipsoid, Geometric Constants, Indian Geodetic Datum, Dimensions of some well- known Spheroids, Everest Spheroid, Definition and Determination of Geoid Undulation, Coordinate System used in Geodesy, Coordinate System used by Survey of India (, , H), Redefinition of Horizontal and Vertical Datum in India, Indian Mean Sea Level Datum, Satellite Geodesy, Basics of Orbiting Heavenly Bodies / Satellites – Kepler's Model , Accessories

Text books

1. Ewing, C. E. and Mitchell, M. M. (2012), Introduction to Geodesy, Elsevier, New York. Oxford, 1979; W.Torge & J.Müller: Geodesy. 4.th edition, De Gruyter, ISBN 9783110007187.
2. Guochang Xu, GFZ Potsdam (2013), Sciences of Geodesy - II, Springer, ISBN13: 9783642280009
3. Lu, Zhiping, Qu, Yunying, Qiao, Shubo (2014), Introduction to Geodetic Datum and Geodetic Systems, Springer, ISBN13: 9783642412455
4. Wolfgang Torge, Jürgen Müller (2014), Geodesy, 4th Edition, De Gruyter, ISBN: 9783110207187

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS505: AERIAL PHOTOGRAPHY

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Explain the evolution of Aerial Photography
LO2-Illustrate the basic negative-to-positive photographic sequence
LO3-Know about the spectral sensitivity of black and white films
LO4-Judge the colour film

Syllabus

History of Aerial Photography, Simple Camera and Films, Focus, Basic Negative-to-Positive Photographic Sequence, Spectral Sensitivity of Black and White Films, Colour Film, Colour-Mixing Processes, Structure and Spectral Sensitivity of Color Film, Computerized Processing of Films, Filters, Aerial Film Cameras, Single-Lens Frame Cameras, Types of Aerial Photographs, Geometric Elements of a Vertical Photograph, Scales of Aerial Photographs, Ground Coverage of Aerial Photographs, Photographic Resolution

Text book

1. Wolf, P., Dewitt, B., and Wilkinson, B. (2014). Elements of Photogrammetry with Applications in GIS (4th Ed.). Boston, MA: McGraw-Hill, ISBN- 13: 978-0071761123

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS507: PHOTOGRAMMETRY

Hours: 2 (2--0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Identify the geometrical elements of vertical air photo
LO2-Correct image positions of terrain points using relief displacement
LO3-Evaluate object height and ground coordinate location from parallax measurement
LO4-Constrast the Analogue photogrammetry and Digital photogrammetry

Syllabus

Geometric Elements of Vertical Air Photos, Characteristics of Relief Displacement of Vertical Features, Object Height Determination from Relief Displacement Measurement, Correcting for Relief Displacement, Image Parallax, Characteristics of Image Parallax, Object Height and Ground Coordinate Location from Parallax Measurement, Parallax Measurement, Hardcopy Measurements, Softcopy Measurements, Ground Control for Aerial Photography, Orthophotos, Analog Photogrammetry, Digital Photogrammetry

Text book

1. Wolf, P., Dewitt, B., and Wilkinson, B. (2014). Elements of Photogrammetry with Applications in GIS (4th Ed.). Boston, MA: McGraw-Hill, ISBN- 13: 978-0071761123

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS509: CONCEPT AND FOUNDATION OF REMOTE SENSING

Hours: 3 (3-0-0) (Lecture-Tutorial-Lab)

Credit: 13

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Describe various types and stages of remote sensing
LO2-Illustrate energy source and radiation principles
LO3-State the characteristics of real remote sensing system
LO4-Interpret optical images

Syllabus

Definition of Remote Sensing, Types of Remote Sensing, Satellite Remote Sensing, Stages of Remote Sensing, Energy Source and Radiation Principles, Photons, Nature of EMR, Electromagnetic Spectrum, Bands used in Remote Sensing, Energy Interaction in the Atmosphere, Effect of the Atmosphere on Radiation – Radiative Transfer Theory, Energy Interaction with Earth Surface Features, Spectral Reflectance, Recognition of Earth Surface Features, Data Acquisition and Interpretation, Data Transmission to Earth,

Characteristics of Satellite Remote Sensing Data, Data Volume, Interpretation of Remotely Sensed Data, Interpretation of Optical Images -Panchromatic Images & Multispectral Images, False Colour Composite, Natural Colour Composite, Reference Data, Supervised Classification, An Ideal Remote Sensing System, Characteristics of Real Remote Sensing System, Real Sensors

Text books

1. Charles Elachi, Jakob van Zyl (2006), Introduction to the Physics and Techniques of Remote Sensing, Second Edition, John Wiley & Sons, ISBN13: 9780471783398
2. Lillesand, T. M. and Kiefer R.W. (2015), Remote Sensing and Image Interpretation", 7th Edn. Published by Wiley and Sons, ISBN10: 0471451525

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS511: ORBITAL CHARACTERISTICS OF REMOTE SENSING SATELLITES

Hours: 3 (3-0-0) (Lecture-Tutorial-Lab)

Credit: 13

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Relate with the satellite orbits / space borne platforms, basics of orbiting satellites as per Kepler's model, geostationary orbits, and sun synchronous orbits
LO2-Describe the various types of sensor resolutions.
LO3-Identify the various types of remote sensing satellites, sensors, and their applications
LO4- Appraise the Indian Remote Sensing System series of satellites
LO5-Recognize the European Remote Sensing series of satellites

Syllabus

Satellite Orbits / Space Borne Platforms, Basics of Orbiting Heavenly Bodies / Satellites – Kepler's Model, Characteristics of Satellite Platforms, Satellites - Geostationary Orbits & Sun Synchronous Orbits, Sensors, Resolution of Sensors, Types of Remote Sensing Satellites, Sensors and Applications, Preparation of Standard False Colour Composite, Comparison between MSS and TM Sensors, SPOT- HRV, IRS – Indian Remote Sensing System, European Remote Sensing Satellite and European Space Agency, ERS – 1, 2 Orbit, Sensors, Orbital Characteristics of Remote Sensing Satellites, Types of Sensors, Resolution of Sensors – Spectral, Spatial, Radiometric & Temporal, Types of Remote Sensing Satellites (Landsat, SPOT, ERS, IRS etc.)-their Sensors and Applications, Recent High Resolution Commercial Satellites

Text books

1. Charles Elachi, Jakob van Zyl (2006), Introduction to the Physics and Techniques of Remote Sensing, Second Edition, John Wiley & Sons, ISBN: 9780471783398
2. Lillesand, T. M. and Kiefer R.W. (2015), Remote Sensing and Image Interpretation", 7th Edn. Published by Wiley and Sons, ISBN10: 0471451525

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS513: GROUND BASED OBSERVATION EQUIPMENTS & STUDY OF TOPOGRAPHICAL MAP

Hours: 3 (3-0-0) (Lecture-Tutorial-Lab)

Credit: 13

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Identify different map projections and topographical maps

LO2- Identify features for ground-based recognition
LO3- Interpret the topographical sheets.

Syllabus

Map Projection, Topographical Map, Map Reading, Identification of Topographical Sheets, Study of topographical sheets for delineation of different features, Methods to be followed during Interpretation, Identification of the Features, Ground based observation equipment – Radiometer, spectrophotometer.

Text book

1. Lieut. R. P. Rodgers, Lt.Commander Harrington,Commodore Danl. Ammen (2005), A text book on surveying, projections, and portable instruments, Scholarly Publishing Office, University of Michigan Library, ISBN 13: 9781425513283.

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS515: IMAGE INTERPRETATION & MAP SCALES

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:
LO1-Understand the characteristics of image and its interpretation
LO2-Identify image interpretation elements
LO3-Generate thematic maps
LO4-Construct graphical scales –plain and comparative scale

Syllabus

Fundamentals of Airphoto/ Satellite image interpretation, Basic photo/ Image elements, Characteristics of image and its interpretation, image reading, measurement and analysis, Generation of thematic maps, Different weather satellites, Optical satellite data interpretation, Radar data interpretation, Interferometry, Concept of scale of maps, Representation of Map Scales, Cartographic Representation of Map Scales, Construction of Graphical Scales, Plain Scale, Comparative Scale, Diagonal Scale

Text book

1. Lillesand, T. M., Kiefer R.W., and. Chipman, J.W. (2008), Remote Sensing and Image Interpretation, 6th Edition, Published by Wiley and Sons. ISBN 13: 978-0-470-05245-7

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS502: IMAGE INTERPRETATION FOR EARTH SCIENCE AND TERRAIN EVALUATION

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:
LO1-Identify various types of igneous rocks, metamorphic rocks and their formation
LO2-Detect different types of rock and minerals through Remote Sensing
LO3-Apply remote sensing to assess soil textures, soil moisture regime, soil organic matters

Syllabus

Igneous Rocks, Intrusive Igneous Rocks, Extrusive Igneous Rocks, Metamorphic Rocks, Soil Texture and Moisture Content, Soil Organic Matter, Remote Sensing of Rocks and Minerals

Airphoto/ Satellite Image Interpretation for Terrain Evaluation for Study of soil Characteristics, Study of drainage & erosion, Study of land use & vegetation, Study of sedimentary, igneous & metamorphic rocks, Study of Aeolian, glacial & fluvial landforms

Text book

1. John R. Jensen (2006), Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Edition, Pearson, ISBN-13: 978-01 31889507

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS504: INTERPRETATION OF REMOTE SENSING DATA FOR THEMATIC MAPPING

Hours: 4 (4-0-0) (Lecture-Tutorial-Lab)

Credit: 18

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Achieve urban growth using remote sensing
LO2-Identify wildlife ecology and archaeological applications; and environmental assessment
LO3-Apply principles of landform identification and evaluation, soil characteristics, topography, drainage pattern, texture and land erosion.

