1.1 SCHOOL OF MATHEMATICS AND COMPUTER SCIENCE

Head of School
Mohsen Aghaeiboorkheili, PhD (UTM, Malaysia), MSc (Khaje Nasir Toosi, Iran), BSc (IAU, Iran)

Computer Science Section

Associate Professors
Arun Kumar Singh, PhD (Shobhit University, India), M.Tech (IIIT-A, India), B.Tech(Ambedkar University, India)

Senior Lecturers
Rajendran Bhojan, PhD, MPhil, MCA, BSc (Bharathiar University, India)
Benson Mirou, MSc (University of Wales, United Kingdom), BSc (UPNG, PNG)

Lecturers
Lenz Nerit, MSc (Victoria University of Wellington, New Zealand), BSc (Unitech, PNG)
YalingTapo, MSc (University of Southern Queensland, Australia), BSc (Unitech, PNG)
Peter Helebi, MSc (University of South Australia, Australia), BEng (Unitech, PNG)
Nicholas Puy, MSc (Central University of Tamil Nadu, India), BSc (Unitech, PNG)

Mathematics Section

Professors
Gumral Hasan, PhD (Bilkent University, Turkey), MSc, BSc (Middle East Technical University, Turkey)

Senior Lecturers
Chris Wilkins, PhD (Uni of Adelaide, Aust), MSc (Uni. of Adelaide, Aust), BSc (Uni of Adelaide, Australia)

Lecturers
Mohsen Aghaeiboorkheili**,** PhD (UTM, Malaysia), MSc (Khaje Nasir Toosi, Iran), BSc (IAU, Iran)
John Lanta, MSc (Queensland University of Technology, Australia), BSc (UPNG, PNG)
Samuel Dunstan, PhD (University of Warwick, United Kingdom), M.Tech (Unitech, PNG), BEng(Unitech, PNG)
Mansooreh Kazemilari, PhD (UTM, Malaysia), MSc, BSc (Azad University, Iran)
Boaz Andrews, MPhil (Unitech, PNG), BSc (UPNG, PNG)
Raymond Kuna, MPhil (Unitech, PNG), BSc (UPNG, PNG)
Doris Benig, MPhil (Macquarie University, Australia), BSc (Divine Word University, PNG) (Study Leave - NZ)

Senior Technical Instructor
Abuzo Sankwi, BSc (Unitech, PNG)
Joel Tahie, M.Ed (Divine Word University, PNG), B.Ed (Divine Word University, PNG)

Part-time Tutors
Bobby Angopa, BSc (UPNG, PNG)
Vincent Mbuge, MEd (Divine Word University, PNG), BSc (UPNG, PNG)
Luke Kolalio, BSc (UPNG, PNG)
Alois Wemin, BSc (UPNG, PNG)
Issac Angra, BSc (UPNG, PNG)
Jean Vava, BSc (UPNG, PNG)
Savithiri Kothumudi Mathan, MSc, BSc, BEd (Bharathiar University, India)
Kialakun Galgal, BEng (Unitech, PNG)
Japhat Tikil, BEd (UoG, PNG)

Technical Team
Technical Officer
Abel Silas, Diploma in Information Technology (Don Bosco Technical Institute, PNG)

Administration Team
Administrative Officer
Sine Banit, BoM (Divine Word University, PNG)

Executive Secretary
Mary Poni-Aisi, BoM (Divine Word University, PNG)

Secretary
Bumae Zate, Office Management (Commercial Training College, PNG)

Janitor
Rebeca Koen

Degree Programs

The School of Mathematics & Computer Science consists of two sections, Mathematics and Computer Science. Apart from the service courses, the School offers the following four-year academic programs leading to:
(a) Bachelor of Science in Computer Science
(b) Bachelor of Science in Applied Mathematics

These degree programs are designed to produce Applied Mathematician and Computer Technologists who will be able to pursue careers in industry, academia or government sectors.

Employment opportunities for graduates in applied mathematics with good grades exist in many areas of government and private sector where modelling and the analysis of data is required. This includes banks, research institutes, statistical officers and engineering. There are also employment opportunities at the upper secondary and tertiary levels of the education system where graduates with good mathematics degrees are in short supply. The Applied Mathematics programme gives enough time and emphasis to computer oriented subjects to open up employment opportunities in the IT sector.

The graduate in computer science will be equipped with skills and knowledge in the broad area of Computer Science to solve critical problems of stakeholders ethically, sustainably and efficiently. They possess strong analytics skills in troubleshooting and provide better alternative solutions and be able to communicate better and conduct themselves ethically.

Entry requirements for undergraduate programs:

Bachelor of Science in Computer Science: The entry requirement is a Grade 12 certificate with a minimum of B grades in Advanced Mathematics, English, and Physics from the Science stream. Grade 12 school leavers are also expected to sit the Unitech STAT-P test to qualify for entry.

Bachelor of Science in Applied Mathematics: The entry requirement is a Grade 12 certificate with a minimum of B grades in Advanced Mathematic, English, and Physics from the Science stream or Advanced Mathematics, English and Economics from the social science stream. Grade 12 school leavers are also expected to sit the Unitech STAT-P test to qualify for entry.

Entry requirements for postgraduate programs:

The School also offers postgraduate degrees in Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) by research in Mathematics and Computer Science.

Entry requirement for a MPhil is Bachelor's Degree in Science with above average grades from a recognized university and for a PhD program Master of Science degree is required.

COMPUTER SCIENCE COURSE STRUCTURE

First Year First Semester

Code	Subject	Contact Hours	Credit
EN 112	Engineering Mathematics 1	6	21
CD111	Development Practice & Sustainability	6	18
CS113	Introduction to ICT	6	18
CS 115	Programming 1	6	19
		24	**76**

First Year Second Semester

CS123	Advance ICT	6	18
CS122	Mathematics for Computer Science	6	20
EN123	Introduction to Circuits and Electronics	6	20
CS125	Programming ll	6	19
		24	**77**

Second Year First Semester

Code	Subject	Contact Hours	Credit
CS 210	Programming lll	6	19
CS 211	Networking l	6	15
CS 212	Database l	6	19
CS 213	Concepts of Computer Science	6	19
		24	**72**

Second Year Second Semester

CS 220	Programming lV	6	19
CS 221	Applied Statistics	6	17
CS 222	Internet Programming l	6	17
CS 223	Operating Systems	6	17
		24	**70**

Third Year First Semester

Code	Subject	Contact Hours	Credit
CS 311	Networking II	6	17
CS 312	Database II	6	17
CS 313	Numerical Methods	6	20
CS 314	Data Structures and Algorithms	6	19
		24	**73**

Third Year Second Semester

CS 321	Software Engineering	6	20
CS 320	Internet Programming ll	6	17
CS 322	Systems Programming with C/C++ [Elective Topic Subject]	6	17
CS 323	Computer Hardware	6	17
CS 324	Computer Security	6	17
CS 325	Introduction to Data Science	6	17
CS 326	Computer Modelling	6	17
CS 327	Distributed Systems	6	17
		24	**71**

Fourth Year First Semester

Code	Subject	Contact Hours	Credit
CS 410	Research and Presentation skills	6	19
CS 413	Networking III	6	20
CS 414	Advanced Topics in Computer Science	6	18
CS 415	Special Topics	6	19
		24	**76**

Fourth Year Second Semester

CS 420	Research Project	6	19
CS 421	Operations Research	6	19
CS 422	Business and Entrepreneurship [Elective Topic Subject]	6	18
CS 423	Advanced DBMS	6	17
CS 424	Software UI Design	6	17
CS 425	Internet of Things	6	17
CS 426	Mobile Programming	6	17
		24	**73**

Graduate Statement (GS)

In addition to possessing the graduate attributes of PNGUOT students (lifelong learner, critical thinker, effective communicator, cultural modernist, morally upright, and technologically savvy) computer science graduates will:

- Be proficient at using existing computing technologies.
- Be proficient at developing and implementing new computing technologies.
- Be proficient in processing, analysing, and presenting data.
- Understand the core concepts that underpin computer systems.

Course Learning Outcomes (CLOs)

1	An ability to apply theoretical knowledge to practical situations.
2	An ability to analyze a problem, and identify and define the Project requirements appropriate to its solution.
3	Ability to analysis, design, implement, and evaluate a computer-based systems, processes, components, or programs by acquiring and using appropriate tools.
4	To have theoretical background compatible with international standards in the field.
5	An ability to understand the professional, ethical, legal, and security issues and responsibilities, and the societal impact of computing.
6	An ability to analyze the local and global impact of computing on individuals, organizations, and society.
7	An ability to use current techniques, skills, and tools necessary for modern Information Computing Technology and Telecoms support services.
8	An ability to apply mathematical methods and algorithmic principles to the development and maintenance of computer-based systems.
9	An ability to apply software engineering principles in the construction of software systems.
10	Have the analytical skills to process, analyze and interpret data.

11	An ability to communicate effectively in both oral and written individually and in team.
12	An ability to apply entrepreneurial skills in ICT.

SUBJECT DETAILS

EN112: ENGINEERING MATHEMATICS I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Engineering Mathematics I
Subject Code	EN 112
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**22**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

To provide students with the fundamental mathematical concepts, principles and analytical processes that underpins the field of Engineering. The topics of functions is important is studying behaviour of systems and limits help to critically analyse limitations of the systems. Differentiation and integration techniques help to calculate features and characteristics of a system while complex numbers help to represent systems where the natural numbers cannot adequately cater.

Subject Topics

1. **Functions & Limits:** Functions: Types of functions; Composition of functions; Inverse functions; Logarithmic and exponential functions; Trigonometric and hyperbolic functions; Inverse trigonometric and hyperbolic functions.
2. **Sequence and Series:** Infinite Series and Processes: Sequences; Partial sums; Tests for convergence of a series of real numbers; Power series; radius and interval of convergence of a power series; Taylor and McLaurin series.
3. **Differentiation & Applications:** Differentiation: Differentiation by using limits; Techniques of differentiation; Applications of differentiation - maxima and minima, tangents to curves, small increments
4. **Integration & Applications: Integration: Ant derivatives;** The First and Second Fundamental Theorems of Calculus; Techniques of integration - substitution, by parts; Applications of integration - the area enclosed between two curves, volumes of solids of revolutions.
5, **Complex Numbers:** Cartesian, polar and exponential forms of a complex number; Euler's Formula; De-Moiré's Theorem; Roots of a complex number.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

SLO1: Demonstrate a clear understanding of trigonometric, logarithmic, exponential and hyperbolic functions, and their inverses.

SLO2: Test series for convergence, and find radii and intervals of convergence of power series.

SLO3: Apply the techniques of differentiation to solve problems involving maxima and minima and related rates.

SLO4: Use integration to find areas enclosed between curves, and volumes of solids of revolution.

SLO5: Solve problems involving complex numbers.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(35%)**
Assignment	**(15%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 15% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 35% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Stroud K. A. Engineering Mathematics: Programmes and Problems. 6th Edition (ELBS/Macmillan 2000)
2. Anton H, Calculus with Analytical Geometry, 6th Edition (Wiley 1999)

References

1. Kreyszig E, Advanced Engineering Mathematics, 7th Edition Wiley, 1999.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS 113: INTRODUCTION TO ICT

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Introduction to ICT
Subject Code	CS113
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**18**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject will develop the fundamental ICT concepts and principles. The subject also provide technical skills needed to prepare the students to be able to use these skills in the other areas of their studies and give a broad perspective of what is covered in their preceding years.

Subject Topics

1. Hardware

    Desktop, laptop, tablet and smartphone systems. Primary and secondary storage devices. Input/output devices, including keyboards, pointing devices, touch screens, networks and printers

2. Operating Systems

    Windows and UNIX systems. Graphical User Interfaces (GUI) and command line interfaces

3. Application Software

    Office systems, graphics programs, web browsers, email clients, etc.
    File Management: Types of files. File properties. File systems. Directory trees. File manipulation (naming, renaming, storage, retrieval, viewing content, updating content, moving, and deleting). Read-only and hidden files. File backup. File editors.

4. Graphics Pixels and images. Image size and resolution. Bitmap images. Graphics compression standards. Using a graphics program to manipulate images. Creating animations from still images

5. Word Processing

    Formatting and styles. Tables. Drawing objects. Mailing lists.

6. Spread Sheet

7. Database

8. VBA Programming

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

LO 1. Describe the hardware components of their workstation or laptop computer;

LO2: Describe the components of their computer's operating system;

LO3: Save, manipulate and retrieve files from storage;

LO4: Set up a computer to access the resources of hard-wired and wireless networks;

LO5: Use a word processor to produce textual documents;

LO6: Use a spread sheet to solve real-world problems.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(35%)**
Assignment	**(15%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 15% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 35% towards the final grade for the subject.

Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Using Information Technology: A Practical Introduction to Computer & Communications" by Williams Sawyer, 6th Edition (McGraw HILL)

References

1. Department provided resources
2. Internet

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS114: PROGRAMMING I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Programming I
Subject Code	CS115
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Grade 12 Advanced Mathematics
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

To provide students with the fundamental programming concepts, principles and analytical processes that are involved in solving problems. This include analysing problems using flow charts and pseudo-codes and derive step-by-step approach in solving the problems.