Syllabus

Airphoto/ Satellite interpretation for Geological Mapping, Soil Mapping, Landuse/ Land cover mapping, Agricultural applications, Forestry Applications, Urban & Regional applications, Wetland mapping, Wildlife Ecology Application, Environmental Assessment, Archaeological Application, Urban Growth Using Remote Sensing, Wetland Mapping, Wildlife Ecology Applications, Archaeological Applications, Environmental Assessment, Principles of Landform Identification and Evaluation, Soil Characteristics, Topography, Drainage Pattern and Texture, Erosion, Image Interpretation Process, Sedimentary rocks, Sandstone, Limestone

Text book

1. Lillesand, T. M., Kiefer R.W., and. Chipman, J.W. (2008), Remote Sensing and Image Interpretation, 6th Edition, Published by Wiley and Sons. ISBN 13: 978-0-470-05245-7

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS506: THERMAL INFRARED AND HYPERSPECTRAL REMOTE SENSING

Hours: 3 (3-0-0) (Lecture-Tutorial-Lab)

Credit: 13

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Describe the thermal radiation principles, interpret thermal scanner imagery
LO2-Recognize thermal scanners, FLIR systems
LO3-Describe the Planck's radiation (blackbody) law, diurnal heating effects
LO4-Describe the thermal properties of water; heat capacity mapping mission
LO5-Conceptualize hyperspectral remote sensing and potential application of hyperspectral remote sensing

Syllabus

Fundamentals of Thermal Remote Sensing, Sensing Radiant Temperature, Black body Radiation, Across-Track Thermal Scanning, Thermal Radiation Principles, Radiant versus Kinetic Temperature, Radiation from real materials, Atmospheric effects, Interaction of Thermal Radiation with Terrain Elements, Thermal Energy Detectors, Thermal Radiometers, Thermal Scanners, Interaction of Thermal Radiation with Terrain Elements, Interpreting Thermal Scanner imaginary, Geometric Characteristics of Thermal Scanner Imaginary, Spatial Resolution and Ground Coverage, Tangential-Scale Distortion, Temperature Mapping with Thermal Scanner Data, FLIR Systems, Warm Earth: Thermal Remote Sensing, Planck Radiation (Blackbody) Law, Some Critical Problems and Solutions, Diurnal Heating Effects, Thermal Properties of Water, Thermal Sensors, Heat

Capacity Mapping Mission (HCMM) – Whether Satellites, Concept of Hyperspectral remote sensing, Satellites used for Hyperspectral remote sensing, potential application of hyperspectral remote sensing

Text book

1. George Joseph (2005) Fundamental of Remote Sensing, University Press, 2nd Edition, ISBN-13: 978-8173715358.

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS508: MICROWAVE REMOTE SENSING

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Relate with the fundamentals of microwave sensing, radars, microwave sensors onboard satellites
LO2-Describe the concept of radar altimeter, microwave scatterometer, microwave radiometer
LO3-Describe the spatial resolution of SLAR systems and synthetic aperture radar
LO4-Underline the terrain characteristics which influence radar returns, polarisation
LO5-Underline NASA's SIR-C/X-SAR mission

Syllabus

Fundamental of microwave Remote Sensing, Microwave Sensors / Modes of Microwave Remote Sensing - Side Looking Real Aperture Radar SLAR System operation, Radar Remote Sensing from space, Seasat, Radarsat, Shuttle Imaging Radar, Elements of Passive Microwave Sensing, Passive Microwave Sensors, Applications of Passive Microwave Remote Sensing, Spatial Resolution of SLAR systems - Range Resolution and Azimuth Resolution, Geometric Characteristics of SLAR Imaginary, earth surface feature characteristics influencing Radar returns, Interpretation of SLAR imaginary, Microwave Sensors Onboard a Satellite, Radar Altimeter, Microwave Scatterometer, Microwave Radiometer, Terrain Characteristics Influencing Radar Returns - Geometrical Characteristics and Electrical Characteristics, Synthetic Aperture Radar SAR Imaging – Frequency, Polarization and Incidence Angle, Microwave Frequency, Interpreting SAR Images, Relief Displacement, Parallax, Interaction between Microwaves and Earth's Surface, Radar Remote Sensing from Space – Interpreting SAR Images, Microwave Polarization in Synthetic Aperture Radar, Incidence Angles, Speckle Noise, Backscattered Radar Intensity, Multitemporal SAR images, Radar Remote Sensing from Space, Radarsat, Space Shuttle (Shuttle Imaging Radar), NASA SIR- C/X-SAR Mission, Passive Microwave Sensing

Text books

1.Baghdadi N. and Zribi M. (2016), Microwave Remote Sensing of Land Surface: Techniques and Methods, 1st Edn., ISTE Press Limited - Elsevier Incorporated, ISBN-10 1785481592, ISBN-13 9781785481598

2.Tsang,L., Kong, J. A. and Shin, R. T. (1985), Theory of microwave remote sensing, 1st Edn., Wiley-Interscience, ISBN-10: 0471888605, ISBN-13: 978-0471888604.

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS510: DIGITAL IMAGE PROCESSING SYSTEM – BASICS & CHARACTERISTICS

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Envision the components of digital image processing system
LO2-Describe the notations commonly used in digital remote sensing data
LO3-Discuss on preprocessing of a digital image.
LO4-Assemble logical units of DIP, with high level language

Syllabus

Image Processing System Characteristics: CPU, Arithmetic Co-Processor, RAM, Operating System and Compiler, Basic operations, Hardware, Software, Humanware, Data, Procedure, History of development, Classification of digital computer, workstations, Communication device, Transmission media, Logical units of DIP, Operating system, Application software, Software categories, Data representation in DIP, Programing language, High level, language, Program development tools, Concept of internet, Basic features of digital images, Image display system, B/W Image Interpretation, Video Image display, transferring video displays to hard copy displays. Classification of digital images, DIP flowchart, Modes of digital image generation, Data format of digital satellite imagery, soft copy image to hardcopy image

Text books

1.Jensen, J. R. (2014), Introductory Digital Image Processing – A Remote Sensing Perspective, 4th Edition, Pearson Series in Geographic Info Science. ISBN 13: 978-0-134-05816-0.

2.Richards, J. A. and X. Jia (2013), Remote Sensing Digital Image Analysis: An introduction, 5th edn. Springer, ISBN10: 3540251286

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS512: IMAGE RESTORATION & MANIPULATIONS

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:
LO1-Preprocess digital images,
LO2-Apply contrast manipulations, mosaicking and image rectification
LO3-Apply image enhancement techniques, image filters

Syllabus

Geometric Correction, Radiometric Correction, Noise Removal, Contrast Manipulation, Gray-Level Manipulation, Level Slicing, Contrast Stretching, Spatial Feature Manipulation, Spatial Filtering,Convolution, Fourier Analysis, Edge Enhancement, Mosaics, Image rectification, Atmospheric corrections, Radiative transfer theory, Image enhancement techniques, Filters, high pass, low pass, Edge detections, Fourier transformations

Text books

1. Jensen, J. R. (2014), Introductory Digital Image Processing – A Remote Sensing Perspective, 4th Edition, Pearson Series in Geographic Info Science. ISBN 13: 978-0-134-05816-0.
2. Richards, J. A. and X. Jia (2013), Remote Sensing Digital Image Analysis: An introduction, 5th edn. Springer, ISBN10: 3540251286

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS514: MULTI-IMAGE MANIPULATION – INFORMATION EXTRACTION

Hours: 2 (2--0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Understand image transformations, band combinations, band ratioing, develop knowledge on Principal Component Analysis

LO2-Analyse various vegetation indices, colour space transformation

LO3-Analyse various image classification algorithms, various outputs of data processing, methods of accuracy assessment

Syllabus

Spectral Rationing, Principal and Canonical components, Vegetation Components – TVI, NDVI, Intensity – Hue – Saturation (HIS) Colour Space Transformation, Image Classification, Classification Algorithms, Minimum Distance to Means Classifier, Parallelepiped Classifier, Gaussian Maximum likelihood Classifier, Supervised Classification, Training stage, Unsupervised Classification, Output stage – Graphic Products, Tabular Data, Post Classification Smoothing, Classification Accuracy Assessment, Advanced classification techniques

Text books

1. Jensen, J. R. (2014), Introductory Digital Image Processing – A Remote Sensing Perspective, 4th Edition, Pearson Series in Geographic Info Science. ISBN 13: 978-0-134-05816-0.

2. Richards, J. A. and X. Jia (2013), Remote Sensing Digital Image Analysis: An introduction, 5th edn. Springer, ISBN10: 3540251286

Assessment

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS516: GEO-STATISTICS

Hours: 3 (3-0-0) (Lecture-Tutorial-Lab)

Credit: 13

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Apply statistical tests to data to assess precision and accuracy of single and groups of linear measurements;

LO2-Use partial differentials to derive error analysis of linear and non-linear functions;

LO3-Apply statistical methods for the definition of specifications;

LO4-Apply basic statistical analyses for thematic mapping and spatial data aggregations, generalisations and polygon manipulations.

Syllabus

Sampling and summarizing Geographical data: Types of sampling methods, Estimates from sample, Types of error. Collection of data, Classification & Tabulation; Chart and Diagrams; Frequency distribution, Measures of central tendency and dispersion; Moments, skewed Concept of Probability distribution; Normal Probability distribution; Properties of Normal Curve. Mean centre of population & settlement and their temporal shift, Locational Quotient (LQ), Lorenz Curve & Gini's Coefficient of Correlation, Standard Score / Z-Score, Nearest Neighbor analysis &, Population Potential, Bi-variate distribution and Correlation: Scatter diagrams and regression analysis; Measures of Correlation: Product Moment Correlation coefficient, introduction to least square & Residual Mapping, Spearman's Rank correlation coefficient. Time series analysis and spatial distributions and interaction; shortest path analysis.

Text book

1. Zhiyi Zhang, Douglas S. Shafer (2012), Introductory Statistics, Saylor Foundation, ISBN: 978-1-4533448-7-3

Assessment
Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS601: PRACTICAL ON DIGITAL IMAGE PROCESSING (DIP) - INTRODUCTION TO REMOTE SENSING WITH ERDAS IMAGINE

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Operate on ERDAS image processing software
LO2-Prepare FCC prep and Scientific Visualization
LO3-Describe the various pre-processing techniques
LO4-Prepare image masking and image mosaicking

Syllabus
Handling satellite image, FCC preparation and Scientific Visualization: Image loading & display, Standard FCC and various band combination FCC, Studying FCC, Signature generation on graph sheets for various land covers; Pre-processing: Image registration, Single map (topographic map), Map to Image, Image to Image, Image with known points; Image Mosaicing: Registration of all adjacent images in the same co-ordinate system, Image mosaicing, Sub set images registration, Image cutting with given boundary.

Text books
1. Jensen, J. R. (2014), Introductory Digital Image Processing – A Remote Sensing Perspective, 4th Edition, Pearson Series in Geographic Info Science. ISBN 13: 978-0-134-05816-0.
2. Lillesand, T. M., Kiefer R.W., and. Chipman, J.W. (2008), Remote Sensing and Image Interpretation, 6th Edition, Published by Wiley and Sons. ISBN 13: 978-0-470-05245-7

Reference/Module
1. ERDAS IMAGINE Tour Guides (2001), Atlanta, Georgia
2. Departmental Modules

Assessment
Continuous Assessment: 100%

RGS603: PRACTICAL ON DIP - INTRODUCTION TO DIGITAL IMAGE PROCESSING

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Development skills on different crop/subset methods
LO2-Perform image enhancement and image transformation
LO3-Apply Erdas Imagine model builder on Surface temperature modelling

Syllabus
Image Masking: Vector boundary generation, Vector polygon topology building, Vector to AOI (area of interest) conversion, Masking image with coordinates, masking with inquire box; Image Enhancement: spatial, spectral and radiometric enhancement, Contrast Stretching, Histogram Stretching, Linear Stretching, Non-linear Stretching; Image Transformation: Principal Component Generation, Band Rationing & NDVI generation, Other band combinations, model maker/model builder for surface temperature modelling.

Text books
1. Jensen, J. R. (2014), Introductory Digital Image Processing – A Remote Sensing Perspective, 4th Edition, Pearson Series in Geographic Info Science. ISBN 13: 978-0-134-05816-0.
2. Lillesand, T. M., Kiefer R.W., and. Chipman, J.W. (2008), Remote Sensing and Image

Interpretation, 6th Edition, Published by Wiley and Sons. ISBN 13: 978-0-470-05245-7

Reference/Module

1. ERDAS IMAGINE Tour Guides (2001), Atlanta, Georgia
2. Departmental Modules

Assessment

Continuous Assessment: 100%

RGS605: PRACTICAL ON DIP - SATELLITE IMAGE CLASSIFICATION, 3D MODELING AND MAPPING

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Understand Digital Elevation Modeling and 3D analysis

LO2-Compare various unsupervised and supervised image classification

LO3-Prepare output maps

Syllabus

Satellite Image Classifications: Unsupervised classification, Pseudo-colour assignment to classified image, Signature creation after visual interpretation, Supervised classification, Statistics generation from classified image, Classification with mask, Recoding, Accuracy assessment, classification error matrix generation; Output generation: Raster to vector generation from classified image, Smoothening of classified image to reduce noise, Preparation of colour thematic maps, ready for print to a pdf or Tiff file; 3D modelling: Understanding contour layer and Z (altitude values), Create surface from the contour layer using Z coordinate, display the DEM/3d surface data into the Virtual GIG viewer, Vertical exaggerations, flood zone or water level analysis.

Text books

1. Jensen, J. R. (2014), Introductory Digital Image Processing – A Remote Sensing Perspective, 4th Edition, Pearson Series in Geographic Info Science. ISBN 13: 978-0-134-05816-0.
2. Lillesand, T. M., Kiefer R.W., and. Chipman, J.W. (2008), Remote Sensing and Image Interpretation, 6th Edition, Published by Wiley and Sons. ISBN 13: 978-0-470-05245-7

Reference/Module

1. ERDAS IMAGINE Tour Guides (2001), Atlanta, Georgia
2. Departmental Modules

Assessment

Continuous Assessment: 100%

RGS607: PRACTICAL ON PHOTOGRAMMETRY, VISUAL ANALYSIS OF AIRPHOTO & SATELLITE IMAGE

Hours: 4 (0-0-4) (Lecture-Tutorial-Lab)

Credit: 06

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Identify interpretation techniques of analog data products

LO2-Use stereoscopes and Parallax bar

LO3-Determine scale of image from reference map, topographical sheets

LO4-Apply image and photo interpretation and preparation of map

Syllabus

Study of border information from Air Photo, Stereo Test with lens stereoscope and Stereo Test Card, Orientation of stereo model under mirror stereoscope, Determination of Photo scale, Use of Parallax Bar, Use of Parallax Bar and determination of height from stereo pair, Study of border information of IRS Satellite imagery, marking of

reference system (Study of path & row), Preparation of Base map from Toposheets,

Visual Interpretation of Air photo, Single band & False Colour Composite (FCC) imagery for identification of earth surface feature, Mapping of the following themes using satellite imagery - Landuse/ Land Cover, Forest, Soil Geomorphology, Surface water, Geology

Text book

1. Wolf, P., Dewitt, B., and Wilkinson, B. (2014). Elements of Photogrammetry with Applications in GIS (4th Ed.). Boston, MA: McGraw-Hill, ISBN- 13: 978-0071761123

Reference/Module

1. Departmental Modules
2. Manual of Remote Sensing, Vol-I & II, American Society of Photogrammetry

Assessment

Continuous Assessment: 100%

RGS609: COMPONENTS OF GEOGRAPHIC INFORMATION SYSTEM (GIS)

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Describe the geographic information system and applications

LO2-Recognize different segments in geographic information system

LO3-Describe data structures

Syllabus

Introduction to Geographic Information System(GIS), Components of Geographic Information System(GIS); GIS software module, Organizational aspects of GIS, Data for GIS Applications, Various Segments – in GIS, Developments in GIS – Past, Present & Future – Pitfalls, GIS as a Unique concept, Data Structures, Raster Based GIS, Vector Based GIS, Databases, Global Positioning Systems (GPS)- an Excellent Tool in Aid of GIS, Remote Sensing Interface, Data Standards and Future Trend, Measurement, Representation, Operation, Transformations, GIS as a Set of Interrelated Subsystems, Scope of Environmental Applications of GIS, Future trend in GIS.

Text book

1. Chang K. T. (2013), Introduction to Geographic Information Systems, Edition: 7th, ISBN 13: 978-0-0778-0540-1

2. Heywood, I. Cornelius, S. & Carver, S. (2002). An introduction to GIS. Prentice Hall, ISBN o - 13061198-0

3. Paul Bolstad (2012) GIS Fundamentals: A First Text on Geographic Information Systems, XanEdu Publishing Inc; 4 edition, ISBN-13: 978-0971764736

Assessment

Continuous assessment - 50%

Computer based Practical examination - 50%

RGS611:DATA ORGANISATION & DATA MODELS IN GIS

Hours: 2 (2--0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Identify data structures for GIS

LO2-Understand geographical data in computer

LO3-Practice raster data structure

LO4-Recognize vector based GIS

LO5-Compare advantages and disadvantages of the data models

Syllabus

Data Organisation in computer; Data Structures For GIS, Geographical Data in Computer, Files and Data Access, Data structure of GIS: Points, lines and area; Geographical data in computer; Perceived structures and computer representation of geographic data, Raster Data System -Raster Data Structures, Vector Based GIS - Vector data structure for thematic maps; Choice of Vector or raster data, Mosaic, Reclassification, Slicing, Choice of Data Model – Advantages and Disadvantages

Text books

1. Chang K. T. (2013), Introduction to Geographic Information Systems, Edition: 7th, ISBN 13: 978-0-0778-0540-1
2. Heywood, I. Cornelius, S. & Carver, S. (2002). An introduction to GIS. Prentice Hall, ISBN o - 13061198-0
3. Paul Bolstad (2012) GIS Fundamentals: A First Text on Geographic Information Systems, XanEdu Publishing Inc; 4 edition, ISBN-13: 978-0971764736

Assessment

Continuous assessment - 50%
Computer based Practical examination - 50%

RGS613:DATA ENCODING & DATA MANIPULATION

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Recognize data input
LO2-Describe manual digitising and scanning of analogue maps
LO3-Discuss on the direct data entry LO4-Manage data structures for GIS
LO5-Perform line generalisation, simplification, and smoothing algorithms

Syllabus

Data encoding, database structure, computer representation of data, Data Manipulation. Need of numerical data manipulation, Operational, automatic decision/classification techniques, Data Input, Manual Digitising and Scanning of Analogue Maps, Direct Data Entry, Data Structures for GIS, Computer Representations of Data, Data Manipulation and Analysis, Types of Numerical Data, Line Generalization Algorithms, Line Simplification Algorithms, Line Smoothing Algorithms, Buffers, Decision-Making with GIS, Historical Development of Decision Science, Single Objective / Single Criterion Decision Problems

Text books

1. Chang K. T. (2013), Introduction to Geographic Information Systems, Edition: 7th, ISBN 13: 978-0-0778-0540-1
2. Heywood, I. Cornelius, S. & Carver, S. (2002). An introduction to GIS. Prentice Hall, ISBN o - 13061198-0
3. Paul Bolstad (2012) GIS Fundamentals: A First Text on Geographic Information Systems, XanEdu Publishing Inc; 4 edition, ISBN-13: 978-0971764736

Assessment

Continuous assessment - 50%
Computer based Practical examination - 50%

RGS615: GIS–APPLICATIONS & SOME CASE STUDIES

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Recognize capabilities of GIS and GIS applications
LO2-Describe data analysis – spatial modelling LO3-Use functional tools for map analysis
LO3-Utilize map projection and spatial transformation LO5-Demonstrate spatial

retrieval, classification and measurement functions

LO4-Manage map algebra utilities and error – sources and handling

Syllabus

GIS Application, Creation of Digital Elevation Models as Input for GIS, Data Analysis - Spatial Modelling, Capabilities of a GIS, Definition of database, Basic Database Requirements Data Analysis; Simple Data Retrieval, Functional Tools for Map Analysis, Projection and Spatial Transformation

Utilities, Spatial modeling, Cartographic modeling: Map overlay, Data Quality; Spatial Retrieval, Classification, Measurement Functions, Data Retrieval Using Rules of Boolean Logic, Logical and Visual Overlaying Capabilities, Proximity and Network Functions, Map Algebra Utilities, Vector Overlay Processing, Vector Based GIS Overlay, Error

- Sources & Handling in GIS, Errors resulting from rasterizing a vector map; errors associated with digitizing a map and with geocoding; errors associated with overlaying two or more polygon network, GIS application for – Forest resource inventory; Landuse- landcover study; Drought monitoring, Soil mapping; Geological study, Geomorphological study, Environmental Management, Oceanographic Study, Natural Hazard Management.

Text books

1. David Martin (1995), Geographic Information Systems: Socioeconomic Applications, 2nd Edition, ISBN-13: 978-0415125727
2. Paul Bolstad (2012) GIS Fundamentals: A First Text on Geographic Information Systems, XanEdu Publishing Inc; 4 edition, ISBN-13: 978-0971764736

Assessment

Continuous assessment - 50%
Computer based Practical examination - 50%

RGS602: PRACTICAL ON GEOGRAPHIC INFORMATION SYSTEM (GIS) - INTRODUCTION TO ARCGIS BASICS

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-Operate in ArcGIS platform
LO2-Describe spatial reference to a raster data
LO3-Demonstrate table and data base handling procedures
LO4-Manage data inArcGIS platform

Syllabus

Introduction, Raster and Vector Data Storage, Overview of The ArcGIS Software System, Hands on training related to GIS software: ARC/GIS, Introduction basics of ArcMap, Exploring Raster and Vector data with ArcMap; Display a Raster data, Performing Standard FCC of the Raster data, Performing Zoom in, moving and full Extent of map, Display a vector layer, Off-On layers and Changing display symbol of Vector layers, Identifying features from Vector layers; Dealing with data and table: Performing Attribute Query from Vector layers, Performing Spatial Query from Vector layers, joining a Table from other GIS layer, Export a GIS layer, Importing data base into GIS, Joining a Table from database file; Using Raster Images – Creating control Points and Geo-coding, Geometric transformation.

Text book

1. Heywood, I. Cornelius, S. & Carver, S. (2002). An introduction to GIS. Prentice Hall, ISBN o - 13061198-0

Reference/Module

1. Booth, B. (2001), Getting started with ArcGis. Redlands, CA: ESRI Press.
2. Departmental Modules

Assessment
Continuous Assessment: 100%

RGS604: PRACTICAL ON GIS - CREATION OF NEW VECTOR COVERAGE, DATA BASE AND THEMATIC MAPPING

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Digitise new coverage and create data base
LO2-Prepare thematic maps
LO3-Managing animations and recording
LO4-Develop hazard related maps and data base

Syllabus
Vector layer creation and Digitization: New Vector layer creation, Point layer, Line layer and polygon layer creation, Point features, line features and area/polygon features digitization; Attribution to the vector layer: Attribution to the point (vector) layer, line layer and polygon layer; Cartographic design and map representation: Display data layers and change the symbol, Change the layer symbol and label properties, Making a choropleth map using polygon layer, Preparing Map for Presentation using Legend, scale, North arrow, grid and Title, Exporting Map to TIFF format and print.