Subject Topics

Topic 1: Introduction to programming languages

- History of programming languages
- Current languages and their use
- Data Types: Integer, Floating point, Characters, Strings, Boolean
- Introduce variables-local and global
- and objects in known programming language

Topic 2: Program Design

- Understanding the problem-analyse and derive flow charts and pseudo-code.
- Develop algorithms to solve problems

Topic 3: Using Integrated Development Environment

- Installing compilers
- Write simple programs using a given IDE and compile source codes to run programs
- Debugging code of errors: compile-time and run-time errors

Topic 4: Decision Constructs

- Introduce *if-then*, *if-then-else* statements and *nested if* logical statements
- Use of logical operators: AND/OR NOT
- Switch/case constructs
- Application of decision constructs to solve problems.

Topic 5: Iteration Constructs

- For loops
- While loops
- Do while loops
- Loop counters
- Infinite loops
- Breaking out of loops
- Using iteration to simplify task.

Topic 6: Functions and Procedures

- Writing and calling user-defined functions
- Passing parameters by value and by reference

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

Learning Outcomes:
LO1: Install a compiler and/or language IDE on a computer;
LO2: Develop algorithms to solve simple problems;
LO3: Design small programs to solve these problems;
LO4: Write programs illustrating an understanding of variables and data types;
LO5: Write programs using functions, selection and iteration to solve problems.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(30%)**
Assignment	**(14%)**

Lab	**(6%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 14% towards the final grade for the subject.

Assessment 2 - **Lab:** There will be 3 labs contributing 6% towards the final grade for the subject.

Assessment 3 - **Test:** There will be 3 tests contributing 30% towards the final grade for the subject.

Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Introduction to Programming I-using NetBeans-A Student Manual (Florence Tiu Balagtas, Version 1.3, June 2006)
2. Introduction to Programming Using Java (David J. Eck, Version 6.0, June 2011)
3. Departmental electronic resources (reference books, relevant web articles, computer software).
4. Recommended Programming Tools: NetBeans and Eclipse

References

1. Department provided resources
2. Internet

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS123: ADVANCE ICT

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Advance ICT
Subject Code	CS123
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**18**
Delivery Mode	On campus
Prerequisites	CS 113
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject will develop the fundamental ICT concepts and principles. The subject also provide technical skills needed to prepare the students to be able use these skills in the other areas of their studies and give a broad perspective of what is covered in their preceding years.

Subject Topics

1. **Introduction to Web Design:** The HTML protocol. HTML editors. Designing a simple web page. HTML tags for simple text formatting.
   HTML tags for tables, lists, images and anchors. Introduction to styles and cascading style sheets. Separating content from design.
2. **Introduction to Databases:** Database terminology. Comparison of databases and data files. Organization of information. Flat-file databases. Using a spreadsheet to create a simple database. Relational databases. Key fields and indexes. Hierarchical databases.
3. **Macro Programming:** Automating tasks using macros in spreadsheets, word processors and text editors. Recording and editing macros.

4. **ASCII Coding:** The ASCII character set. Hidden and control characters. Differences between operating systems. Manipulating ASCII codes. Other coding systems (e.g., MIME64). Binary files.
5. **Computer Graphics:** Pixels and images. Image size and resolution. Bitmap images. Graphics compression standards. Using a graphics program to manipulate images. Creating animations from still images.
6. **Sound**: Digitizing sound. Compression standards. Proprietary and free protocols. Application programs.
7. **File Compression**: Advantages and disadvantages of compression. Use of data compression programming.MD5

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

LO1: Design a simple web page;
LO 2: Construct and query a simple flat-file database.
LO3: Write simple macro programs in a spreadsheet, word processor or text editor;
LO4: Manipulate text and handle hidden text characters;
LO5: Edit graphics images and change the properties of images;

Assessment Tasks and Weighting

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(35%)**
Assignment	**(15%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 15% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 35% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

J. Glenn Brookshear, Computer Science: An overview, 6th Edition (Addison Wesley Longman, Inc, 2000)

References

1. Department provided resources
2. Internet

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS122: MATHEMATICS FOR COMPUTER SCIENCE

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Mathematics for Computer Science
Subject Code	CS122
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Grad 12 Advanced Mathematics
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject will develop the fundamental ICT concepts and principles. The subject also provide technical skills needed to prepare the students to be able use these skills in the other areas of their studies and give a broad perspective of what is covered in their preceding years.

Subject Topics

Topic 1:

Definition and algebra. Orthogonal vectors. Dot, cross and scalar triple products and their applications. Angle between vectors. Vector projections. Vector equation of lines in 3D space. Equations and normal of planes n 3D space. Sample problems involving lines and planes. Application to computer modelling.

Topic 2: Matrices:

Definition and algebra. Determinants, inverse matrices and application to solving systems of equations. Elementary row operations. Echelon and row reduced forms, with application to solving systems of simultaneous equations and finding inverse matrices. 3D rotation matrices.

Topic 3: Decimal, Binary, Octal and Hexadecimal Number Systems:

Meaning of the nth digit. Prime numbers. The sieve of Eratosthenes. Composite numbers and factoring algorithms. Modulo arithmetic and applications. Counting in different bases. Conversion between bases. Modulo arithmetic in different bases.

Topic 4. Boolean Algebra:

Truth and falsity. Definition and use of AND, OR, NOT, XOR. Laws of Boolean algebra, with truth table proofs. Simplifying Boolean expressions. Application to IF and WHILE constructs.

Topic 5: Iteration and Recursion:

Series, with illustrations. Recursion algorithms and example recursive functions (factorial function, Fibonacci series, flood-filling, towers of Hanoi).

Topic 6: Counting

Fundamental counting principle, permutations, and combinations. The pigeon hole principle. The binomial theorem. Counting algorithms.

Topic 7: Proof and disproof

Modus ponens and modus tollens. Mathematical induction. Patterns of proof. Well-ordering. Disproof.

Topic 8: Tree structures

Binary and non-binary trees. Application of trees to storage/retrieval problems, including search metrics. Self-balancing (B) trees. Iterative and recursive tree walk algorithms.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Use vectors and matrices to solve problems relevant to computer science.
2. Use and convert between different number base systems.
3. Use results from Boolean algebra to manipulate and simplify logic constructs.
4. Demonstrate the difference between iteration and recursion when solving various problems.
5. Apply sets and counting principles on sets to computer algorithms.
6. Use formal logic is used in the development of systems.
7. Show how tree structures can be used to organize, store and retrieve data efficiently.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(33%)**
Assignment	**(17%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 4 assignment contributing 17% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 33% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Discrete Mathematics and Its Applications, Seventh Edition (2012), Kenneth H. Rosen
2. Computer Science – An Overview, Eleventh Edition (2012), J. Glen Brookshear
3. Other online resources.

References

3. Department provided resources
4. Internet

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS125: PROGRAMMING II

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Programming II
Subject Code	CS125
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	CS 115 Programming I
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

To provide students with the fundamental programming concepts, principles and analytical processes that are involved in solving problems. Furthermore, to provide students with the opportunity to implement algorithms in programs to solve problems.

Subject Topics

Topic 1: Using Characters and Strings

- Converting between characters and strings. String manipulation (joining strings, sub-strings, extracting characters from strings, etc.).

Topic 2: Data Structures: Arrays: Using Arrays to store and manipulate data.

Topic 3: Using Algorithms: Sorting using Arrays

Topic 4: Manipulating File:

a. File types. Opening, reading from, writing to, appending to and closing text files.

Topic 5: Programming Approaches:

- Modular Programming-Top-down program design
- Object-Oriented Programming- Introduction to classes and objects. Creation of simple objects. Use of library classes.
- GUI and Event-triggered Programming: Using buttons, edit boxes, images, lists, etc. Tying code to controls.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

Learning Outcomes:
LO1: Write programs that manipulate characters and strings;
LO2: Use arrays to solve problems like sorting data;
LO3: Read information from files into a program, and write program output to file;

LO4: Write programs using the principles of program design;
LO5: Create and use simple objects, and use library classes;
LO6: Write GUI programs utilizing various controls like buttons, lists, etc.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(30%)**
Lab	**(6%)**
Assignment	**(14%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 114% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 test contributing 30% towards the final grade for the subject.
Assessment 3 -	**Lab:** There will be 3 labs contributing 6% towards the final grade for the subject
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Introduction to Programming I-using NetBeans-A Student Manual (Florence Tiu Balagtas, Version 1.3, June 2006)
2. Introduction to Programming Using Java (David J. Eck, Version 6.0, June 2011)
3. Departmental electronic resources (reference books, relevant web articles, computer software).
4. Recommended Programming Tools: NetBeans and Eclipse

References

5. Department provided resources
6. Internet

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS125: PROGRAMMING III

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Programming III
Subject Code	CS210
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	CS 115 Programming II
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This will provide Object-Oriented Programming concepts. It covers designing Classes, Object and object referencing, Inheritance, Polymorphism, Abstraction and Encapsulation. Furthermore, the course covers String class and methods, Predefined and user-defined classes and objects. Use of existing data types and objects in the Java Library. Program creation using inheritance, polymorphism and interfaces. Introduction to applets, class construction, methods and message passing arrays, string processing, file processing,

Subject Topics

Topic 1: Intro. To OOP Objects and Classes
- What is OOP?
- What is a class?
- Class as an object container
- Constructor class & methods
- Object instantiation

Topic 2 Abstraction
- Abstraction
- Encapsulation

Topic 3: Inheritance and Polymorphism
- Inheritance
- Polymorphism

Topic 4: Abstract Classes and Interfaces
- Design and use abstract classes
- Design and use interfaces

Topic 5: Application of OOP
- Derive a subclass from a superclass
- Invoke superclass methods using keyword super
- Access data and methods from using the protected modifier

Subject Learning Outcomes (SLOs)

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

LO1: Develop understanding of Java objects and classes.
LO2: Develop understanding of user defined and predefined class (object) types.
LO3: Demonstrate ability to formulate algorithms, to solve problems and to implement those solutions using objects and classes
LO4: Develop skills in object-oriented design and use of appropriate applications such as applets
LO5: Develop an understanding of class construction using subprograms such as methods with basic data input output capability.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(30%)**
Lab	**(6%)**
Assignment	**(14%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 114% towards the final grade for the subject. .
Assessment 2 -	**Test:** There will be 3 test contributing 30% towards the final grade for the subject.
Assessment 3 -	**Lab:** There will be 3 labs contributing 6% towards the final grade for the subject
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Java Foundations: Introduction to Program Design and Data Structures, by Lewis, DePasquale, and Chase, published by Addison Wesley, 2008.

References

1. Program Development in Java, Barbara Liskov
2. Object-Oriented Design & Patterns, Cay Horstmann, Second Edition.
3. Practical Object Oriented Design, Bhuvan Unhelkar
4. Effective Java, Josh Bloch
5. Internet

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS211: NETWORKING I	
Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Networking I
Subject Code	CS211
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**16 (**3 Lect + 3 Lab)
Delivery Mode	On campus
Prerequisites	CS113, CS114
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This subject will introduce students to networks and communication in the modern world. LANs, WANs, Internet and the changing Networking Environment. The subject will look at the OSI model its 7 layers and the network protocols and devices that allow communication at each layer. Compare the OSI and TCP/IP models. Discuss the various Ethernet technologies. Discuss IPv4 basics, sub-netting, CIDR, VLSM and Summarization. Discuss IPv6 basics its communications types and basic network configuration. Configure a network operating system using the Cisco IOS.

Subject Topics

1. Networking Standards
   Industry Standards Organisations in the world
   OSI model and TCP/IP model
2. Transmission Basics and Networking Media
   Networking Hardware
   Types of medium for transmission
   Physical layer protocols
   Data link layer protocols
   Media Access Control
3. TCP/IP Protocols
   Rules of communication
   Data Encapsulation
   Data Access (Network Addresses)
4. Topologies and Ethernet Standards
   Ethernet protocols
   LAN switches
   Address Resolution Protocol
5. Network Layer protocols
   Routing and Routers
6. IPv4 Basics

Sub-netting
CIDR
VLSM and Summarisation

7. IPv6 Basics
   Communication types
   Basic Network Configuration
8. Transport and Application layer protocols
   TCP and UDP
   Application layer services and Port Numbers
9. Network Operating Systems
   Configuring a network operating system

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

LO 1. Understand the characteristics and applications of various networking technologies;

LO 2: Understand how a collection of communication protocols co-operate and communicate to achieve the overall communication function;

LO 3 Have a working knowledge of the protocols at each of the main levels of the OSI seven-layer reference model and the TCP/IP;

LO 4: Carry out network designs using an appropriate network simulation tool;

LO 5: Understand packet forwarding and the role of routing protocols;

LO 6: Understand error detection and recovery mechanisms.

LO 7: Understand how features such as flow control and quality of service are achieved.