Text book
1. Paul Bolstad (2012) GIS Fundamentals: A First Text on Geographic Information Systems, XanEdu Publishing Inc; 4 edition, ISBN-13: 978-0971764736

Reference/Module
1. Booth, B. (2001), Getting started with ArcGis. Redlands, CA: ESRI Press.
2. Departmental Modules

Assessment
Continuous Assessment: 100%

RGS606: PRACTICAL ON GIS - SPATIAL DATA ANALYSIS AND 3D MODELING

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)

Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Recognize different 3D and surface analysis procedures
LO2-Understand proximity analysis
LO3-Apply overlay analysis and spatial interpolation process

Syllabus
Spatial Interpolation with vector layer: Display the point (vector) layer, Inverse Distance Weighted Interpolation, Spline Interpolation, Kriging Interpolation, Reclassification of Raster data; Surface Analysis using DEM data: Creating TIN using Contour data, Displaying TIN in the ARC Scene, Surface Analysis: Contour From DEM data, Slope, Aspect, Hill shade, View shade, and Cut and Fill From DEM data; Overlay and proximity analysis: Simple buffer for point layer, Multiple ring buffer for point layer, Intersection between two Polygon Layers, Union between two Polygon Layers.

Text book
1. Jonathan Campbell, MIchael Shin (2011), Essentials of Geographic Information Systems, Saylor Foundation, ISBN 13: 9781453321966

Reference/Module
1. Booth, B. (2001), Getting started with ArcGis. Redlands, CA: ESRI Press.
2. Departmental Modules

Assessment
Continuous Assessment: 100%

RGS608: APPLICATION OF GEOINFORMATICS

Hours: 4 (4-0-0) (Lecture-Tutorial-Lab)

Credit: 18

Learning Outcomes

Upon completion of the subject student will be able to:

LO1-State real world application of geo-informatics

LO2-Describe the GNSS / NAVSTAR GPS and other countries' navigation systems

LO3-Describe differential GPS positioning

LO4-Generation of specific theme-oriented GIS systems

LO5-Analyze several case studies on specific themes

Syllabus/Case Studies

Nationwide Land use / Land cover mapping, Urban growth monitoring Urban fringe Study, Wasteland mapping & monitoring, Remote Sensing, GIS & GPS aided route alignment, Planning of Infrastructure, Disaster Reduction / Disaster Management, Watershed planning and management, Health and sanitation, Inventory of problems and potentials: Soil, Forest, Ground Water, Mineral Resources; Concept of Global Positioning System (GPS); GPS Satellites, Working procedure of GPS, Differential GPS positioning. Use of GPS in Geoinformatics; RS & GIS based Mathematical Models: Estimation of crop acreage & yield using agro, meteorological and space data & modified Universal Soil Lass Equation; Ground Water & Mineral targeting through R.S, Potential Fishing Zone Prediction through R.S. and GIS; Generation of Land Information System, Soil Information System, Biodiversity Information System, Marine Information System through R.S. & GIS.

Text book

1.Bai Tian (2016), GIS Technology Applications in Environmental and Earth Sciences, CRC Press LLC, ISBN: 9781498776042

DEPARTMENT OF SURVEYING AND LAND STUDIES

➢ MASTER OF SCIENCE IN URBAN AND REGIONAL PLANNING

MASTER OF SCIENCE IN URBAN AND REGIONAL PLANNING

RATIONALE

This beautiful country – often referred to as *'the paradise on earth'* by the philanthropists – deserves a befitting management of her enormous natural resources. The sustainable development of natural resources and eco-friendly exploitation of the resources can only be achieved by the enlightened citizens. The program aims to create skilled manpower/human resources that will be adept in optimal planning, management and development of Urban and Rural areas. In a nutshell, this program will churn out qualified professionals who, using state of the art technology, will be instrumental in developing, managing, exploiting all sorts of natural and man-made resources in a sustainable manner in order to create sustainable villages, towns, cities and provinces to facilitate PNG's achievement of mid-term and long-term development aspirations.

The program aims at creating human resources capable of integrating the physical planning and development of PNG with the emerging technologies of remote sensing, geographic information systems, Global Positioning System (GPS) etc.

It is paramount to note that the country has dire shortage of qualified planners / planning professionals to man the public and private sectors. We presume that this course will be churning out qualified professionals to fill in this void. Moreover, the department foresees that this course could draw a substantial interest from a large section of PNGians who earnestly yearn for attaining a post-graduate degree from this ace institution of PNG. Once we start the course, we expect a chain reaction and the market will be self-sustained.

The program will be substantially offered from this department, with the multi-disciplinary support of a number of allied departments in the University (Architecture and Building, Civil Engineering, and Communications and Development Studies). With the additional support received from two other departments in the University (Business and Agriculture) we have designed a globally benchmarked program curriculum substantially offered from this department that will feed into the preparation of standard course modules. We can now look forward to commencing this course in November 2017.

PROGRAM OUTCOMES

The aim of the M.Sc. URP program is to train and develop highly skilled urban and regional planners to meet the increasing needs of local, municipal, provincial and national governments as well as the private sector for the overall purpose of the planning of the scientific, aesthetic, and orderly disposition of land, resources, facilities and services with a view to securing the physical, economic and social efficiency, health and well-being of urban and rural communities in PNG and South Pacific.

Upon completion of the course, it is expected that the graduates will have acquired the knowledge and skills relating to:

1. How urban and regional planning practice is intertwined with urban and regional planning theory, and how theory gets honed from practice.
2. Lessons that can be learned from the histories of great human settlements in resolving the multi-dimensional dilemmas of contemporary human settlements.
3. The principles and practice of urban and regional planning and development relevant to the social, cultural and economic environment in PNG and relative to regional and global opportunities and constraints within the system.
4. The interrelationships and impacts of geographical, legal, physical, economic, social, political and global factors affecting sustainability and liveability of human settlements in a holistic fashion.
5. Built environment (theoretical and applied) research, data collection, data analysis and report writing as inputs in policy making and implementation.
6. The design, analysis and evaluation of urban and rural development schemes, including physical development plans, for both private and public-sector clients and other stakeholders.
7. Working on multi-disciplinary project teams and comprehending team members' scopes of work, deliverables and issues in which all members are able to lead the team towards the desired goal of creating sustainable villages, towns and cities.
8. Recognition of the need for, and an ability to engage in life-long learning to upgrade to higher learning and research activities for the benefit of urban and rural communities.

9. Production of a range of environmental and liveability analyses for new and existing settlements as well as environmental impact assessments for large-scale projects at an appropriate level of professional competence.
10. Application of basic concepts in mapping, cartography, reference surfaces and coordinate systems in the design and study of human settlements.
11. Application of GIS and Remote Sensing technologies in the design and management of human settlements and in addressing climate change challenges.
12. Use of public advocacy to secure effective public participation and achieve conflict resolution in the planning process.
13. Application of financial analysis, feasibility studies, graphics, risk/sensitivity analysis, data analysis and sustainable development techniques in the evaluation of urban and rural development schemes.
14. Undertaking computer assisted design and architectural design in the process of planning, development and long-term management of human settlements.
15. Application of physical (environmental) planning standards and building regulations in preparing site plans, land sub-division layouts, subject, local, provincial and master/structure plans for sustainable human settlements.

SUMMARY OF THE COURSES

The duration of the proposed MSc. URP course will be normally two years. In case a student fails to complete it within the scheduled timeline he/she will be allowed relaxation for a maximum of 2 more years on valid grounds (e.g. medical, financial etc.). After four years, the candidate's enrollment will be treated as cancelled and the entire course fee paid by him/her will be forfeited. Then the candidate shall have to seek re-admission as a fresh candidate.

The program will be offered in DISTANCE MODE over a period of *four semesters* with the session starting from November and ending in November/December. The residential (direct contact) period is proposed to be in the months of November-December while, depending upon the situation, another session of contact may be given in the month of June (for about 15 days). Notwithstanding the contributions of allied departments, the administration of entire study modules, lectures, examinations, etc., shall be the responsibility of the department of Surveying and Land Studies.

ENTRY REQUIREMENT

The entry requirement for admission of students is a Bachelor's degree in Science, Social Science or Engineering from a recognized university as per the University norms.

Course Schedule

Year	Mode of Study	Duration	Contract Hours	Credit
Year 1	Residential 1	Nov -Dec	34	109
	Semester 1- Distance	Feb-June	20	75
	Semester 2 - Distance	July-Oct	18	67
Year 2	Residential 2	Nov -Dec	32	94
	Semester 1- Distance	Feb-June	28	75
	Semester 2 - Distance	July-Oct	28	75
	Residential 3	Nov -Dec	32	55
		Total	192	550

Subject Outline

		Code Subject Hours with CCC
Year 1	Residential 1	URP 501: Planning Theory and Methods 20 (4-1-0) URP 502: Mapping Concepts 22 (4-2-0) URP 503: Urban Planning & Design Studio 16 (3-0-2) URP 504: Statistics for Planners 22 (4-2-0) URP 505: GIS for Planners 20 (4-1-0) URP 506: Hands-on Exercises Using Geo-spatial Data 9 (0-0-6)
	Semester 1- Distance	URP 507: Planning for Coastal Zones 15 (3-1-0) URP 508: Satellite Remote Sensing for Planners 15 (3-1-0) URP 509: Demographic Studies 15 (3-1-0) URP 510: Regional Planning 15 (3-1-0) URP 511: Planning Policies, Law & Ethics in PNG 15 (3-1-0)
	Semester 2	URP 512: Rural Development Planning 15 (3-1-0)

	- Distance	URP 513: Disaster Management 15 (3-1-0) URP 514: Women in Rural Development 15 (3-1-0) URP 515: Organisational Behaviour 22 (4-2-0)
Year 2	Residential 2	URP 516: Rural Sociology 20 (4-1-0) URP 517: Project Evaluation, Planning and Sustainability 16 (3-0-2) URP 518: Satellite Image Processing Techniques 10 (1-0-4) URP 519: GNSS/GPS: Theory and Practice 15 (2-0-4) URP 520: Research Methodology 22 (4-2-0) URP 521: Dissertation 11 (0-5-0)
	Semester 1- Distance	URP 521: Dissertation 45 (0-20-0) URP 522: Climate Change: Policy Implications for Human Settlements and Planners' Response 15 (3-1-0) URP 523: Transportation Engineering and Planning 15 (3-1-0)
	Semester 2 - Distance	URP 524: Urban Housing and Settlement Planning 15 (3-1-0) URP 525: Land Use Planning and Sustainability 15 (3-1-0) URP 521: Dissertation 45 (0-20-0)
	Residential 3	URP 521: Dissertation 37 (0-10-10) URP 526: Practical on Watershed Management Using RS Images 9 (0-0-6) URP 527: Mapping of Urban Land Use with High Resolution Images 9 (0-0-6)

Contact hours: (X-Y-Z); X = Lecture hours; Y = Tutorial hours; Z = Lab hours

DETAILS OF THE SUBJECTS

URP 501: PLANNING THEORY AND METHODS

Hours per week: 5 (4-1-0)
Credit: 20

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Explain the histories, theories and methods of planning relating to contemporary professional practice
2. Demonstrate how practice is informed by theory and how theory emerges from practice
3. Examine the multi-dimensional dilemmas that planners attempt to resolve in day-to-day practice and the contradictions that animate their work

Syllabus

Definitions and Historical Perspectives

Definition of planning; aims and objectives of physical planning; the necessity and rationale of planning; the characteristics of planning; the planning process; history and evolution of Urban and Regional Planning thought in Europe, America, Africa and Oceania

Philosophy and Theory of Urban and Regional Planning

Normative planning, positive planning and ameliorative planning; the synoptic or rational comprehensive planning theory; Incremental planning theory, Mixed-Scanning theory, Transactive planning theory, Advocacy planning theory, Radical planning theory, Choice theory and Action planning; their relevance

Planning Practice

Levels of planning in PNG and the Pacific; their broad interrelationships, components of settlements, Planning techniques and the changing role of the planner, the nature of planning, procedural and substantive process, planning traditions in both capitalist and socialist economies, citizen participation in the planning process

Planning Methods & Modes

Economic base and input-output methods, methods of population projections, National and Regional Income Accounting and Industrial Complex Analysis, methods of Evaluation in Planning; methods of cost-benefit and goals achievement analyses; Planning Programming and Budgeting systems; Planning modes.

References

1. Fishman, R. (2012). Urban utopias: Ebenezer Howard and Le Corbusier. In S. Campbell & S. Fainstein (Eds.), Readings in Planning Theory (3rd ed.) (pp. 27-53). Oxford: Wiley-Blackwell
2. Forester, J. (1989). Planning in the face of power. In Planning in the face of power (pp. 27-47). Berkeley: University of California Press
3. Friedmann, J. (2012). The good city: In defence of utopian thinking. In S. Fainstein & S.

Campbell (Eds.), Readings in Planning Theory (3rd Ed.) (pp. 87-104). Oxford: Wiley-Blackwell
4. Hall, P. (1988). The city of monuments (Chapter 6). In Cities of Tomorrow: An intellectual history of urban planning and design in the twentieth century (pp. 188-217). Oxford: Blackwell Publishing

Journal

1. Frank, N. (2002). Rethinking planning theory for a Master's-level curriculum, *Journal of Planning Education and Research*, 21(3), 320-330.

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 502: MAPPING CONCEPTS

Hours per week: 6(4-2-0)
Credit: 22

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Use the basic concepts in Mapping
2. Apply the concepts of Reference Surfaces, Coordinate Systems and Map Projections
3. Undertake map design and layout
4. Apply their knowledge of Topographic and Thematic Cartography.

Syllabus

Basic Concepts: Map and its Basic Characteristics, Cartography, History and nature of cartography, Scales of maps, Classification of maps, Maps and Plans.

Reference Surfaces, Coordinate Systems and Map Projection: Physical Surface of the Earth, Geoid, Reference Spheroid and Geodetic datum, Geographical Coordinate System, Map Projection (LO, UTM),

Map Design and Layout: The graphic outline (the title, legend and scale), Lettering and Toponomy, Cartographic Generalization, Map Numbering System, Map Reproduction.

Topographic and Thematic Cartography: Definition and scales of topographic maps, Topographic data Content, Representation of Relief.

Textbooks

1. Robinson, A. H., Morrison, J. L., Muehrcke, P. C., Kimerling, A. J., & Guptill, S.C. (1995). Elements of Cartography. Sixth Edition. John Wiley & Sons, Inc, ISBN 0-471-55579-7.
2. Kraak, M. J. & Ormeling, F. J. (1996). Cartography: Visualization of Spatial Data.Third Edition. Addison-Wesley Pub Co, ISBN: 0273722794.

References

1. Departmental Modules

Assessment

Continuous Assessment:	50%
Written Examination	50%

URP 503: URBAN PLANNING & DESIGN STUDIO

Hours per week: 5 (3-0-2)
Credit: 16

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Apply urban design principles and concepts in undertaking site planning and urban design analysis
2. Design the process of and appreciate the products of the design of the built environment
3. Undertake visual, graphic and spatial representations of the built environment
4. Appreciate the impact of experiential learning by doing (through cooperative studio exercises and projects) and the interdependence of procedural and substantive knowledge.

Syllabus

Theoretical Background to Design Studio

Macro theories and principles of design; the formulation of minimum and desirable space standards; ecological approaches to urban and regional design; visual elements in an urban complex; design of urban images, urban from determinants - urban scale, urban space, urban mass and open spaces.

Intermediate Design Studio

Design resources, design composition, space articulation and aesthetic qualities, practical assignments in site planning particularly the design of housing, industrial, commercial and recreational estates.

Advanced Design Studio
Preparation of three-dimensional models; designs of New Towns and capital cities; preparation of Master Plans and Structure Plans; Anatomy of urban districts. Case Studies in Urban Design Project: analysis of central or core areas of selected PNG cities: their forms, their strong images, their common themes, element interrelationships and structure orders, urban renewal. Case studies as class projects.

Textbooks
1. Jason, S. (2010). The Designer's Desktop Manual, 2nd Edition. Cincinnati, OH:
2. Jacobs, J. (1961). The Death and Life of Great American Cities. New York: Vintage
3. Lynch, K. (1960). The Image of the City. Cambridge, M. A: The MIT Press Simmons

References
1. Journal articles and websites as provided

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 504: STATISTICS FOR PLANNERS

Hours per week: 6(4-2-0)
Credit: 22

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Apply the basic concepts of Statistics
2. Analyse geographical data
3. Undertake basic statistical data analysis
4. Apply statistical analysis to thematic mapping

Syllabus
Variable and Graphs: Introduction to Statistics- The Research Process & Use of Statistics in Planning and Policy, Descriptive Statistics, Population and Sample.
Frequency Distribution: Raw data, Array, Frequency distribution, Class Boundaries, Relative Frequency and Percentages, Relative frequency distribution, Relative Cumulative-Frequency distribution and percentage Ogives.
Measures of Central Tendency: Mean, Median, Mode, Quartile, Decile and Percentile.
Measures of Dispersion: The Range, the Inter-quartile Range, Standard deviation/Root Mean Square error, the variance, properties of Standard Deviation, Absolute and relative dispersion; Coefficient of Variation, Standard Variable; Standard Scores.
Elementary Sampling Theory: Sampling theory, Random samples and Random Number, Sample with and without replacement, Sampling distribution, Sampling distribution of mean, standard error
The Small Sampling Theory:Small sample, student's t distribution, test of hypotheses and significance, the chi square distribution, degree of freedom, the chi square test for goodness of fit.
Correlation Theory: Correlation and regression, linear relation, Measure of Correlation, The least squares regression lines, standard error estimation, residual mapping, Coefficient of correlation, Correlation of time series

Textbook
1. Murray, R. S. (1992). Theory and Problems of Statistics, Schaum's Outline Series

References
1. Walford, P. (1995). Geographical Data Analysis, John Wiley and Sons Inc., New York.
2. Departmental Modules

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 505: GIS FOR PLANNERS

Hours per week: 5 (4-1-0)
Credit: 20

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Understand and apply basic concepts of GIS
2. Explain spatial data modelling techniques
3. Use various data capture methods
4. Perform various types of GIS data analysis

Syllabus
GIS Introduced: An overview of the development of the GIS field, spatial and non-spatial data, GIS defined, Components and functions, Data sources, GIS applications.
Spatial Data Modeling (Computer representation of cartographic features): Spatial feature types – points, lines, areas and networks and surfaces, Spatial data

models (vector and raster models), spatial data structure (vector and raster)
Data Capture Methods: Map digitization: manual digitization, semi-automatic and automatic digitization, Scanning and geo-referencing, automatic vectorization, Conversion from other digital sources, Attribute data input and management, metadata.
GIS Data Analysis/Processing: Measurements in GIS, Queries, Buffering, Integration, digital terrain modeling, data visualization.

Textbook

1. Heywood, I. Cornelius, S. & Carver, S. (2002). An introduction to GIS. Prentice Hall, ISBN o -13061198-0

References

1. Departmental Modules

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 506: HANDS ON EXERCISES USING GEO-SPATIAL DATA

Hours per week: 6 (0-0-6)
Credit: 9

Learning Outcomes
Upon completion of this subject, students will be able to:

1. Understand and apply the various data handling techniques used in ArcGIS platform
2. Design and use geo-spatial tables and relevant data handling procedures
3. Perform spatial referencing with regards to raster data and digitising of new coverage
4. Design GIS Database and thematic mapping.

Syllabus
Introduction to ArcGIS: Introduction basics of ArcMap, Display a Raster data, Performing Standard FCC of the Raster data, Performing Zoom in, moving and full Extent of map, Display a vector layer, Identifying features from Vector layers.
Dealing With Data and Table: Performing Attribute Query from Vector layers, Performing Spatial Query from Vector layers, joining a Table from other GIS layer, Export a GIS layer, Importing data base into GIS, Joining a Table from database file; Using Raster Images – Creating control Points and Geo-coding, Geometric transformation.
Vector Layer Creation and Digitization: New Vector layer creation, Point layer, Line layer and polygon layer creation, Point features, line features and area/polygon features digitization; Attribution to the vector layer: Attribution to the point (vector) layer, line layer and polygon layer.
Cartographic Design and Map Representation: Display data layers and change the symbol, Change the layer symbol and label properties, Making a choropleth map using polygon layer, Preparing Map for Presentation using Legend, scale, North arrow, grid and Title, Exporting Map to TIFF format and print.

Textbook

1. Maguire, D. J., Goodchild, M. F. & Rhind, D. W. (eds.) (1991). Geographical Information Systems, Principles and Applications, Avon: Longman Scientific and Technical.

References

1. Departmental practical modules on GIS

Assessment:

Continuous Assessment:	50%
Practical Examination:	50%

URP 507: PLANNING FOR COASTAL ZONES

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes
Upon completion of this subject, students will be able to:

1. Explain the sustainable use of coastal natural resources
2. Demonstrate how to maintain high levels of biodiversity and real conservation of critical habitats
3. Explain how to maintain and support fisheries, protect the community from storm ravages, attract tourists, promote public health, maintain yields from mangrove forests and preserve coral reefs

Syllabus
Definition of coastal zone and related nomenclature; Coastal processes: Wave, tide and wind. Coastal currents and cells; Coastal morphodynamics: Micro,

macro and biogenic forms; Systems of change in coasts: cyclical and progressive; Classification of coasts based on processes and sediment characteristics; Coastal biogeography with special reference to sea weeds, mangroves, dune vegetation and corals: Their ecological and economic significance; Natural coastal hazards and their management: Sea level rise, erosion, sedimentation and tropical cyclones; Techniques of monitoring changes in coastal processes and landforms; Coastal regulations with special reference to PNG; Human utilisation of coasts, environmental impacts and management: Navigation, mining, fishing and fish-processing, off-shore oil exploitation, reclamation and tourism; Coastal engineering and its impacts: Ports and harbours, measures for prevention of erosion and sedimentation; Coastal pollution: Sources, impacts and management; Integrated Coastal Management: Concepts, techniques and applications; Major environmental issues, problems and their management; Application of Remote Sensing with special reference to Fishery; Monitoring Surface waters in Coastal Regulatory Zone (CRZ); Study of Suspended mineral in water; Study of Chlorophyll in water; Measurement of Sea Surface Temperature (SST)

Textbooks

1. Bird, E. C. F. (2000). An Introduction to Coastal Geomorphology, John Wiley and Sons Ltd. New York
2. Carter, R. W. G. (1988). Coastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines, Academic Press, London

References

1. Departmental practical modules on GIS

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 508: SATELLITE REMOTE SENSING FOR PLANNERS

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and explain the conceptual foundation of Remote Sensing
2. Explain the various RS platforms, sensors, and associated concepts
3. Understand and describe the concept of Digital image processing
4. Describe the benefits and strategies for the application of satellite images in the 21st century

Syllabus

Physics of Remote Sensing: Definition and Stages, Electromagnetic radiation, Electromagnetic Spectrum, Radiation Laws, Interaction Mechanism with Atmosphere and Earth Features, Atmospheric Windows and bands, Spectral Reflectance Curve; **Platform and Sensors:** Ground, air and space borne platforms, Sensors: Imaging and non-imaging sensors, Active and Passive Sensors, Push broom Scanners, Spectral, Spatial, Radiometric and Temporal Resolution False Colour Composites.
Remote Sensing Satellites: LANDSAT, SPOT, IRS, IKONOS, QUICKBIRD, Worldview, RADARSAT, NOAA etc.
Image Interpretation: Elements of image interpretation, Visual and digital interpretation techniques, their advantages and limitations, Ground truth Collection.
Digital Image Processing: Image statistics, Radiometric and Geometric Corrections, Image Enhancement, Information Extraction, Visual and digital interpretation techniques, their advantages and Limitations, Ground truth Collection **Applications:** Topographic surveying, Land use/Land cover mapping

Textbooks

1. Lillesand, T. M., Kiefer, R. W. & Chipman, J. W. (2004). Remote Sensing and Image Interpretation.5th Edition, John Wiley & Sons, Inc, New York.
2. Sabins, F. F. (1987). Remote Sensing: Principles and Interpretation. Second Edition, W.H. Freeman and Company, New York.