Assessment Tasks and Weightings

The course has two components: Continuous Assessment (Internal) is 50% and Final Examination is 50%.

Unit Assessment consists of three assignments, two tests and a final examination as summarised below. Students must also refer to the Assignments, Tests and the Subject Assessment Guide for Networking I: Detailed information is provided for each assignment.

Students must also refer to the Subject Assessment Details.

Tests	**(27 %)**
Assignments	**(23%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 2 Tests contributing 27% towards the final grade for the subject.

Assessment 2 - **Assignment:** There will be 2 assignment contributing 23% towards the final grade for the subject

Assessment 3- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Dye, Mark A., Reid, Allan D.: "Introduction to Networks Companion Guide", Cisco Press, 2014.

References

1. Department Resources
2. Online Materials

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS212: DATABASE I

Course(s)	Bachelor of Sience in Computer Science (NQF Level 7)
Subject Name	Database I
Subject Code	CS212
Duration	13 Teaching weeks
Contact Hours	6 (4 hours lectures, 2 hours lab)
Credit Points	19
Delivery Mode	On campus
Prerequisites	CS114
Co-requisites	None
Subject Coordinator	TBA

Synopsis

To provide students with the fundamental programming concepts, principles and analytical processes that are involved in solving problems. This include analysing problems using flow charts and pseudo-codes and derive step-by-step approach in solving the problems.

Subject Topics

1. Database background. Database architecture.

- Data redundancy and interdependence
- Database environment
- Database architecture: 1-tier, 2-tier, 3-tier

2. Relationship theory –
    - Data models
    - Entity-attribute relationship model
    - Examples and applications
    - Relationship theory – Domains, keys
    - Data analysis and database schema
    - Constrains on attributes
3. Introduction to Normalization
    - Single-valued facts
    - Dependencies
    - The three normal forms
    - BCNF
4. Data Manipulation
    - Data manipulation using SQL commands
    - Examples with diagrammatic support
    - SELECT and FROM clause
    - WHERE clause
    - GROUP BY and HAVING clause
    - ORDER BY

5, Database Programming
    - Embedded SQL
    - Database connectivity
    - Calling Store procedures with and without parameters
    - Cursor technology

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:
After completing this unit students will be able to:

Learning Outcomes:
LO1: Demonstrate basic understanding of Database Technologies.

LO2: Define and understand Database terminologies.
LO3: Design Database using conceptual model such as ER modelling.
LO4: Construct, manipulate and manage a Database system using a DBMS.
LO5: Understanding of Programming SQL using a programming language and connecting using client/server model

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(30 %)**
Lab	**(10 %)**
Assignments	**(10%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 3 Tests contributing 30% towards the final grade for the subject.
Assessment 2 -	**Lab:** The laboratory practice will contribute 10% towards the final grade for the subject
Assessment 3 -	**Assignment/Group work:** There will be 2 assignment contributing 10% to the final grade of the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework

References

1. Database Management systems (Ramakrishnan Genhrke, Third edition 2003)

2. Departmental electronic resources (reference books, relevant web articles, computer software).

3. Internet resources.

Relevant Unitech Policies

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CS213: CONCEPTS OF COMPUTER SCIENCE (NQF LEVEL 7)

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Concepts of Computer Science
Subject Code	CS213
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	None
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This course provides the fundamental concepts of Computer Science through five major fields: Computer Applications, Computer Architecture and Data Representation, Computer Systems, Problem Solving and Programming and ICT in society, the course provides elements to understand and effectively interact with the information technology infrastructure of today's world.

Subject Topics

1. Computer Applications
2. Computer Architecture and Data Representation
3. Computer Systems
4. Algorithmic Problem Solving and Programming
5. Information and Communications Technology in Society

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

Learning Outcomes:
LO1: Write programs that manipulate characters and strings;
LO2: Use arrays to solve problems like sorting data;
LO3: Read information from files into a program, and write program output to file;
LO4: Write programs using the principles of program design;
LO5: Create and use simple objects, and use library classes;
LO6: Write GUI programs utilizing various controls like buttons, lists, etc.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(30 %)**
Lab	**(6 %)**
Assignments	**(14%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 3 Tests contributing 30% towards the final grade for the subject.
Assessment 2 -	**Lab:** The laboratory practice will contribute 6% towards the final grade for the subject.
Assessment 3 -	**Assignment:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 14% towards the final grade for the subject
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

References

1. Database Management systems (Ramakrishnan Genhrke, Third edition 2003)

2. Departmental electronic resources (reference books, relevant web articles, computer software).

3. Internet resources.

Relevant Unitech Policies

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CS220: PROGRAMMING IV

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Programming IV
Subject Code	CS220
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Programming III
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This course covers advanced programming techniques. This includes testing and debugging, genericity, collection frameworks, recursion and dynamic programming and some event handling and Graphical User Interface (GUI) programming as well as documentation of code.

Subject Topics

1. Testing and Debugging
    - Debugging programs: handling exceptions
    - Testing Activities-Integration testing, function testing, Acceptance testing
    - Unit Testing (such as using JUnit in Java)
        - Static Testing (at compile time)-code walk through, code inspection
        - Dynamic Testing (at runtime)-black box testing, white box testing
2. Java Collections Framework
    - List -- Array List, Linked List, Vector, Stack
    - Queue – Priority Queue, Array Queue
    - Set -- Hash Set, Tree Set
3. Graphical User Interface Programming:
    - Principles,
    - Event-driven programming,
    - Model-View-Controller architecture, JavaFX Framework
4. Recursion and Dynamic Programming (DP)
    - Reducing problems into smaller problems in order to solve larger problems
    - Using Memorization for DP algorithms
5. Generics
    - Generic Types/Parameterized types
    - Bounded/Unbounded Types
    - Wildcard Subtyping
    - Erasure and Restrictions on Generic Types

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

Learning Outcomes:
LO1: Develop understanding of writing, testing and debugging code.
LO2: Develop understanding in Java Collection Frameworks and API libraries.
LO3: Develop understand of designing GUI for applications in Java
LO4: Develop skills in recursion and dynamic programming techniques to solve problems
LO5: Demonstrate ability to formulate algorithms, to solve problems and to implement solutions using genetic algorithms.
LO6: To learn how to write annotations and documentation of code.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(30 %)**
Laboratory practice	**(6%)**
Assignments	**(14%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 3 Tests contributing 30% towards the final grade for the subject.
Assessment 2 -	**Lab:** The labs will contribute 6% towards the final grade for the subject.
Assessment 3 -	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 14% towards the final grade for the subject
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%

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Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Y, Daniel Liang: "Introduction to Java Programming", 8th Edition, Prentice Hall, 2011.

References

1. Introduction to Programming Using Java (David J. Eck, Version 6.0, June 2011)
2. Department provided resources
3. Internet

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS221: APPLIED STATISTICS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Applied Statistics
Subject Code	CS221+
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS112 Mathematics for Computer Science
Co-requisites	None
Subject Coordinator	TBA

Synopsis

To develop an understanding and working knowledge of Statistics and statistical procedures. The course is intended to provide a background capacity in statistical description and analysis. The focus of the course is on the practical use of data in a decision making environment, especially in an environment of risk and uncertainty.

Subject Topics

1. Introducing Statistics
2. Numerical Descriptive Measures
3. Correlation
4. Regression
5. Probability
6. Random Variables and Probability Distribution
7. Introduction to Statistical Inference

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

SLO1: Present and analyse statistical data using tables and diagrams, test hypotheses, goodness of fit.
SLO2: Define and use the rules of probability.
SLO3: Use Binomial, Normal, t- and Chi-square and Poisson distributions.
SLO4: Apply linear and multiple regression techniques with understanding.
SLO5: Use spreadsheet and statistical packages

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(30 %)**
Lab Practical	**(14%)**
Assignments	**(3 %)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 3 Tests contributing 30% towards the final grade for the subject.

Assessment 2 - **Lab Practical :** The laboratory practice will contribute 14% towards the final grade for the subject.

Assessment 3 - **Assignment:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 6% towards the final grade for the subject

Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

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Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Mathematics & Computer Science Department Modules,
2. Johnson R.A. and Bhattacharyya G.K., Statistical Concepts and Methods, 2nd ed (Wiley, 1992).
3. Chase W. and Bown F., General Statistics (Wiley, 1992).

Relevant Unitech Policies

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CS222: INTERNET PROGRAMMING I

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Internet Programming I
Subject Code	CS222
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 114 Advanced ICT, CS116 Programming
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This subject introduces Internet and Web Programming and aims to lightly cover many aspects of this area. It gives students practical understanding of how a website and web application are developed and hosted for users to use across a network or the Internet. It elaborates on the technologies for front-end web development and briefly touches on CGI and back-end web programming tools.

Subject Topics

1. Introduction to World Wide Web

    History of Internet and World Wide Web. Website Vs. Web Application, Web Architecture, Distributed Systems Design, Web Design Concerns, Web programming tools (HTML, CSS, JavaScript). Web libraries Vs. Frameworks.

2. HTML and CSS:

    Design and build websites. Introduction to Bootstrap and SaaS (Syntactically Awesome Style Sheets). UI elements.

3. JavaScript

    JavaScript basics, JavaScript and the DOM. JavaScript and JQuery Interactive Front-end Web Development

4. Back-end development

    Web server basics, Apache HTTPD server. Introduction to PHP, MySQL database and Web service basics. XML and JSON basics.

5. AJAX

    AJAX basics. PHP and AJAX application development using RAXAN web framework

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Design and implement simple websites with HTML, CSS, and JavaScript.
SLO2: Design and implement simple web applications using PHP and AJAX.
SLO3: Design and implement simple web services that use XML and JSON standards.
SLO4: Understand web programming libraries and frameworks: Bootstrap, JQuery, Raxan.
SLO5: Remember terminologies, best practices, and a variety of tools used in Internet programming projects.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 40% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 60% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(20%)**
Project	**(13%)**
Assignments	**(12%)**
Quiz	**(9 %)**
Exam	**(40%)**

Assessment 1 - **Tests:** There will be 2 Tests contributing 20% towards the final grade for the subject.
Assessment 2 - **Project:** project will contribute 13% towards the final grade for the subject.
Assessment 3 - **Assignment:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 11% towards the final grade for the subject
Assessment 4 - **Quiz:** There will be 3 Quiz contributing 9% towards the final grade for the subject.
Assessment 5- **Final written examination:** A 3 hour written examination weighs 40%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Internet and World Wide Web – How to Program, Fourth Edition (2008), Pearson

References

1. TutorialsPoint.com (HTML5, JavaScript, and other Web Technologies)

2. Online W3C school site: w3schools.com

3. Departmental electronic resources (books, relevant web articles, computer software).

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ **and** www.unitech.ac.pg/Plagiarism/

CS223: OPERATING SYSTEMS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Operating Systems
Subject Code	CS223
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS114 Advanced ICT, CS213 Concepts of Computer Science
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This subject introduces Operating Systems concepts and aims to lightly cover many of them. It will help students to understand how operating systems work, their anatomy, and design. A comparison will be made on the two big OS rivals: Unix and Windows. And students will be given practical understanding on how to write commands in non-graphical modes in Windows and Unix environments.

Subject Topics

1. Operating Systems basics

   The purpose of the OS, relationship of OS to users, programs, memory and other hardware – emphasizing multi-user and multi-tasking system, events, and software/hardware interrupts. foreground and background processing, process state, interaction between processes. Memory management, file systems.

2. Modern Operating Systems:

   Graphical and no graphical systems, survey of current systems on traditional and mobile computing devices. Similarities and differences between systems. Command based systems: history, a survey of some windows commands with the use of switches and wildcard symbols.

3. Unix Systems

   History, current implementations. comparison to windows systems. The Unix windows manager, different desktop environments. the Unix file system, file security, standard directories, user and groups. Boot managers, Unix shells, and basic shell commands. jobs, processes, the use of foreground/background processing, Unix scripts.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO6: Demonstrate understanding of the concepts, structure and design of operating Systems.
SLO7: Explain the different types of operating systems and the major ones in use today.
SLO8: Discuss about the importance of processes, memory, and storage management.
SLO9: Demonstrate competence in recognizing and using operating system features.
SLO10: Identify the security threads and security techniques.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Quiz	**(10%)**
Assignments	**(20%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 2 Tests contributing 20% towards the final grade for the subject.
Assessment 2 - **Quiz:** There will be 3 quiz contributing 10% towards the final grade of the subject.
Assessment 3 - **Assignment:** The assignments encourage students to work as a team, and it will contribute 20% towards the final grade of the subject. There will be 2 assignment.
Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Silberschatz A., Galvin P.B.,and Gagne G.,"Operating System Concepts", 7th edition or later. 2013.

References

1. Deitel, H.M., "Operating Systems", Addison- Wesley Publishing Company, New York.
2. Tanenbaum, A.S., "Operating System-Design and Implementation", Prentice Hall.
3. Departmental electronic resources (books, relevant web articles, and computer software).