References

1. Departmental Modules

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 509: DEMOGRAPHIC STUDIES

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Explain the meaning of Statistical data as a source of population data
2. Define terms and concepts relating to demography, e.g. gender/sex composition
3. Identify the factors affecting sex ration and age-sex pyramid
4. Explain the Malthusian theory of population growth
5. Describe the Demographic Transition Model and its application

Syllabus

Scope and contents of Demography; Sources of population data, their nature and quality; Population characteristics and composition: age, sex, education, religion, casts and tribes, rural and urban, occupation, language (with special ref. to PNG); Theory of population dynamics – fertility, mortality, migration; Factors determining population growth, distribution and density with special reference to PNG; Migration: Types, patterns and streams of migration and controlling factors; Theories of population growth – classical and modern theories; Demographic transition and the problems of developed and developing countries; Nutrition, fertility, morbidity and mortality with special reference to PNG; PNG's population policies; Problems of displaced population; Human development index, the PNG scenario; Population Health: HIV /AIDS with special reference to PNG.

Textbooks

1. Carter, J. & Jones, T. (1989). Social Geography: An Introduction to Contemporary Issues, London: Edward Arnold
2. Patrick, S., Heuveline, P., & Guillot, M. (2000). Demography: Measuring and Modeling Population Processes, Wiley-Blackwell, ISBN: 978-1-55786-451-2

References

1. Siegel, J. J. & Swanson, D. A. (Ed.) (2004). The Methods and Materials of Demography, Second Edition, Elaevier Academic Press.
2. Weeks, J. (2005). Population: An Introduction to Concepts and Issues, Wordsworth Learning, Singapore 9th edition.

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 510: REGIONAL PLANNING

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Describe the theories, concepts, ideas, and strategies employed in the pursuit of regional planning and economic development
2. Develop and apply basic principles that enable critical assessment of alternative development policies and programs
3. Reflect on the goals and objectives, implementation strategies, successes and failures of regional planning and economic development efforts

Syllabus

Concept of Region and Regional Planning (Concepts, Scope, Content and Types of Regional Planning), Historical Development of Regional Planning: Regional Planning in Developed, less Developed world, PNG and current status of Regional Planning, Regional Development models/Theories (spatial, non-spatial models), Strategic Development; Theoretical and Philosophical Issues in Regional Development Planning: The various schools of thought in planning in both Capitalist and Socialist economies. The contribution of social sciences to the field of planning. The evolution of development strategies in the developing and developed world. The expanded role of planning and planning crisis in the developing world. Regional Development Planning: Regional development process: conceptual and functional issues; Regional Planning through the Development of a Central Place, Growth Pole and

Growth Centres in Regional Development Strategy, Theories of Regional Growth and Location. Regional imbalance and disparity in PNG, Planning Regions of PNG, Problems and prospects of Regional Planning; Case studies of Regional Planning practice in both developed and developing countries. Socialist and capitalist approaches to Regional Planning. Special problems of regional planning in developing countries. Conceptual and Theoretical Frameworks for Urban and Regional Planning Analysis: Advanced analysis of city system and the urban and regional structural compositions. Advanced techniques of evaluation, monitoring and control in planning; Multipurpose River Basin planning, Social Dimensions of Regional Development, Delineation of Planning Regions, Intra-provincial planning region, Planning for Customary and Tribal Development

Textbooks

1. Harrington, J. W. & Warf, B. (1995). Industrial Location: Principles, Practice, and Policy. London, United Kingdom: Routledge.
2. Malizia, E. & Feser, E. J. (1999). Understanding Local Economic Development. New Brunswick, New Jersey: Center for Urban Policy Research (Read Chaps 3 & 6 intensely).

References

1. Bartik, T. J. (1990). The market failure approach to regional economic development policy. Economic Development Quarterly, 4 (4): 361-370.
2. Foster, K. A. (2007). Snapping back: what makesregions resilient? National Civic Review, 96 (3):27-29.

Assessment

Continuous Assessment: 50%
Written Examination: 50%

URP 511: PLANNING POLICIES, LAW AND ETHICS IN PNG

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Describe the planning process and the regulatory tools used to implement it
2. Explain the legal doctrines that empower local governments to regulate land use activities
3. Understand the models, frameworks, and theoretical perspectives under which professionals can assess ethical problems in planning
4. Evaluate the most important emerging ethical trends and controversies in planning, such as ethical uses of the conventional and new media to market projects and ideas
5. Identify the scope and power of professional roles within PNG's legal and institutional frameworks
6. Apply the fundamental principles of land use law to real world planning issues; and
7. Gain skills in critical analysis and logical reasoning by resolving ethical problems both verbally and in writing.

Syllabus

The public interest dilemma; the rationale for State intervention in the allocation of resources in the built environment; critical examination of the Planning Acts and Legislations in PNG. Land Laws; the Public Health Code and the Housing Code. Laws on compensation with special reference to PNG. History and development of Local Government in the U.K. Australia and PNG and effects on Urban Planning, Urban Government systems, the enforcement of development control, zoning; politics of planning in PNG; Planning policies, practices and procedures, norms and ethics of the planning profession, professional responsibilities and discipline, PNG Institute of Town Planners' management strategies for environmental hazards; Environmental Impact Assessment; Sustainability issues; The Town Planners Registration Board of PNG and its role. Planning as a business venture. Business skill acquisition and self-employment strategies. Introduction to business management. Personnel management (recruitment, motivation and rewarding). Prudence in financial management. Business ethics and planning ethics. Some laws governing contracting/consultancy case studies. Money laundering, corruption and international politics in business and their impacts on planning.

Textbooks

1. Duxbury, R. (2012). Telling and Duxbury's Planning Law and Procedure, Oxford University Press. ISBN: 9780199655021.
2. Witty, D. R. (2012). Professional Practice Manual, Canadian Institute of Planners, Ottawa: Canada
3. Kulshrestha, S. K. (2012). Urban and Regional Planning in India: Handbook for

Professional Practice, Sage Publications, New Delhi.

References

1. Anonymous (2016). American Institute of Planners, Code of Ethics and Professional Conduct; Available at: http://www.planning.org/ethics/
2. Anonymous (2015). Planning Institute of Australia, Professional Conduct: Available at: http://www.planning.org.au/aboutpia/constitution-by-laws
3. Anonymous (1989). PNG Physical Planning Act and related statutes; Available at www.paclii.org/pg/legis/consol_act/ppa1989185.rtf

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 512: RURAL DEVELOPMENT PLANNING

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Identify and appraise the theories, policies and methods of rural development in an urbanising world
2. Understand the relationship between rural social framework and social change in rural areas and analyse approaches to rural development in selected developed and developing countries, including the Pacific countries
3. Analyse rural governance and administration in PNG, including the impact of VGGT on customary land tenure system and the ILGs
4. Analyse and synthesise the challenges, prospects and policies of rural industrialisation in PNG

Syllabus

Concepts and Models of Rural Development

Basic elements and rationale of rural development; growth versus development; rising expectations and development; development and change, dilemmas in development; approaches to rural development; rural development policies; regional and rural development policies in PNG; rapid rural appraisal and participatory rural appraisal, VGGT principles and land governance, public participation and role of voluntary organisations in rural development

Rural Poverty

Theories, concepts, causes, effects, nature, biases (spatial, project, person, season, diplomatic and professional); clusters of disadvantages and deprivation; trap, rural poverty alleviation measures; rural poverty scenario in PNG

Rural Settlements

Types of settlement; principles and elements of human settlement; approaches to spatial, social, human resources and technological problems of rural areas; policy goals and instruments for rural integration; principles and strategies in the planning of public and private rural facilities; the problems of rural threshold

The Need for Decentralized Planning

The need for decentralization of legal and administrative frameworks for cost minimisation and efficiency; PNG as a case study, planning at the Provincial level, advantages and disadvantages over centralized planning; strategies for decentralized planning; institutional framework for decentralized planning in PNG

Textbooks

1. Hanson, L., Allen, B., Bourke, R., & McCarthy, T. (2001). Papua New Guinea Rural Development Handbook. Canberra, Australia: The Australian National University
2. William, K. (1988). Sociology in a changing world, Holt, Riehart and Winston Inc.

References

Anonymous (2016). World Development Reports, World; www.worldbank.org

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 513: DISASTER MANAGEMENT

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Identify and describe various disasters and their impacts on human settlements

2. Identify disaster mitigation measures and cost-effective preparedness strategies
3. Design sustainable environmental planning strategies for disaster-prone areas
4. Understand and apply relief and rehabilitation measures for the sustainability/liveability of disaster areas

Syllabus

Introduction to Disasters
Introduction to Disasters, Classification of Disasters; Natural disasters, man-made disasters

Types of disasters: Biological hazards: epidemics, animal and insect infestation; Geophysical hazards: Earthquakes; Mass movement dry; Mass movement wet, Tsunamis; Volcanic eruptions; Drought; Extreme temperatures; Wildfires / Urban fires, Floods, Tropical storms, hurricanes, typhoons and cyclones, Storms and tidal waves, Industrial accidents, Transport accidents, Famine/food insecurity

Scope and Objectives of Disaster Mitigation, Preparedness and Response
Preparedness planning; action plans and procedures, training issues and models, checklists/disaster response planning, roles and responsibilities of various agencies/emergency operations support and management, community participation, public awareness.

Planning for disaster-prone areas
Disaster mapping, vulnerability analysis, vulnerability atlas, predictability, forecasting and warning, relief measures, reconstruction and rehabilitation, disaster preparedness plan, land use zoning for disaster management, infrastructure management skill assessment.

Textbooks

1. Hyndman, Donald & Hyndman, David (2010). Natural Hazards and Disasters, Brooks Cole; Third Edition ISBN- 0538737522
2. William, K. (1988). Sociology in a changing world, Holt, Riehart and Winston Inc.

References

1. Anonymous (1986). Bangkok under the Capacity Building in Asia using Information Technology Applications project, to the participating universities and institutions for educational purpose only. www.adpc.net.
2. Anonymous (2007). Mitigating the Impacts of Disasters: Policy Directions, Abridged Edition, UN-Habitat Earthscan Publishing, London.
3. Departmental Module

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 514: WOMEN IN RURAL DEVELOPMENT

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and appreciate the concept of rural development
2. Recognize and appreciate the multiple roles that women play in rural development
3. Analyse the role and status of rural women within the context of overall development at the local, provincial, regional and international levels
4. Assess the current and emerging development issues facing rural women in developing countries
5. Identify and apply sustainable strategies capable of fully integrating women into national economic development and rural development processes

Syllabus

General theories in development in relation to role of women; Government policies supporting women's involvement in rural development in developing countries including PNG; rural infrastructure & services; social and economic involvement of women in rural development in developing countries and in PNG; the household, women's role in agriculture production, use of multi–disciplinary approach to integrate women into the rural development process; relationship among the multiple roles rural women play in agriculture production, household food & nutritional security , family and community life; equal opportunity in education and training for rural women in developing countries for effective participation in rural development process; opportunities for rural women both as participants and beneficiaries in rural development; obstacles to women's participation in rural development.

Textbook

1. Boserup, E. (2007). Woman's Role in Economic Development, Earthscan, ISBN 9781844073924

References
1. Handaragama, S., Rathnayake, H. & Uluwaduge, P. (2013). On Women's Economic Participation in Rural Development. *International Journal of Education and Research*, August.
2. Anonymous (1975). On Role of Women in Rural Development. World Conference of International Women's Year (IWY) [cited 2016 May 24]; Available at: www.fao.org/docrep/x5589e/x5589e07.htm
3. Anonymous (2012). The Empowerment of Rural Women and Their Role in Poverty and Hunger Eradication, Development and Current Challenges. Contribution to the 56th Session of the United Nations Commission on the Status of Women. New York -27th February.
4. Anonymous (2011). The State of Food and Agriculture: Women in Agriculture, Closing the Gender Gap for Development, FAO, Rome, Italy.

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 515: ORGANIZATIONAL BEHAVIOUR

Hours per week: 6 (4-2-0)
Credit: 22

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and apply the concept of organizational behaviour
2. Identify and describe the foundations of individual behaviour
3. Understand and describe the typical organizational behaviour process
4. Apply the principles and theories of organization behaviour in resolving organizations' problems hindering employee engagement, organizational growth and sustainability

Syllabus

Introduction to Organizational Behaviours (OB)
Foundations of OB, importance and shortcomings of, approaches to OB. Definition and meaning; Why study OB? Learning – nature of learning, how learning occurs, learning and OB.

Foundations of Individual Behaviour
Diversity personal factor, environmental factor, organizational systems and resources, psychological factors. Personality - structure, determinants, personality traits and OB. Perception - Perceptual process, attribution, errors in perception, managing perception. . Attitudes - formation, factor, changing attitudes, job satisfaction. Value - types. Modes and Emotions. Motivation - challenges, importance, content theories and process theories. Applied motivation practices - rewards, job design, socio technical systems OB model, empowerment, goal setting. Learning - how learning occurs, principles of learning Work Stress - stress model, cause, consequences, coping strategies.

Group and Interpersonal Behaviour
Group dynamics - why groups form, types, group norms, cohensiveness, decision making / styles, strategies for improving decision making teams - special types of groups, types of teams, *Power and political behaviour* - sources of power, effective use of power. Organisational policies, forces creating political behaviour, forces creating political behaviour, personality and political behaviour. Conflict - Sources and strategies to resolve conflict. Leadership - styles, contemporary developments. Interpersonal communication - essentials, networks, communication technologies, non - verbal communication, barriers, strategies to overcome barriers. Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Followership, An introduction to Transactional Analysis (TA)

Organisational Process
Organizational design - types and their behavioral implications. Organizational change - cause for change, why change resisted - managing change. Organization culture - how is culture created and sustained.

OB Challenges
Managing diversity, globalisation, technology transformation, ethical behaviour. International Organizational Behaviour: trends in international business, individual and interpersonal behaviour in global perspective.

Textbooks

1. Colquitt, J. (2015). Organizational behaviour: improving performance and commitment in the workplace, Fourth edition. McGraw-Hill Education, 2 Penn Plaza, New York
2. Robins, S. P.& Judge, T. A. (2013). Organizational Behaviour, (15th Edition), Prentice Hall, USA
3. Ricky W. G. & Gregory, M. (2010). Organizational Behavior: Managing People and Organisations (10 Edition) Cengage Learning
4. Konopaske, R., Ivancevich, J. M. &Matteson, M. T. (2016). Organizational behaviour

and management, McGraw-Hill Education, New York.

Assessment

Continuous Assessment: 50%
Written Examination: 50%

URP 516: RURAL SOCIOLOGY

Hours per week: 5 (4-1-0)
Credit: 20

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and apply the concept of rural sociology as it applies to PNG
2. Describe the theoretical perspectives of rural sociology and their policy implications
3. Identify and describe the social systems in PNG and their impact on natural resource consumption, e.g. customary land
4. Analyse the challenges facing the social systems in PNG based on the theoretical framework

Introductory Concepts

Nature of sociology: definition of society, and the emergence of sociology; basic sociology concepts; social structure; social group; social institution; socialization

Theoretical Perspectives

Structural theory, conflict theory, functionalist theory and interactionist theory

Social Systems

Tribal society; feudalism, capitalism, pro-capitalistic systems, place of culture in society; social stratification and social structure (caste, class and patriarchy); mechanism of social change; rural political and administrative systems, rural economy. Rural sociology: approaches to the study of rural society, agrarian institutions, social issues and strategies for rural development, rural development, rural trends, urban edge, core-periphery dichotomy

Textbooks

1. Kornblum, W. (1988). Sociology in a Changing World; Holt, Riehart and Winston Inc.
2. Galaski, B. G. (1972). Basic concepts of rural sociology, Manchester University Press.

References

1. Smith, S. (2011). The Institutional and Intellectual Origins of Rural Sociology (PDF); Paper for 2011 Rural Sociology Assn. meeting.

Assessment

Continuous Assessment: 50%
Written Examination: 50%

URP 517: PROJECT EVALUATION, PLANNING AND SUSTAINABILITY

Hours per week: 5 (3-0-2)
Credit: 16

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Effectively use basic land and urban economics tools to evaluate major infrastructure projects
2. Understand when to complement this basic analysis with more sophisticated tools
3. Critique the process used to evaluate typical infrastructure projects
4. Describe a broad range of project types that are relevant to Urban and Regional Planning and related fields
5. Describe the ways in which project performance can be measured and improved
6. Analyse the impact of uncertainty on project sustainability and its measurement
7. Undertake an end-to-end project evaluation

Syllabus

Nature and features of large-scale infrastructure projects; Environmental Impact Assessment; Review of case studies of adaptation of orthodox planning techniques to specific planning issues in the developing countries. Project evaluation and feasibility studies; planning and management: Identification and formulation of a project; Analysis of a project, definition of a project, Private and social profitability; Speculative and public projects; Project management services; Project budget using various techniques, e.g. Residual Valuation Approach; Project proposal writing; Sources and sourcing of funds for project execution; costing and loan disbursements; professional scale of fees. Sourcing of professionals; co-ordination and management of project; Risk factors and risk management in project

execution; Risk-return trade-off; Difference between academic project and applied project report writing.

Textbook

1. Martland, C. D. (2011). Toward More Sustainable Infrastructure: Project Evaluation for Planners and Engineers, John Wiley.

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 518: SATELLITE IMAGE PROCESSING TECHNIQUES

Hours per week: 5 (1-0-4)
Credit: 10

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and describe iimage processing using Erdas Imagine S/W.
2. Apply image preprocessing techniques for problem solving
3. Understand and describe different enhancement techniques
4. Understand and apply different classification techniques
5. Produce accuracy report and change detection report from classified data

Syllabus

Introduction to Digital Images Processing: Concept of digital image, digital image processing and its advantages, image compression techniques, image statistics

Image Pre-processing: Radiometric corrections, geometric corrections, geo-referencing

Image Enhancement: Contrast enhancement, band combinations, band rationing, spatial filtering, edge enhancement, special transformations, image fusion; image enhancement with RADAR and LIDAR data sets

Information Extraction: Supervised and un-supervised classification techniques for land use / land cover mapping.

Accuracy Assessment and Change Detection: Hands on training on accuracy, assessment, and change detection and future trends in land use-land cover linkages

Textbook

1. Jenson J. R. (1986). Introductory Digital Image Processing – A Remote Sensing Perspective, Prentice Hall, New York. Wiley, New York

References

1. Departmental Practical Modules on Satellite Image Processing.

Assessment

Continuous Assessment:	50%
Practical Examination:	50%

URP 519: GNSS/GPS - THEORY AND PRACTICE

Hours per week: 6 (2-0-4)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and describe the concept of GNSS
2. Describe in full the components of GPS
3. Explain the various GPS positioning methods
4. Understand and discuss the limitations of GPS survey
5. Understand and describe the operational aspects of GPS

Syllabus

Introduction to GNSS
Positioning techniques; History and developments: GPS, GLONASS, IRNSS, COMPASS, GALILEO, etc.

GPS Components
Space segment, the control segment and user segment, Signal structure

GPS positioning methods
Positioning concept (resection from space), Point positioning, Relative positioning, Static positioning, Kinematic positioning

Limitations of GPS survey
Sources of error, Datum, Anti-spoofing and selective availability, Geoid model

Practical exercise using GPS
Familiarization with GPS instruments, implementing a GPS-based survey as a project

Textbook

James R. S. (1997). Introduction to Geodesy-The History and Concepts of Modern Geodesy, John Wiley & Sons, INC.

References

1. Departmental Modules

Assessment

Continuous Assessment (Theory & Practical): 50%
Written Examination: 50%

URP 520: RESEARCH METHODOLOGY

Hours per week: 6 (4-2-0)
Credit: 22

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Plan, undertake and manage an urban or regional planning research project
2. Collect survey data using appropriate means and undertake data analysis to generate findings
3. Relate research findings to literature and conceptual framework and draw appropriate conclusions
4. Prepare a standard research report, communicate the findings to a professional audience, and submit the research report for assessment.

Syllabus

Identifying a Research Problem

Reasons for research; the research process and research design; selection of a researchable topic; sources of research problems/topics; qualitative and quantitative research methods; types of research: applied, theoretical and action researches; literature review strategies; research culture and funding; consent of respondents and research ethics

Conceptual/Theoretical Framework and Literature Review Strategies

Purpose and functions of conceptual/theoretical framework; strategies; useful examples

Data Collection and Analysis

Secondary and primary data sources; sampling methods; statistical techniques; data collection; data coding/treatment; data analysis; report writing; open presentation/defence

Individual Research Project

Every student will undertake an independent research project that must make substantial contribution to knowledge in general and the planning profession in particular. Students are reminded that the lessons they learn from Statistics and Computer Techniques will be of immense benefit to them when writing their projects.

Textbooks

1. Babbie, E. R. (2010). The practice of social research, Belmont, CA: Wadsworth. H62.B2 2
2. Kothari, C. R. (2014): Research Methodology: Methods and Techniques, New Age, 978-8122436235
3. Galvin, J. L. (2009). Writing literature reviews: A guide for students of the social and behavioral sciences (4th Ed.). Glendale, C A: Pyrczak.