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ **and** www.unitech.ac.pg/Plagiarism/

CS311: NETWORKING II

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Networking II
Subject Code	CS 311
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 211 Networking I
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This subject extends on the basics of networking covered in Networking I (CS211) and introduces students to the concepts of basic routing and switch configuration using IPv4 and IPv6. Students' understanding is enhanced by the use of some networking simulation tools such as Cisco Packet Tracer to create LANs and WANs before the actual network deployment. Basic network security and troubleshooting techniques are also covered.

Subject Topics

1. Internet Protocol Version 4 (IPv4) IPv4 addressing scheme, including classes, sub-netting, variable length subnet masks (VLSM), Class full vs Classless Inter domain routing (CIDR), super nets.

2. IPv6
   IPv6 basics, address types and structure. IPv6 configuration
3. Network Simulation Tool and Cisco Internet Operating System (Cisco IOS)
   Introduction to Cisco Packet Tracer and GNS3 and using the Cisco IOS to create networks.
4. Static Routes and Routing Protocols
   Types of static routes – directly connected, recursive and default static routes and their deployment in an IPv4 or IPv6 network.
   Highlight differences between the use of static routes and routing protocols.
   Introduction to basic routing protocols using Routing Information Protocol version 2 (RIPv2 for IPv4) and RIPv3 for IPv6
5. Basic Network Security
   Network Security – Switch and router password security, password encryption, level password security on Cisco IOS
   Introduction to basic Access Control Lists (ACLs)
6. Remote Access using Telnet and SSH
   Introduction to Telnet and SSH

Telnet and SSH configuration using Cisco IOS for remote access for administrative and maintenance purposes.

7. Network Troubleshooting Concepts and Tools

Basic troubleshooting skills using knowledge of the OSI and TCP/IP model.
Basic switch and router troubleshooting using an OS such as the Cisco IOS.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO11: Demonstrate an understanding of IPv4 and IPv6 addressing scheme and its implementation in networks.
SLO2: Describe the network resources needed to construct LANs, and to connect LANs and WANs together.
SLO3: Use a network simulation tool to create LANs and WANs and test connectivity.
SLO4: Demonstrate an understanding of basic Network Security.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(28 %)**
Lab	**(10%)**
Quiz	**(12%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 4 Tests contributing 28% towards the final grade for the subject.
Assessment 2 - **Labs:** There will be 2 labs contributing 10% towards the final grade for the subject.
Assessment 3 - **Quiz:** There will be 4 Quiz contributing 12% towards the final grade for the subject.
Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Mohamed Salem Salem Ali Easa, CCNA in 21 Hours 640-802 Syllabus Edition 1, bookboon.com

References

1. www.cisco.netacad.com

2. www.apnic.net

3. Relevant online resources

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS312: DATABASE II

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Database II
Subject Code	CS 312
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 212 Database I
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This subject furthers the concepts covered in Database I (CS212). It aims at covering database concepts at the intermediary and advanced level.

Subject Topics

1. Enhanced Entity Relationship Model

   Subclass and superclass. Specialization and generalization. Union type/category.

2. Advanced data normalization rules

   BCNF, 4NF, 5NF, 6NF. Applications of these rules. De-normalization.

3.Advanced SQL programming

   Advanced JOIN operator. Types of subqueries and correlated queries. Using SQL functions to manipulate dates, strings, and other data. Set operators: UNION, UNION ALL, INTERSECT, MINUS, etc. Create and use stored procedures, triggers, and events. Create embedded SQL.

4. Database Administration

   Setting up and configuring a DBMS. Database design and implementation. Creating users and controlling access. Backup and recovery. DB administrative tasks applied using a DBMS.

5. More database design and implementation theory

   Distributed databases. Database catalogue. Query optimization. Database performance tuning. New database applications and architectures: e.g. Data Warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document orientated databases, etc.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

After completing this unit, students will be able to:

SLO12: Use the Enhanced Entity Relationship Model in database design.
SLO13: Understand and complete normalization up to 6th normal form (6NF).
SLO14: Develop knowledge on advanced SQL programming.
SLO15: Understand database administrative tasks with a DBMS system.
SLO16: Demonstrate an understanding of current and trending database technologies and theories.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Assignment	**(14%)**
Quiz	**(13%)**
Project	**(13%)**
Final Examination	**(40%)**

Assessment 1 - **Tests:** There will be 2 Tests contributing 20% towards the final grade for the subject.
Assessment 2 - **Labs:** There will be 2 labs contributing 10% towards the final grade for the subject.
Assessment 3 - **Quiz:** There will be 4 Quiz contributing 12% towards the final grade for the subject.
Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Connolly, T. M., & Begg, C. E. (2015). *Database systems: A practical approach to design, implementation, and management* (6th Ed). Pearson Education Limited.

References

1. H. Garcia-Molina, J.D. Ulman, J. Widom. (2011). *Database Systems: The Complete Book.* Pearson Education.

2. www.tutorialspoint.com

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS313: NUMERICAL METHODS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Numerical Methods
Subject Code	CS 313
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	CS 112 Mathematics for Computer Science and EN112 Engineering Mathematics I
Co-requisites	None
Subject Coordinator	TBA

Synopsis

To provide and equip students with the approximation techniques related in the field of Computer Science. Topics include Errors, Linear and Non-linear systems of equations, Matrices, Polynomial Approximations, Numerical Integration and Numerical Solutions to Ordinary Differential Equations. Also covered is Eigen values and Eigen vectors.

Subject Topics

1. Errors
   Round off and truncation. Idea of ill- conditioning. Induced and inherent stability.
2. Matrices:
   Concepts of matrix and its application. Inverse, and multiplication, augmented matrix, column and row matrices.
3. Solution techniques of linear and nonlinear systems:
   Direct and iterative methods. Convergence of iterative methods and acceleration techniques. Recurrence equations: solution and stability.
4. Polynomial Approximations:
   Polynomial approximation including interpolation and spline interpolation.

5. Numerical Integration:
   Simpson, Newton –Cotes, Gauss quadrature methods. Idea of minimax approximation.
6. Numerical Solutions to Ordinary Differential Equations, counting (3 week)
   Euler, predictor –corrector and Runge –Kutta methods. Idea of stability.
7. Eigen vectors and eigenvalues
   Eigen - values and Eigen - values by power and similarity transform methods. Matrix theory to support these numerical methods.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

- Use numerical methods for approximation to solving linear and non-linear systems of equations, matrix manipulation, integration and solving ordinary differential equations.

  Solve applied problems in each of the above areas.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(30 %)**
Assignment	**(20%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 3 Tests contributing 30% towards the final grade for the subject.

Assessment 2 - **Assignment:** There will be 3 assignment contributing 20% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Greenbaum, A., & Chartier, T. P. (2012) *Numerical methods: Design, analysis, and computer implementation of algorithms*. Princeton, New Jersey: Princeton University Press.

References

1.Holmes, M. H. (2007) *Introduction to numerical methods in differential equations*. Springer
2.Departmental electronic resources (books, relevant web articles, computer software).

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS314: DATA STRUCTURES AND ALGORITHMS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Data Structures and Algorithms
Subject Code	CS 314
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	CS 220 Programming IV
Co-requisites	None
Subject Coordinator	TBA

Synopsis

This subject covers fundamental data structures and algorithms and highlights the tradeoffs between different implementations of these abstractions. It includes theoretical analysis, implementation, and application, lists, stacks, queues, heaps, dictionaries, maps, hash trees and balanced trees, sets, and graphs; as well as searching and sorting algorithms. It also shows Java's collections framework as an example implementation of basic algorithms.

Subject Topics

1. Algorithm analysis
2. List, Stacks and Queues
3. Priority Queues
4. Sorting
5. Graph Algorithm
6. Algorithm Design Techniques

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Formulate and apply object-oriented programming, using java, as a modern tool to solve engineering problems.

SLO2: Demonstrate an understanding of basic data structures (such as an array-based list, linked list, stack, queue, binary search tree) and algorithms.
SLO3: Demonstrate the ability to analyze, design, apply and use data structures and algorithms to solve engineering problems and evaluate their solutions.
SLO4: Demonstrate an understanding of analysis of algorithms. Study an algorithm or program code segment that contains iterative constructs and analyze the asymptotic time complexity of the algorithm or code segment.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(30 %)**
Assignment	**(10%)**
Quiz	**(10%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 3 Tests contributing 30% towards the final grade for the subject.
Assessment 2 - **Assignment:** There will be 2 labs contributing 10% towards the final grade for the subject.
Assessment 3 - **Quiz:** There will be 5 Quiz contributing 10% towards the final grade for the subject.
Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Weiss, Mark A, *Data Structures and Algorithm Analysis in Java, 3rd Edition*, Pearson Education, Inc.

References

1. Michael T. Goodrich & Roberto Tamassia, *Data Structures and Algorithm in Java, 4th Edition,* John Wiley & Sons, Inc.

2. Online tutorial

3. Departmental electronic resources (books, relevant web articles, computer software).

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS321: SOFTWARE ENGINEERING

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Software Engineering
Subject Code	CS 321
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	CS 220 Programming IV, CS312 Database II
Co-requisites	CS320 Internet Programming
Subject Coordinator	TBA

Synopsis

This subject describes software processes and goes into detail on the use of engineering concepts in software development. It aims to show students the activities involved in software projects which include: requirement analysis and validation, system specification, prototyping and other tools, programming, testing, and deployment. Other concepts covered include intellectual property management and open source licensing, as well as project management, monitoring and control.

Subject Topics

1. Process Models

- Waterfall, V-Model, Prototyping, Boehm's Spiral, Phased Development. Rational Unified Process, Agile manifesto and principles, Agile process models, Extreme Programming (principles and practices), Scrum, etc.

2. Capturing Requirements
- Process, structured analysis and object oriented analysis prototyping, use cases, use case diagram, class diagrams, ERDs, DFDs, etc.
- Requirements quality: desirable characteristic, validating, and verifying.

3. Design and Software Architecture
- Definition, process, uses.
- Architectural styles: pipes-and-filter, client-server, peer-to-peer, publish-subscribe, repositories, layering.
- Quality attributes and tactics.

4. Testing
- Objective of testing, types of faults, process:
  - Closed/black box, clear/white box,
  - Unit testing, integration testing: component driver, stub, bottom-up, top-down, sandwich, etc.
  - System testing: function testing, performance testing, acceptance testing, and installation testing.
- System testing techniques:
  - build or integration plan, regression testing, configuration management
  - When to stop: estimating the number of remaining faults, e.g. Mills' fault seeding, confidence.

5. Deployment and Maintenance
- The changing system: S-, P-, E-system, process, user training, documentation, types of maintenance, software rejuvenation.

6. Intellectual Property and Open Source

- Patent, copyright, licenses, copy left, software categories:
    - proprietary software, free software, open source software, the Cathedral model, the Bazaar model, Fetch mail lessons, The factory model, the beekeeper model.
    - Indirect sale-value models (loss-leader/market positioner, Widget Frosting, Give away recipe, open restaurant, etc.)

Subject Learning Outcomes (SLOs)

SLO1: After completing this unit students will be able to:
SLO2: LO1: Demonstrate an understanding of the software life cycle.
SLO3: LO2: Use specification languages.
SLO4: LO3: Design, manage and complete software project.
SLO5: LO4: Demonstrate the understanding of software licensing and legal implications associated with intellectual properties.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(24 %)**
Assignment	**(14%)**
Project	**(12%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 3 Tests contributing 24% towards the final grade for the subject.
Assessment 2 - **Assignment:** There will be 3 labs contributing 14% towards the final grade for the subject.
Assessment 3 - **Project:** There will be 1 Project contributing 12% towards the final grade for the subject.
Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Pressman, Roger S (2009). *Software Engineering: A Practitioner's Approach* (7th ed.). Boston, Mass: McGraw-Hill.

References

1. Ian Sommerville, “Software Engineering”, 8th Edition, Pearson Education Ltd., 2007.
2. S.H. Pleeger, J.M. Atlec, “Software Engineering: Theory and Practice”, 4th Edition, Pearson Education, 2009.
3. Pankaj Jalote, “An Integrated Approach to Software Engineering”, 3rd Edition, Narosa Publishers, 2008.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS320: INTERNET PROGRAMMING II

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Internet Programming II
Subject Code	CS 320
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 222 Programming I
Co-requisites	CS321 Software Engineering
Subject Coordinator	TBA

Synopsis

This subject reviews the basics of Internet and Web Programming and aims to give students the necessary skills and knowledge to develop systems and applications for Web 2.0 and beyond. It gives students practical understanding of how websites, web applications, web services, and mobile apps are developed using the current development tools. It elaborates on the use of development frameworks and covers more of the back-end technologies.

Subject Topics

1. World Wide Web

2. Website Design Basics

3. Client-side Development

4. Server-side Development

5. Client-server and and machine-machine communication

6. Client-server Development

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Understand the different web technologies and be able to explain them.
SLO2: Use web frameworks for web development.

SLO3: Design and develop web applications.
SLO4: Design and develop web services and APIs.
SLO5: Design and develop mobile apps.
SLO6: Use agile development techniques in Internet programming projects.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Assignment	**(18%)**
Project	**(13%)**
Quiz	**(9%)**
Final Examination	**(40%)**

Assessment 1 - **Tests:** There will be 2 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Assignment:** There will be 3 labs contributing 18% towards the final grade for the subject.

Assessment 3 - **Project:** There will be 1 Project contributing 13% towards the final grade for the subject.

Assessment 3 - **Quiz:** There will be3 Quiz contributing 9% towards the final grade for the subject.

Assessment 4- **Final written examination:** A 3 hour written examination weighs 40%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Deitel, P. J., & Deitel, H. M. (2008). *Internet and World Wide Web – How to program* (4th Ed). Pearson.

References

1.TutorialsPoint.com

2. Online W3C school site: w3schools.com

3. Departmental electronic resources (books, relevant web articles, computer software).

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS323: COMPUTER HARDWARE

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Computer hardware
Subject Code	CS 323
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 123 Advanced ICT
Co-requisites	non
Subject Coordinator	TBA

Synopsis

This subject covers historical advances and current technology of computer hardware.

Subject Topics

1. History
   Development of computers from the early mainframes to current technologies.
2. Primary Memory
   Regular, cache, video and virtual memory.
3. System Boards, UEFIs, CPUs, Chipsets and Buses
   Modern desktop and notebook computer boards. Modern CPUs and chipsets. The North and South bridges. Serial and parallel, and control and data buses. Modern buses (ISA, EISA, PCI, SCSI). Purpose and development of UEFI systems.
4. Secondary Memory
   Generations of hard drive technology, including PATA, SATA, SCSI and solid state. Optical and flash drives, and modern developments. Cloud memory. Bus mastering.
5. Networking
   Current trends in networking hardware.
6. Peripheral Devices
   Video devices, printers, scanners, pointing devices, graphics tablets, and etcetera.
7. Server Systems
   Introducing redundancy into systems. Software backup strategies.
   Video devices, printers, scanners, pointing devices, graphics tablets, and etcetera.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Develop knowledge of important hardware histories.
SLO2: Explain modern primary memory systems.
SLO3: Identify modern motherboard and component standards.
SLO4: Explain modern secondary memory systems.
SLO5: Describe and use network and peripheral devices.
SLO6: Understand the concepts of hardware and software redundancy.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(29 %)**
Assignment	**(15%)**
Quiz	**(6%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 3 Tests contributing 29% towards the final grade for the subject.

Assessment 2 - **Assignment:** There will be 3 labs contributing 15% towards the final grade for the subject.

Assessment 3 - **Quiz:** There will be 3 quiz contributing 6% towards the final grade for the subject.

Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Patterson, D. A., & Hennessy, J. L. (2017). *Computer organization and design: The hardware/software interface*. Cambridge, Massachusetts: Elsevier Inc.

References

As the majority of this subject covers cutting edge developments, most information will be obtained from Internet research.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS322: PROGRAMMING WITH C/C++

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	programming with C/C++
Subject Code	CS 322
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 220 Programming III
Co-requisites	CS320 Internet Programming
Subject Coordinator	TBA

Synopsis

This subject uses the student's knowledge of programming in Java to investigate the C and C++ programming languages. The main strength of C and C++ is in systems programming and this subject gives the student a taste of this.

Subject Topics

1. Introduction
    - Selecting a C/C++ compiler and/or an IDE. The C/C++ pre-compiler, compiler and linker. C machine code.
2. C Basics
    - C as a non-object oriented, procedural, structured language. C syntax (logic, loops, selection and functions). Data types and memory requirements. Character strings. Static data structures.
3. C Function Libraries
    - The philosophy of program development. The C function libraries (standard, input/output, string, math, c-type, time). Application to file handling, string manipulation and other day to day programming tasks.
4. C as a System's Programming Language
    - O Addresses and pointers. Memory access. Dynamic memory management.
5. C++ as an Applications Object Oriented Programming Language
    - The Implementation of classes, inheritance and polymorphism. The C++ class libraries.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO7: Set up a working environment including compiler and/or IDE.
SLO8: Write C programs to illustrate how logic is implemented.
SLO9: Use the standard C libraries.

SLO10: Handle file input and output, and manipulate strings.
SLO11: Use addresses and pointers to access memory using low level development tools.
SLO12: Write simple object oriented programs in C++.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(29 %)**
Assignment	**(15%)**
Quiz	**(6%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 3 Tests contributing 29% towards the final grade for the subject.
Assessment 2 - **Assignment:** There will be 3 labs contributing 15% towards the final grade for the subject.
Assessment 3 - **Quiz:** There will be 3 quiz contributing 6% towards the final grade for the subject.
Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Stroustrup, B. (2013). *The C++ Programming Language* (4th Ed). Addison-Wesley Professional.

References

1. Online tutorial sites such as **learncpp.com**
2. Department electronic resources, including alternative texts.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS324: COMPUTER SECURITY

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Computer Security
Subject Code	CS 324
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 123 Advanced ICT
Co-requisites	non
Subject Coordinator	TBA

Synopsis

This subject aims to familiarize the student with the fundamental concepts of computer security. It covers topics such as the principals of confidentiality, integrity and availability; operation of encryption techniques: digital signatures, public key infrastructure, authentication and non-repudiation; intrusion detection and response; firewall defences; security configuration to PC-based application and design of information systems with security compliance; and security standards and protocols.

Subject Topics

1. Cyber Security Introduction
   Cyber Security Essentials, domains, common threats.
2. Cyber Security Cube
   The three dimensions of cyber security cube, CIA triad, states of data, cyber security countermeasures, and IT security management framework.
3. Threats, Vulnerabilities and Attacks
   Malware and Malicious Code, Deception and Attacks.
4. Protecting Secrets
   Cryptography, Access Controls, Obscuring Data.
5. Ensuring Integrity
   Types of Data Integrity Controls, Digital Signatures, Certificates, Database Integrity Enforcement.
6. The Five Nines Concept
   High Availability, Measures to improve Availability, Incidence response, Disaster Recovery.
7. Protecting a Cyber Security Domain
   Defending Systems and Devices, Server Hardening, Network Hardening, Physical Security.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

LO1: Develop an understanding on how cyber criminals use technology to attack computer systems.
LO2: Develop an understanding on how to defend computer systems using different techniques and products.

LO3: Develop knowledge on the fundamentals of confidentiality, integrity and availability.
LO4: Implement strategies to provide security for a networked computer system.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(28 %)**
Assignment	**(16%)**
Quiz	**(6%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 2 Tests contributing 28% towards the final grade for the subject.

Assessment 2 - **Assignment:** There will be 2 assignment contributing 16% towards the final grade for the subject.

Assessment 3 - **Quiz:** There will be 2 quiz contributing 6% towards the final grade for the subject.

Assessment 4- **Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

Computer Security (3rd) 2011 John Wiley & Sons, Ltd by Dieter Gollmann.

Subject Text book

Patterson, D. A., & Hennessy, J. L. (2017). *Computer organization and design: The hardware/software interface*. Cambridge, Massachusetts: Elsevier Inc.

References

1. Joseph Migga Kizza (2014) Computer Network Security and Cyber Ethics, (4th ed.) McFarland.
2. Cisco Networking Academy Online Course on “Cyber Security Essentials”

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS326: COMPUTER MODELLING

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Computer Modelling
Subject Code	CS 326
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	Basic Computer, maths, and Algebra Skills
Co-requisites	non
Subject Coordinator	TBA

Synopsis

The course will introduce the basic concepts of computation through modelling and simulation that are Increasingly being used by architects, planners, and engineers to shorten design cycles, innovate new products, and evaluate designs and simulate the impacts of alternative approaches. Students will use MATLAB to explore a range of programming and modelling concepts while acquiring those skills. They will then undertake a final project that analyses one of a variety of scientific problems by designing a representative model, implementing the model, completing a verification and validation process of the model, reporting on the model in oral and written form, and changing the model to reflect corrections, improvements and enhancements. Its main purpose is to familiarize the student with the basic computer programming principles and teach the basics of the software platform MATLAB.

Subject Topics

1. MATLAB Structure and Basics
2. Calculator mode
3. M-Files
4. Matrices in MATLAB
5. Vectors in MATLAB
\6. Graphing in MATLAB
7. Soling Systems of Linear Equations
8. Finite Difference Equations
9. Numerical Differentiation
10. Numerical Intergration
11. Simulink Applications

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Demonstrate the basic principles of computer programming application to the solution of engineering problems.
SLO2: Use the MATLAB computing environment.
SLO3: Write programs in MATLAB to solve basic engineering problems.
SLO4: Use SIMULINK to develop models for solving engineering problems.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Labs	**(63 %)**
Assignment	**(7 %)**
Project	**(30%)**

Assessment 1 -	**Labs:** There will be 7 Labs contributing 63% towards the final grade for the subject.
Assessment 2 -	**Assignment:** There will be 1 assignment contributing 7% towards the final grade for the subject.
Assessment 3 -	**Project:** There will be 1 project contributing 30% towards the final grade for the subject.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Palm, William John. Introduction to MATLAB for Engineers. New York: McGraw-Hill, 2011.

References

1. Van Loan, Charles F., and K-Y. Daisy Fan. Insight through computing: a MATLAB introduction to computational science and engineering. Society for Industrial and Applied Mathematics, 2010.
2. Moler, Cleve B. Numerical computing with MATLAB. Society for Industrial and Applied Mathematics, 2004.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS325: INTRODUCTION TO DATA SCIENCE

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Introduction to Data Science
Subject Code	CS 325
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 221 Applied Statistics and Cs314 Data Structures and algorithms
Co-requisites	non
Subject Coordinator	TBA

Synopsis

This subject requires that students have a good background in programming, data structures and algorithms, as well as statistics. The subject introduces fundamental concepts of data science and uses Python as a programming tool.

Subject Topics

1. Python Programming
2. Basics introduction to Data Science
3. Data Visualization
4. Linear Algebra
5. Statistics, Probability and Inference
\6. Getting Data and Working with data
7. Modelling, Similarity, Neighours, and Clusters
8. Decision tress and Neural Networks

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Develop knowledge of Python programming.
SLO2: Apply concepts of linear algebra in data science using Python.
SLO3: Apply concepts of statistics and probability in working with data using Python.
SLO4: Use data gathering and manipulation techniques.
SLO5: Create visual graphics for data sets.
SLO6: Apply different statistical models including machine learning in data processing.
SLO7: Understand and use decision trees and neural networks in data processing.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(18 %)**
Assignment	**(24%)**
Quiz	**(8%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 2 Tests contributing 18% towards the final grade for the subject.
Assessment 2 -	**Assignment:** There will be 4 assignment contributing 24% towards the final grade for the subject.
Assessment 3 -	**Quiz:** There will be 2 quiz contributing 8% towards the final grade for the subject.
Assessment 4-	**Final written examination:** A 3 hour written examination weighs 50%

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Grus, J. (2015). *Data science from scratch: First principals with Python*. O'Reilly Media.

References

1. EMC Education Services (2015). *Data science and big data analytics: Discovering, analysing, visualizing, and presenting data*. John Wiley & Sons Inc.

2. Other online resources and learning sites such as Coursera.

Relevant Unitech Policies

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CS327: DISTRIBUTED SYSTEMS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Distributed Systems
Subject Code	CS 327
Duration	15 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 124 advanced ICT, CS211 Networking I
Co-requisites	non
Subject Coordinator	TBA

Synopsis

The aim of this course is to provide students with distributed system concepts and techniques in which the modern computer technology is built upon. These include client-server architecture, grid and web based systems that support a wide range of applications ranging from business data processing to multimedia information systems. This course will teach the concepts and principles used in designing and constructing distributed systems with practical examples so students are well versed with the distributed system knowledge and may be able to apply it in the industry.

Subject Topics

1. Introduction to key concepts related to distributed systems and architectures

2. Processes/threads and inter-process communication algorithms
3. P2P systems and content distribution

4. Replication and data consistency/ naming and synchronization

5. Fault tolerance and classical distributed algorithms
\6. Cloud computing and Block chain consensus

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

LO1: The student should be able to compare the principles and goals of distributed system designs and identify trade-offs in using different mechanisms in building distributed systems.
LO2: To be able to understand how distributed processes (middleware components) communicate with each other.
LO3: To be able to understand how overlay networks work as well as develop understanding of Cloud Computing. The students should be able to apply the knowledge of distributed system to solve problems.
LO4: Be able to implement a simple distributed system to demonstrate the understanding of distributed system concepts.
LO5: Develop understanding of how data replication works as well as looking at issues regarding data consistency.
LO6: Understanding of fault tolerant/resilient networks.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Labs	**(6 %)**
Assignment	**(14%)**
Test	**(20%)**
Exam	**(50%)**

Assessment 1 -	**Labs:** There will be 3 Labs contributing 6% towards the final grade for the subject.
Assessment 2 -	**Assignment:** There will be 3 assignment contributing 14% towards the final grade for the subject.
Assessment 3 -	**Test:** There will be 2 project contributing 30% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Tanenbaum, A. S., & Steen, M. V. (2006). *Distributed Systems: Principles and Paradigms* (2nd Ed). Prentice Hall.