References

1. Maimon, E. P., Peritz, J. H., & Blake Yancey, K. (2006). A writer's resource: A handbook for writing and research. Boston, MA: McGraw Hill. PE1408.M3366 2006
2. Anonymous (2010). Publication manual of the American Psychological Association. Washington DC: APA. REFERENCE AC1.P83 2010
3. Creswell, J. W. (2009). Research design: qualitative, quantitative, and mixed approaches. Thousand Oaks, CA: Sage. H62.C6963 2009
4. Foster, J., Barkus, E., and Yavorsky, C. (2006). Understanding and using advanced statistics. Thousand Oaks, CA: Sage. HA29.F583 2006

Assessment

- Continuous Assessment (Theory & Practical): 50%
- Written Examination: 50%

URP 521: DISSERTATION

Credit: 138

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Plan, undertake and manage a research project

2. Prepare and submit a standard research report that is both academically and professionally sound.

Syllabus

Consolidation

This subject is to be regarded by students as a unique opportunity they have to demonstrate the academic, research and professional planning skills that they have gained throughout their Master's program.

Mastery of Academic Writing

A mastery of proficiency in academic writing, free from plagiarism, is a must for students. Plagiarism is an academic crime that all students must avoid. Students must use a uniform and approved referencing style (e.g. APA system) and submit both soft and hard copies of their dissertation before the stipulated deadline. Students must also realise that their dissertation will be graded by both internal and appointed external assessors.

Textbooks

1. Babbie, E. R. (2010). The practice of social research, Belmont, CA: Wadsworth. H62.B2 2
2. Kothari, C. R. (2014). Research Methodology: Methods and Techniques, New Age, 978-8122436235
3. Galvin, J. L. (2009). Writing literature reviews: A guide for students of the social and behavioral sciences (4th Ed.). Glendale, C A: Pyrczak.

References

1. Maimon, E. P., Peritz, J. H., & Blake Yancey, K. (2006). A writer's resource: A handbook for writing and research. Boston, MA: McGraw Hill. PE1408.M3366 2006
2. Anonymous (2010). Publication manual of the American Psychological Association. Washington DC: APA. REFERENCE AC1.P83 2010

Assessment

Dissertation is a subject that runs through three semesters. Continuous Assessment will be done by lecturers taking the subject. Every student's progress will be judged by the department as either SATISFACTORY or NOT SATISFACTORY. The final output in form of the Dissertation itself will be assessed and based on 100% by External Examiners appointed by the University.

URP 522: CLIMATE CHANGE: POLICY IMPLICATIONS FOR HUMAN SETTLEMENTS AND PLANNERS' RESPONSE

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand the physics of climate change
2. Describe the various contributing factors to climate change
3 Analyse the possible societal impact
4. Identify realistic mitigation and adaptation measures
5. Identify and describe international response to climate change

Syllabus

Introduction: Energy input / output leading to climate change, thermal equilibrium / temperature anomaly, role of greenhouse gas, role of volcanic eruption / aerosols, role of urbanization, policies and strategies: energy planning, energy generation and consumption, conservation, energy supply and demand, fossil fuel, clean energy; mitigation, adaptation, low carbon growth and economic development, REDD+, sea level rise, sinking islands, disaster induced by climate change, role of nations, international response, GHG emission in PNG, PNG's National Climate-Compatible Development Strategy Position as victim of climate change, climate refugee

Textbooks

1. Bicknell, J. (2009). Adapting cities to climate change: understanding and addressing the development change, Earthscan, London.
2. Dash, S. K. (2007). Climate change: An Indian Perspective, New Delhi, Cambridge University Press.

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 523: TRANSPORTATION ENGINEERING & PLANNING

Hours per week: 4 (3-1-0)

Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and describe the links between highway engineering and urban and regional planning
2. Identify and describe the critical elements of planning of airports
3. Identify and describe the critical elements of planning of ports and harbors
4. Identify and describe the critical elements of planning of railways and railway stations as a mode of transport
5. Reflect on the modes of transport in PNG and related transport policies and transport management strategies

Syllabus

Highway Engineering

Roles of transport, modes of transport, importance of highway transportation, principles of highway planning, highway alignment requirements, engineering surveys for highway location, highway materials, elements of transport planning, Selection of bridge sites.

Airport Planning

Airport site selection, aircraft characteristics, various surfaces of an aircraft, wind rose diagram. geometric elements of runway and taxiways, holding apron, parking configuration, terminal building visual aids, air traffic control, airport marking and lighting

Port and Harbor Planning

Site selection, design, construction, and operation of ports and harbors

Railways as Mode of Transport

Site selection of stations, components of a railway track, track alignment, traffic surveys, rack and pinion rails, gradient norms

Modes of Transport in PNG

Different modes of transport in the country; the transport policies and management strategies

Textbooks

1. Khanna, S. K. & Justo, C. E. G. (2010). Highway Engineering.9th edition, ISBN 8185240639
2. Khanna S. K. (1999). Airport Planning and Design, Nem Chand, 818524068X, 978-8185240688

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 524: URBAN HOUSING AND SETTLEMENT PLANNING

Hours per week: 4 (3-1-0)

Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and describe the theoretical underpinnings and relevant techniques for formulating urban housing strategies
2. Review current issues, trends and policies in the field of housing development, finance, and management, and summarize the housing needs of households.
3. Identify and analyse the salient features of the typical housing development process
4. Analyse and examine the challenges associated with squatter settlements around PNG cities and apply squatter upgrading strategies to resolve the impasse
5. Apply financial analysis techniques for housing development and management
6. Evaluate the importance of management and the many aspects of the manager's role in the operation and strategic planning involved in the development and day-to-day management of multifamily housing
7. Practice professional skills in learning to be an effective team member and representative to community partners

Syllabus

The formulation of housing policies and programs in various countries of the world. The determinants of standards and criteria in the design of houses: Formulation of minimum desirable standards of space and environment in building design. Ecological versus economic perspectives on environmental planning. Housing needs/demand and analysis. Housing Development Process: The institutionalised private and public development of housing estates covering

land acquisition and compensation, site planning, design and cost aspects, development finance and funding, development appraisal, construction and project management. Allocation of public housing units, and merchandising of private housing estates. Non-institutional housing development process: squatters traditional self-help and petty commodity production in housing; The Informal Housing Sector; Redevelopment schemes; slum improvement techniques, squatter upgrading strategies and urban renewal.

Textbooks

1. Rose, J. F. P. (2016). The Well-Tempered City, Harper Wave, ISBN: 9780062234728
2. Anonymous (2001). Cities in a Globalizing World: Global Report on Human Settlements, Routledge, ISBN 1853838063, 978-1853838064

References

1. Anonymous (1997). Building consensus for affordable housing / Field, Charles G – Washington DC: Fannie Mae Foundation, Housing Policy Debate - Vol. 8, no. 4 (p. 801-831).
2. Anonymous (2002). Housing affordability in three dimensions: Price, income and interest rates / Montoya, Juan; Trimbath, Susanne -- [Santa Monica, CA]: Milken Institute.
3. Charles, A. (1964). Housing in the Modern World.

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 525: LAND USE PLANNING AND SUSTAINABILITY

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and describe the significance of land use planning and city liveability/sustainability
2. Describe the optimum utilisation of land resources
3. Analyse sustainable development using socio-economic and environmental inputs
4. Understand and use the concept of integrated development in solving urban and regional problems

Syllabus

The nature, trends and patterns of urbanization; the benefits of land use planning, including conversion process of rural land to urban use; significance of job creation in rural areas as a measure to stop migration; Techniques of land use analysis; determination of Highest and Best Use; Evaluation of current land use effects and conflicts; planning standards and sub-division control; Land use estimation and projection methods; Land tenure and land policies; Mathematical modeling of urban land use and activity systems; Contemporary issues in Planning in the developing countries: The influence of Western planning culture on planning in developing countries; concepts of liveability and sustainability; important aspects of sustainability, concept of integrated development, socio-economic input in development planning, development and implementation of action plan leading to sustainable development

Textbook

1.Vedder, A. (2016). Land-Use Planning: Sustainability and Environment Hardcover, Callisto Reference, ISBN 1632397137 ,978-1632397133

References

1. Anonymous (2012). VGGT for Land Tenure Governance, Rome: FAO, Guidelines for land-use planning, FAO Development Series 1.
2. Anonymous (2011). Environmental Land Use Planning and Management, Second Edition, John Randolph: ISBN: 9781597267304.
3. Anonymous (2003). Land Use Planning: A Key to Sustainable Agriculture, Wrachien. Online ISBN 978-94-017-1143-2, Springer.

Assessment

Continuous Assessment:	50%
Written Examination:	50%

URP 526: PRACTICAL ON WATERSHED MANAGEMENT USING RS IMAGES

Hours per week: 6 (0-0-6)

Credit: 9

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and analyse watershed and watershed characteristics for watershed management
2. Practise different tasks on morphometric analysis using RS and GIS software
3. Describe how to manage watershed

Syllabus

Introduction

Introduction, philosophy and concept and role of Remote Sensing in watershed conservation, planning and management

Watershed Characterization and Morphometric Analysis

Watershed hydrology and physical processes in Watershed; Slope, aspect, flow direction, flow accumulation, drainage, network & morphometric analysis, applications of Digital Elevation Models in Water Resources; Watershed Prioritisation; Watershed conservation planning and management

Watershed Management

Runoff estimation, soil erosion/soil loss mapping using satellite data, spatio-temporal soil loss characterizing; soil and water conservation-planning using RS &GIS; erosion, erodibility and Sediment Yield Modeling.

Textbook

1. Murthy, K. S. (1998). Watershed Management in India, 3rd edition, Wiely Eastern Ltd. / New Age International Ltd., New Delhi
2. Murty, J. V. S. (2013). Watershed Management, New Age International Pvt. Ltd, 2nd edition, ISBN 978-8122435184
3. Lyon, J. G. (2002). GIS for Water Resource and Watershed Management, CRC Press, 1st Edition, ISBN 978-8184892932

References

1. Departmental Practical Modules on Watershed management.

Assessment

- Continuous Assessment: 50%
- Practical Examination: 50%

URP 527: MAPPING OF URBAN LAND USE WITH HIGH RESOLUTION IMAGES

Hours per week: 6 (0-0-6)

Credit: 9

Learning Outcomes

Upon completion of this subject, students will be able to:

1. Understand and apply high resolution images for land use mapping
2. Undertake geometric corrections
3. Extract urban land use features from high resolution images for environmental planning purposes

Syllabus

Introduction to High Resolution Images

What are high resolution images? Relevance to urban and regional planning; display, interpretation and enhancement techniques, including pan-sharpened images.

Geometric corrections

Geo-referencing of high resolution images using polynomial transformation and other techniques; exercises on geometric corrections

Extraction of urban land use features

Identification of urban features essential in planning; creation of geo-database, extraction of urban features; urban map composition

Textbook

1. Lillesand, T. M. & Kieffer, R. W. (2008). Remote Sensing and Image Interpretation. 6th Edition, Wiley, New York

References

1. Departmental Module

Assessment

Continuous Assessment: 50%
Practical Examination: 50%

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