References

1.R. Puttini,T.E. Mahmood, Cloud Computing:Concepts,Technology and Architecture (2013)
2. Distributed Systems (Online): https://www.distributedsystemscourse.com/

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS410: RESEARCH AND PRESENTATION SKILLS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Research and Presentation Skills
Subject Code	CS 410
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Non
Co-requisites	non
Subject Coordinator	TBA

Synopsis

Review research techniques and writing research reports. During the subject each student will be assigned two papers/topics, which will be from an area of interest in modern computer science.

Organising seminar/video conferencing sessions. Use of A/V materials to aid a presentation.

Each student will develop seminar experience by preparing and presenting a session based on his/her first allocated topic.

Each student will develop video conferencing software experience by preparing and presenting his/her second allocated topic using an on-line interactive session.

During the subject each student will submit and have approved a topic for the second semester project subject CS420.

Subject Topics

1. Research techniques.
   Locating relevant resources. Citing resources. Paraphrasing source material. Structuring a research paper. Use of appendices.
2. Research topic
   Research a paper/topic, produce a standard research paper on the topic, and present the topic in a 30-minute seminar.
3. Video conferencing software:
   Survey currently available software, and contrast/compare products.
4. Research topic 2
   Research a paper/topic, produce a standard research paper on the topic, setup a video conferencing session, and present the topic via an on-line medium in a 30-minute interactive session using this medium.
5. CS420 Project:
   Submission and approval of project topic for subject CS420.

Subject Learning Outcomes (SLOs)

After completing this unit students should be able to:

SLO1: Demonstrate an ability to research a topic and produce a standard report (research paper)
SLO2: Present a topic, demonstrating knowledge of the topic, and presentation confidence.
SLO3: Set up a video conferencing system, and use to host a topic.
SLO4: Submit an acceptable project topic for CS420

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Unit Assessment consists of two written papers and two presentations.
50% overall must be achieved to obtain a pass grade in this subject.

AT1 Evaluation of topic 1 research project and write-up: Provides 20% of the total marks for the Subject.

AT2 Seminar Presentation: Provides 20% of the total marks for the Subject.

AT3 Evaluation of topic 2 research project and write-up: Provides 20% of the total marks for the Subject.

AT4 Video conferencing setup and presentation: Provides 20% of the total marks for the Subject.

AT5 Completion of selection/approval for subject CS420: Provides 20% of the total marks of the Subject.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism **www.unitech**

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Leong, E., Heah, C., & Hong, K. *Guide to research projects for engineering students: Planning, writing, and presenting*. CRC Press. 2016.

References

1. Kumar, R. *Research methodology: A step-by-step guide for beginners. 3rd edition*. SAGE Publications Ltd, 2011.
2. Evans, D., Gruba, P., & Zobel J., *How to write a better thesis. 3rd edition.* Springer International Publishing. 2014.
3. Thody, A. *Writing and presenting research.* SAGE Publications Ltd, 2006.

Relevant Unitech Policies

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CS413: NETWORKING III

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Networking III
Subject Code	CS 413
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	CS311 Networking II
Co-requisites	non
Subject Coordinator	TBA

Synopsis

This subject takes an advanced step into the topics covered in Networking II (CS311) and introduces students to the concepts of routing protocols, network security fundamentals, virtual LANs, wireless LANs, WAN technologies and troubleshooting using the IOS featured on the Cisco routers.

Subject Topics

1.Review of the fundamentals of IPv4 and IPv6

Emphasis on router configuration using the Cisco IOS.

2. Static Routes and Routing Protocols

Types of static routes – directly connected, recursive and default static routes and their deployment in an IPv4 or IPv6 network.

3. Routing Protocols

Introduction to basic routing protocols using Routing Information Protocol version 2 (RIPv2 for IPv4) and RIPv3 for IPv6, OSPFv2 and OSPFv3

4. Basic Network Security

Router Security – basic network security using router password security, password encryption, level password security on Cisco IOS
Network Security – Introduction to basic Access Control Lists (ACLs)
Network Address Translation (NAT), Port Address Translation (PAT) using IPv4

5. Virtual LAN (VLAN)

VLANs – switch characteristics, configuration, switch port membership, trunking.

6. Wireless LAN (WLAN)

Basic wireless LAN configuration using Wireless router and Access point

7. Troubleshooting a WAN Network

Introduction to basic troubleshooting tools using the Cisco IOS.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Demonstrate an understanding of routing and routed protocols
SLO2: Demonstrate an understanding of how to secure a network using Network Security Tools
SLO3: Demonstrate an understanding of WAN technologies and protocols
SLO4: Demonstrate an understanding of Wireless LAN and its implementation in a WAN.
SLO5: Demonstrate network troubleshooting skills in a WAN.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Labs	**(10%)**
Quiz	**(12%)**
Test	**(28%)**
Exam	**(50%)**

Assessment 1 -	**Labs:** There will be 2 Labs contributing 10% towards the final grade for the subject.
Assessment 2 -	**Quiz:** There will be 4 assignment contributing 12% towards the final grade for the subject.
Assessment 3 -	**Test:** There will be 4 tests contributing 28% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Mohamed Salem Salem Ali Easa, CCNA in 21 Hours 640-802 Syllabus Edition 1, bookboon.com

References

1. Cisco Academy (2020). *Networking academy tutorials*. Cisco Networking Academy. http://www.netacad.com/

2. APNIC (2020). *APNIC networking certifications*. APNIC. http://www.apnic.net/

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS414: ADVANCED TOPICS IN COMPUTER SCIENCE

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Advanced Topics in Computer Science
Subject Code	CS 414
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**18**
Delivery Mode	On campus
Prerequisites	CS221 Applied Statistics, CS325 Introduction to Data Science, CS314 Data Structure & Algorthim
Co-requisites	non
Subject Coordinator	TBA

Synopsis

This course covers various current topics in computer science. Fundamental concepts of Data Visualisation, Data Mining, Big Data, Machine Learning, Artificial Intelligence, Cryptography and Cyber Security. Python programming language will be used to illustrate the different concepts where applicable.

Subject Topics

1. Data Visualisation
   Introduction to Visualisation, Data Manipulation with Pandas, Introduction to Matplotlib, three dimensional plots, geographic data with basemap, Visualisation with Seaborn.
2. Data Mining
   Introduction to Data Mining, Data pre-processing, Data Warehousing and OLAP for Data Mining, Association, correlation, and frequent pattern analysis, Classification concepts – Bayesian classification, Mining Time-Series and Sequence Data, Text Mining and Web Mining
3. Big Data
   Overview of Big Data, Big Data Programming tools (e.g., Hadoop, MongoDB, Spark, etc…), extraction and integration, Big Data storage, scalable big data indexing, large-scale graph processing techniques, big data stream techniques and algorithms, large-scale probabilistic data analysis and Big Data privacy.
4. Machine Learning
   Introduction to ML, Using Numpy-mean, median, mode, Standard deviation, percentile, data distribution, normal data distribution, scatter plot, linear regression, polynomial regression, multiple regression, scale, train/test and decision tree.
5. Cryptography

Introduction to cryptography, stream ciphers, block ciphers, hash functions, message authentication, public-key cryptography and digital signatures

6. Cyber Security

Cybercrimes, Dark web, OSI layer protocols, Internet Protocol Security, Analysis of Transport and Link Layers, Firewalls, Web applications security, Network mapping and port scanning, Network attacks, Wifi attacks, Penetration testing.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Use data science algorithms to solve problems.
SLO2: Categorize and carefully differentiate between situations for applying different data-mining techniques.
SLO3: Identify and develop big data solutions using appropriate tools.
SLO4: Develop an appreciation for what is involved in learning models from data.
SLO5: Demonstrate awareness and understanding of various applications of AI techniques.
SLO6: Explain the fundamentals of cryptography, such as encryption, digital signatures, and secure hashes.
SLO7: Identify risks in a computer network and provide solutions.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Assignment	**(17%)**
Quiz	**(8%)**
Test	**(25%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 2 assignment contributing 17% towards the final grade for the subject.
Assessment 2 -	**Quiz:** There will be 2 quiz contributing 8% towards the final grade for the subject.
Assessment 3 -	**Test:** There will be 2 tests contributing 25% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Grus, J. (2015). *Data science from scratch: First principals with Python*. O'Reilly Media.

Witten, I & Frank, E. (2016). *Data Mining 4th Ed: Practical Machine Learning Tools and Techniques.* Morgan Kaufmann.

Stallings, W. (2014). *Cryptography and Network Security 6th Ed: Principles and Practice*. Pearson.

References

1. EMC Education Services (2015). *Data science and big data analytics: Discovering, analysing, visualizing, and presenting data*. John Wiley & Sons Inc.

2. Coursera (2020). *Data science tutorials*. Coursera. http://www.coursera.org/

3. World Wide Web Consortium (2020). *Data analytics tutorials*. w3schools. http://www.w3schools.com/

Relevant Unitech Policies

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CS415: SPECIAL TOPICS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Special Topics
Subject Code	CS 415
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Not Available
Co-requisites	Not Available
Subject Coordinator	TBA

Synopsis

The Special Topics subject is a subject that does not have a fixed set of topics, assessment tasks, subject-content-specific objectives, and mapping of these elements to the computer science course learning outcomes (CLOs). This subject can cover a specialized set of topics of relevance to the students to develop an in-depth analysis of those topics. As a way of providing a structure to follow for this subject, the specification here contains a sample chosen subject topics in computer graphics.

Subject Topics

Elective topics will be developed with Department Staff in an area of Computer Science or Information Technology including, but not restricted to, the following areas:

Database Systems, Networking and Internet Applications, Programming Languages, Operating Systems, Data Structures and Algorithms, Software Engineering, Hardware, and Cryptography and Computer Security. Below is a sample of topics in Computer Graphics:

Topic 1: Fundamentals of computer graphics

Topic 2: Basics of real-time rendering and graphics hardware

Topic 3: Java programming basics

Topic 4: Graphics programming with OpenGL

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

The specific learning outcomes with the computer graphics topics are that after students complete the subject, they should be able to:

SLO1: Understand key concepts in computer graphics.
SLO2: Render 3D models using appropriate software and hardware tools.
SLO3: Do graphics programming in Java.
SLO4: Apply the OpenGL library in graphics programming.

General outcomes are that after completing the Special Topics subject, students should be able to:

- Pursue a program of supervised study.
- Present oral and/or written discourses on the specialized topic.
- Demonstrate knowledge of the topic to a depth as deemed appropriate by the examiner.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Project	**(20%)**
Quiz	**(10%)**
Test	**(20%)**
Exam	**(50%)**

Assessment 1 - **Project:** There will be 2 project contributing 20% towards the final grade for the subject.
Assessment 2 - **Quiz:** There will be 2 quiz contributing 10% towards the final grade for the subject.
Assessment 3 - **Test:** There will be 2 tests contributing 20% towards the final grade for the subject.
Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

For Computer Graphics, below is the text book:

Shirley, Peter, Michael Ashikhmin, Steve Marschner. *Fundamentals of Computer Graphics*. 3rd ed. A K Peters/CRC Press, 2009. ISBN: 9781568814698.

References

For Computer Graphics:

1. Watt, Alan. *3D Computer Graphics*. Addison-Wesley, 1999. ISBN: 9780201398557.
2. Buss, Samuel R. *3D Computer Graphics: A Mathematical Introduction with OpenGL*. 2003. ISBN: 9780521821032.
3. Akenine-Moller, Tomas, Eric Haines and Naty Hoffman. *Real-Time Rendering*. 3rd ed. A K Peters/CRC Press, 2008. ISBN: 9781568814247.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS420: RESEARCH PROJECT

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Research Project
Subject Code	CS 420
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**16**
Delivery Mode	On campus
Prerequisites	CS410
Co-requisites	Non
Subject Coordinator	TBA

Synopsis

The student is given the opportunity to research a topic of his/her interest. This topic may be of a theoretical or practical nature, or a mixture of the two.

Prior to starting the semester each student will have had his/her project approved (in subject CS410), and will be expected to have been working on it during the mid-semester break.

At the end of the semester each student has to submit a final written report, and give a seminar which will be advertised across the University.

Subject Topics

Topic 1: Research/Application

Perform independent research and/or software development.

Topic 2: Report

Write a professional quality report on the selected research topic.

Topic 3: Seminar

Deliver a seminar on the chosen topic to the University.

Subject Learning Outcomes (SLOs)

After completing this unit students should be able to:

1: Demonstrate an ability to research a topic and/or develop software to solve a real problem.

2: Produce a professional quality report on the research.

3: Present the results of the research/application in a seminar

Assessment Tasks and Weightings

Assessment consists of a written paper and presentations.
50% of the overall assessment will come from each component.

AT1 Evaluation of the student's report provides 50% of the assessment

AT2 Performance at the student's seminar presentation provides 50% of the assessment.

Shown in the table below are details of the unit assessment items. There will be four assessments and an approval. The weight (in percentage) shows how much each item contributes to the overall assessment (100 %).

ITEM	NAME		DESCRIPTION
AT1	**Evaluation**	50%	A mark from the project report
AT2	**Evaluation**	50%	A mark from the project presentation 1

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It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Leong, E., Heah, C., & Hong, K. *Guide to research projects for engineering students: Planning, writing, and presenting*. CRC Press. 2016.

References

1. Kumar, R. *Research methodology: A step-by-step guide for beginners. 3rd edition*. SAGE Publications Ltd, 2011.
2. Evans, D., Gruba, P., & Zobel J., *How to write a better thesis. 3rd edition.* Springer International Publishing. 2014.
3. Thody, A. *Writing and presenting research.* SAGE Publications Ltd, 2006.

Relevant Unitech Policies

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CS421: OPERATIONS RESEARCH

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Operation Research
Subject Code	CS 421
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	CS122 (Mathematics for Computer Science), Applied Statistics CS221
Co-requisites	Non
Subject Coordinator	TBA

Synopsis

Introduce students to the ideas and methods of operations research – of finding optimal feasible solutions of problems that have multiple solutions. The classical models will be surveyed, and hand and computer solution techniques discussed.

The lecturer each year will have the freedom to adjust the topics covered depending on his/her area of expertise or experience.

Subject Topics

Topic 1: Introduction:

Types of problems solved using operations research techniques. History of operations research.

Topic 2: Linear Programming:

Graphical approach. Classical simplex phase 1 and phase 2. Dual formulations. The complementary slackness theorem.

Topic 3: Integer programming:

Relaxation methods.

Topic 4: Classical allocation problems:

Hand solutions of the transportation problem, the allocation and knapsack problems, and the travelling salesman problem.

Topic 5: Network optimisation problems:

Hand solutions of the maximum flow problem and minimum path problem.

Topic 6: Probabilistic problems.

Monte-carlo methods. Timetable allocations.

Topic 7: Other topics

Topics taken from the areas of scheduling, searching, transportation, stock management, resource allocation, location, and project management.

Subject Learning Outcomes (SLOs)

After completing this unit students should be able to:
1: Demonstrate an understanding of the nature of operations research problems
2: Use hand and computer techniques to solve various operations research problems.
3: Formulate a practical problem so that an operations technique can be applied.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Assignment	**(14%)**
Quiz	**(6%)**
Test	**(30%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 2 assignment contributing 14% towards the final grade for the subject.
Assessment 2 -	**Quiz:** There will be 2 quiz contributing 6% towards the final grade for the subject.
Assessment 3 -	**Test:** There will be 3 tests contributing 30% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

P. Rama Murphy, *Operations Research. 2nd Edition* (NAIP, 2007)

References

Hiller, S.F., & Liebermann, G. J. (2012). *Introduction to Operations Research. 9th Edition*. McGraw Hill International.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS422: BUSINESS AND ENTRENEURSHIP

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Business and Entrepreneurship
Subject Code	CS 422
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**18**
Delivery Mode	On campus
Prerequisites	Knowledge of ICT
Co-requisites	Non
Subject Coordinator	TBA

Synopsis

This subject introduces general concepts on Business and Entrepreneurship, and the application of ICT systems and tools in an integrated business working environment. It will help students understand the dynamics of business models and the importance of entrepreneurial skill-sets in a volatile economic environment. The aim is to make students become aware of the impacts on business and environment from entrepreneurial activities and innovations.

Subject Topics

Topic 1: ICT and Business

Topic 2: E-Commerce and E-Business

Topic 3: Business Management (Small Business).

Topic 4: Business Entrepreneurship

Topic 5: Professional Work Practice & Ethics

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Identify relevance of ICT to support businesses.
SLO2: Demonstrate an understanding of E-commerce business models.
SLO3: Understand business management practices.
SLO4: Understand key concepts in business entrepreneurship.
SLO5: Apply professional work practices.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Assignment	**(18%)**
Quiz	**(12%)**
Test	**(20%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 18% towards the final grade for the subject.
Assessment 2 -	**Quiz:** There will be 3 quiz contributing 12% towards the final grade for the subject.
Assessment 3 -	**Test:** There will be 2 tests contributing 20% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Kollmann, T., Kuckertz, A., Stockmann, C. *E-entrepreneurship and ICT ventures: Strategy, organization, and technology*, IGI Global. 2010.

References

Burton, G. *Entrepreneurship and Small Business Management*, Library Press. 2017.

Relevant Unitech Policies

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CS423: ADVANCED DBMS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Advanced DBMS
Subject Code	CS 423
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS312 database II
Co-requisites	Non
Subject Coordinator	TBA

Synopsis

This subject covers advanced concepts in Database Management Systems (DBMS). Databases and information management systems facilitate handling of large amounts of information. The information we want to process is now complicated and diverse than it used to be. We require more intelligent, application-specific and sophisticated systems to do processing. This course will look at different types of Data Models, Cloud Databases (NoSQL) and Data Warehousing.

This subject furthers the concepts covered in Database II (CS312). It aims at covering database concepts at the intermediary and advanced level.

Subject Topics

Topic 1: Different Types of Data Models

Topic 2: Introduction to XML Data Model (Semi-structured)

Topic 3: Introduction to Document Databases (Semi-structured)

Topic 4: Introduction to Cloud Databases (NoSQL Databases)

- Data Replication and Data Consistency Models
- Different types of Cloud databases

Topic 5: Data Warehousing/Big Data Concepts/Techniques/Use Cases

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Compare and understand different data models
SLO2: Develop knowledge on semi-structured data models and be able to apply in real-world
SLO3: Develop knowledge on querying and manipulating semi-structured databases.
SLO4: Develop understanding on Cloud databases and how data replication and consistency models work.
SLO5: Demonstrate an understanding on data warehousing processes and techniques.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Assignment	**(26%)**
Test	**(24%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 4 assignment contributing 26% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 2 tests contributing 24% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

L.Silverson,P.Agnew (2009)The Data Model Resource Book, Vol. 3: Universal Patterns for Data Modeling 1st Edition

References

1. TutorialsPoint (2020). *Database tutorials*. Tutorialspoint. http://www.tutorialspoint.com

2. Banker, K. (2012). *MongoDB in Action, 2nd Edition*. Manning Pubs Co Series.

Relevant Unitech Policies

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CS424: SOFTWARE UI DESIGN

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Software UI Design
Subject Code	CS 424
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	General knowledge of ICT, IT systems and Computer Science Fundamentals
Co-requisites	Non
Subject Coordinator	TBA

Synopsis

Software User Interface Design (UI) is the design for software, such as for mobile devices, home appliances, computers, and other electronic devices focusing on maximizing usability and the user experience. The aim is to make the user's interaction as valuable and outspoken as possible to accomplish user goals. This subject will cover fundamental design principals to guide software interface designs.

Subject Topics

Topic 1: Introduction

Topic 2: UI Design Process

Topic 3: Psychology and Human Factors for User Interface Design

Topic 4: Visual Communication

Topic 5: UI Design Patterns

Topic 6: Social Media

Topic 7: Mobile Software UI Design

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Appreciate the importance of the software UI design process.
SLO2: Demonstrate an understanding of many software UI design patterns.
SLO3: Apply theories in psychology and human factors for UI design.
SLO4: Implement techniques of visual communication in their end-user application designs
SLO5: Design mobile software UIs for good user experience

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Assignment	**(18%)**
Test	**(20%)**
Quiz	**(12%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 18% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 2 tests contributing 20% towards the final grade for the subject.
Assessment 3 -	**Quiz:** There will be 3 quiz contributing 12% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Tidwell, J. *Designing Interfaces, 2nd Edition, O'Reilly Media, Inc.* 2010.

References

1. Anderson J., McRee J., & Wilson R. *Effective UI*. O'Reilly Media, Inc. 2010.
2. Baecker, Ronald M., Jonathan Grudin, et al. *Readings in Human-Computer Interaction: Toward the Year 2000. 2nd ed*. Morgan Kaufmann, 1995. ISBN: 9781558602465.
3. Shneiderman, Ben, and Catherine Plaisant. *Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed.* Addison Wesley, 2004. ISBN: 9780321197863.

Relevant Unitech Policies

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CS425: INTERNET OF THINGS

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Internet of Things
Subject Code	CS 425
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Non
Subject Coordinator	TBA

Synopsis

This subject introduces students to the core concepts of the Internet of Things (IoT). The key elements at the heart of IoT is the concept of connecting devices using sensors, software and other related technologies. The students will be made to appreciate what automation is, how devices are connected to form a network of devices, see how big data is involved in the transfer of information and the need to provide security against cyber intrusion. Python programming for IoT will enable students to experience the feel of creating a software solution to digitalize tasks.

Subject Topics

Topic 1: Digital Transformation

Impacts of digital transformation in industry, private and public organisations and our daily lives. Show how devices connect to the network, exchange information and how security is maintained through sensors or software such as those on a mobile device.

Topic 2: IoT Programming

Introduction to IoT programming using the Python programming language. Discuss IoT innovations using the concept of Prototyping.

Topic 3: Big Data Analytics

What is Big Data? Explain what challenges are present in data storage and what possible solutions are available. Explain how big data is used to support various organizations and individuals.

Topic 4: Automation

What is automation? How are organizations embracing automation? What role are machine learning and artificial intelligence (AI) playing in automation? What is intent-based networking and what impact does it have in business.

Topic 5 – Security

Importance of security in a digital world. Explain how to secure organisations, personal devices and data

Topic 6 – Opportunities

Challenges and opportunities in the digital world both in industry and education.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Demonstrate an understanding of the fundamental concepts of IoT

SLO2: Demonstrate the ability to create an IoT software or app using Python programming language.
SLO3: Demonstrate an understanding on key concepts of Connecting Devices.
SLO4: Demonstrate an understanding of Big Data and its importance in IoT.
SLO5: Demonstrate an understanding of Automation and its impact in IoT.
SLO6: Demonstrate an understanding of the importance of IoT Security.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Labs	**(10%)**
Test	**(28%)**
Quiz	**(12%)**
Exam	**(50%)**

Assessment 1 - **Labs:** There will be 2 labs contributing 10% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 4 tests contributing 28% towards the final grade for the subject.
Assessment 3 - **Quiz:** There will be 4 quiz contributing 12% towards the final grade for the subject.
Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Yuce Mehmet, Khan Jamil (2019). *Internet of Things (IoT) Systems and Applications.* Jenny Stanford Publishing

References

Cisco Academy (2020). *Networking academy tutorials*. Cisco Networking Academy. http://www.netacad.com/

Relevant Unitech Policies

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CS426: MOBILE PROGRAMMING

Course(s)	Bachelor of Science in Computer Science (NQF Level 7)
Subject Name	Mobile Programming
Subject Code	CS 426
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS314 Data Structures and Algorithms, CS 320 Internet Programming
Co-requisites	Non
Subject Coordinator	TBA

Synopsis

This course covers theoretical aspects related to mobile devices: their operating system, hardware, and user interface constraints. Comparing and contrasting families of existing devices rather than focusing on a specific product. The creation of mobile applications using tools that allow development for a wide range of platforms, while focussing more on Google's android system in particular.

Subject Topics

1. Mobile Operating Systems

   Overview of mobile OS, comparing the different mobile operating systems: android, iOS, MS Windows, macOS, KaiOS, and Tizen. Architecture, scheduling, memory, security and Kernel.

2. Mobile Hardware

   Comparing the different processors and memory, cellular and connectivity, digital camera and audio, sensors and power.

3. User Interface Constraints

   Analysing UI constraints: memory. Battery life, ability to adapt to different screen sizes and orientations, security and network bandwidth.

4. Android Application Design Essentials

   Introduction to Appcelerator Titanium SDK: Downloading and installation Appcelerator Titanium, setting up the environment, building an application, Understanding the anatomy of android applications, HTML5 for mobile development and advantages and Java Script overview.

.5. Android User Interface Design

   Designing GUI, creating a view or presentation layer, create view, windows, tabs, and user interface like buttons, textbox, table view and more. Navigation between different entities, control events.

6. Testing Android Applications

   Emulators and targets, Appium (local server), mocha (npm package) for testing and fastlane for automation. Signing, packaging, managing app meta data, testing and deploying in App Stores.

7. Using common Android APIs

Hardware APIs, hardware interfacing using javaScript, APIs available in Appcelerator Titanium, Camera API, Accelerometer API and others.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Identify the different concepts of mobile programming the makes it unique from other platforms.
SLO2: Critique mobile applications on their design
SLO3: Use prototyping techniques to design and develop mobile interfaces faster
SLO4: Create mobile applications for the android operating system which use: basic to advanced phone features
SLO5: Deploy applications to the Android market place for distribution.
SLO6: Identify mobile hardware and its limitations.
SLO7: Identify the different operating systems and its limitations.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Project	**(20%)**
Test	**(15%)**
Quiz	**(8%)**
Assignment	**(7%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 1 assignment contributing 7% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 2 tests contributing 15% towards the final grade for the subject.
Assessment 3 - **Quiz:** There will be 2 quiz contributing 8% towards the final grade for the subject.
Assessment 4 - **Project:** There will be 1 project contributing 20% towards the final grade for the subject.
Assessment 5 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks' semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Griffiths, D. (2017). *Head First Android Development (*2nd Ed)*: A Brain Friendly Guide*.

References

1. Firtman, M. (2010). *Programming the mobile web*. O'Reilly Media.

2. TutorialsPoint (2020). *Mobile programming tutorials*. Tutorialspoint. http://www.tutorialspoint.com

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APPLIED MATHEMATICS COURSE STRUCTURE

First Year First Semester

Code	Subject	Contact Hours	Credit
AM 111	Foundation Mathematics	6	20
AM 112	Calculus and Algebra	6	20
CS 113	Introduction to ICT	6	18
CD 111	Professional Development	6	15
		24	**73**

First Year Second Semester

AM 124	Probability and Statistics I	6	20
AM 125	Linear Algebra I	6	20
AM 126	Analytical Geometry	6	20
CS 123	Advanced ICT	6	18
		24	**78**

Second Year First Semester

Code	Subject	Contact Hours	Credit
AM 211	Calculus and Analysis	6	20
AM 212	Linear Algebra II	6	20
AM 213	Discrete Mathematics	6	20
CS 115	Programming I	6	19
		24	**79**

Second Year Second Semester

AM 224	Mathematical Modelling	6	20
AM 225	Statistics II	6	20
AM 226	Numerical Methods I	6	20
CS 125	Programming II	6	19
		24	**79**

Third Year First Semester

Code	Subject	Contact Hours	Credit
AM 311	Ordinary Differential Equations	6	20
AM 312	Research Methods and Skills	6	20
AM 313	Financial Mathematics I	6	20
CS 210	Programming III	6	19
		24	**79**

Third Year Second Semester

AM 235	Numerical Methods II	6	20
AM 326	Operations Research	6	20

AM 327	Partial Differential Equations & its Applications	6	20
CS220	Programming IV	6	19
		24	**79**

Fourth Year First Semester

Code	Subject	Contact Hours	Credit
AM 411	Introduction to Stochastic Modelling	6	20
AM 412	Special Projects I	6	20
AM 413	Real Analysis	6	20
CS 314	Data Structures & Algorithms	6	19
		24	**79**

Fourth Year Second Semester

AM 427	Special Project II	6	20
CS 325	Introduction to Data Science	6	17
AM 424	Complex Variables	6	20
	[Elective Topic Subject]		
AM 425	Classical Mechanics	6	20
AM 426	Algebraic Structures	6	20
		24	**77**

GRADUATE STATMENT

BSAM has more units on Computer programming and Mathematical modelling which gives our graduate an edge in application of mathematical knowledge using a standard computer and common mathematics software.

This programme aims to produce graduates with solid grounding in mathematics with the ability to solve problems in Statistics, Finance, Science, Technology and Engineering by developing computer programs. They will be employable as Mathematics teachers, Statistical officers, Bank and Finance officers, Programmers, Researchers, etc. In addition, some new disciplines have emerged out of STEM which require solid mathematical and computing background. For example: Big Data Analytics, Data Science, and Computer/Cyber Security. Graduates of BSAM will be ideally equipped for these.

COURSE LEARNING OUTCOME

After completing the 4-year degree program, applied mathematics graduates will possess the following attributes:

1	An ability to apply mathematical theory to solve practical problems.
2	An ability to identify and analyze practical problems and find appropriate and optimal solutions.
3	An ability to use specialized computer software to analyze and find solutions to complex mathematical problems.
4	Have theoretical background compatible with international standards
5	An ability to apply mathematical methods and algorithmic principles to the development and maintenance of computer-based systems.
6	An ability to communicate and work well with experts in many different disciplines that are heavily dependent on mathematical tools in their daily operations

SUBJECT DETAILS

AM111: FOUNDATION MATHEMATICS

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Foundation Mathematics
Subject Code	AM 111
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

A solid foundation is needed as platform on which all other related concepts can be based upon in any given academic training. As such, this course is expected to play such a role in the training of young mathematicians. This unit introduces the student to notions such as properties of real numbers, fundamentals of algebra, different types of functions and their various applications as well as a brief introduction to the fundamentals of calculus.

Subject Topic

1. Properties of the number system.
2. Basic algebra: functions and equations, graphs.
3. Linear functions: Equations and applications, systems of linear equations.
4. Non-linear functions: Quadratic, exponential, logarithmic and trigonometric functions – properties and applications.
5. Introduction to calculus: Rates of change, limits, derivatives, rules of differentiation, second derivatives, maxima and minima and applications, integration and applications.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Solve straightforward equations and draw and interpret graphs of one independent variable.
2. Understand the concepts involved with functions and functional notation and in particular know the properties associated with quadratic, exponential, logarithmic and trigonometric functions and applications of same.
3. Understand the concepts involved with rates of change, derivatives, maxima, minima and integration.
4. Engage in analytical thinking skills and communicate clearly and concisely in mathematical language.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Anton, Bivens& Davis; Calculus Early Transcendentals, 10th Edition, 2012, John Wiley & sons.

References

1. Gould & Hurst; Bridging Gap to University Mathematics, 2009, Springer – Verlag London Limited.

Relevant Unitech Policies

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AM112: CALCULUS AND ALGEBRA

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Calculus and Algebra
Subject Code	AM 112
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Grade 12 Mathematics (Advance or General)
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject aims to connect students' mathematical experience in Calculus & Algebra at secondary level to what they would experience at tertiary level. It is to enable students to be competent in the use and interpretation of mathematical notations, computations and processes needed for degree studies in Mathematics & Computer Science. On completion of this subject students should be able to sketch and manipulate various elementary functions and also differentiate including those in parametric and implicit form using product and chain rule, perform integrals, solve equations containing complex numbers, perform vector computations and operations and matrix operations including use of Gaussian elimination.

Subject Topics

1. Elementary Functions

- Polynomial, trigonometric, logarithmic and exponential functions, Composite functions.

2. Differentiation

- Parametric form, implicit form, Product and Chain rule.

3. Integration

- Integration of various types of functions, Fundamental theorem of Integration, Integration by parts, by substitution, by partial fraction.

4. Complex Numbers

- Solving equations containing complex numbers.

5. Vectors

- Vector in 2 and 3 dimensions
- Addition, subtraction, scalar, dot and cross products.

6. Matrices

- Matrix operations & definitions
- Determinants and the solution of simple linear systems of equations using inverse matrices or Gaussian elimination.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Demonstrate competency in the use and interpretation of mathematical notation.
2. Recognize, manipulate and solve mathematical expressions involving elementary functions, their derivatives and integrals, complex numbers, matrices and vectors.
3. Employ mathematical techniques to solve elementary problems provided in a particular context.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Mallet DG, Pette GJ & Farr AC (2010) Introductory Algebra and Calculus, Pearson..

References

1. Berry J. and Wainwright P., Foundation Mathematics for Engineers
(Macmillan, 1991)

Relevant Unitech Policies

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AM125: LINEAR ALGEBRE I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Linear Algebre I
Subject Code	AM 125
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Grade 12 Mathematics (Advance)
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This unit introduces vector and matrix methods. The concepts and problems covered include: vectors and matrix operations, solution of systems of linear equations, transpose and inverse of a matrix, determinants, diagonal, triangular and symmetric matrices, norm of a vector, dot product, orthogonality, eigenvalues and eigenvectors.

Subject Topics

1. Systems of Linear Equations
    - Matrices and Systems of Linear Equations. Gauss-Jordan Elimination.
2. Matrices
    - Addition, Scalar Multiplication, and Multiplication of Matrices. Algebraic Properties of Matrix Operations
3. Determinants
    - Introduction to Determinants. Properties of Determinants. Determinants, Matrix Inverses, and Systems of Linear Equations.
4. Vector Spaces
    - The Vector Space R^n. Dot Product, Norm, Angle, and Distance. General Vector Spaces. Subspaces. Linear Combination of Vectors, Linear Dependence and Independence. Basis and Dimension. Rank of a matrix. Orthonormal Vectors and Projections in R^n.
5. Eigenvalues and Eigenvectors
    - Eigenvalues and eigenvectors.
    - Diagonalization of Matrices.
6. Linear transformations
    - Matrix Transformations
    - Matrix Representations of Linear Transformations.
7. Inner Product Spaces
    - Inner Product Spaces
    - Application: Least-Squares Curves.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Manipulate matrices, solve systems of linear equations by using of different methods.
2. Calculate determinants, inverse matrices, calculate norms of vectors, dot products, basis of a vector spaces, rank of a matrix.
3. Employ techniques of Linear Algebra to interpret and solve different problems.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Gareth Williams, LINEAR ALGEBRA with applications. Jones and Bartlett Publishers. Boston, 2004.

References

Beezer R.A, A First Course in Linear Algebra, 2014, Congruent Press

Relevant Unitech Policies

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AM124: ANALYTICAL GEOMETRY

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Analytical Geometry
Subject Code	AM 124
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This course is an introduction to probability and statistics with applications. Topics will cover: basic combinatory, random variables, probability distributions, Bayesian inference, hypothesis testing, confidence intervals, and linear regression.

Subject Topics

- Probability
- Counting
- Random variables, distributions, quantiles, mean variance
- Conditional probability, Bayes' theorem, base rate fallacy
- Joint distributions, covariance, correlation, independence
- Central limit theorem
- Bayesian inference with known priors, probability intervals
- Conjugate priors
- Exploratory Data Analysis – distributions and relationships.
- Data collection and Randomness – randomness and sampling.

Computation, simulation, and visualization using Minitab and other software's will be used throughout the course.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Use basic counting techniques (multiplication rule, combinations, permutations) to compute probability and odds.
2. Compute conditional probabilities directly and using Bayes' theorem, and check for independence of events.
3. Set up and work with discrete random variables. In particular, understand the Bernoulli, binomial, geometric and Poisson distributions.
4. Work with continuous random variables. In particular, know the properties of uniform, normal and exponential distributions.
5. Know what expectation and variance mean and be able to compute them.
6. Understand the law of large numbers and the central limit theorem.
7. Compute the covariance and correlation between jointly distributed variables.
8. Create and interpret scatter plots and histograms.
9. Understand the difference between probability and likelihood functions, and find the maximum likelihood estimate for a model parameter.
10. Do Bayesian updating with discrete priors to compute posterior distributions and posterior odds.
11. Do Bayesian updating with continuous priors.
12. Carry out data collection and apply concepts learnt in the subject.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Devore J.L, Probability and Statistics for Engineering and Science, 9th edition, Cengage Learning

References

1. Moore DS, McCabe GP & Craig B (2009) Introduction to the Practice of Statistics, 6th edition, New York: WH Freeman.
2. Utts JM &Heckard RF (2007) Mind on Statistics, 3rd edition, CA: Thomson Brooks/Cole

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM126: ANALYTICA GEOMETRY

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Analytical Geometry
Subject Code	AM 126
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This course is an introduction to probability and statistics with applications. Topics will cover: basic combinatory, random variables, probability distributions, Bayesian inference, hypothesis testing, confidence intervals, and linear regression.

Subject Topics

1. Introduction to plane analytical geometry.
2. Vectors in the plane.
2. Lines.
3. Conic sections.
4. Coordinate transformations.
5. Curve sketching.

6. Polar coordinates and parametric equations.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

SLO1: Solve problems involving lengths and distances in the plane, including midpoint and point-of-division formulas.
SLO2: Demonstrate understanding of the notions of slope and inclination of lines, including angles between lines, parallel lines and perpendicular lines.
SLO3: Recognise the relationship between equations in two variables and graphs in the plane and use the equations to find pertinent information such as points of intersection, and intercepts.
SLO4: Perform arithmetical and geometric operations involving vectors in the plane.
SLO5: Use vectors to solve geometric and physical problems.
SLO6: Sketch graphs and discuss relevant features of curves in the plan determined by certain equations (including lines, circles, parabolas, ellipses, hyperbolas, polynomial functions, rational functions, and features such as slope, inclination, centre, radius, vertices, foci, axes, eccentricity, intercepts, asymptotes).
SLO7: Determine equations of curves when given information that determines the curves.
SLO8: Perform translations and rotations of the coordinate axes to eliminate certain terms from equations.
SLO9: Model real world situations with equations of conics.
SLO10: Use the polar coordinate system, relate it to the rectangular coordinate system, and graph equations using polar coordinates.Sketch graphs in the plane determined by parametric equations by direct sketching as well as elimination of the parameter to obtain a rectangular equation.
SLO11: Engage in analytical thinking skills and communicate clearly and concisely in mathematical language.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Riddle D.F, Analytical Geometry, 6th Edition, 1982, John Wiley & sons.

References

1. Agnew R.P; Analytical Geometry and Calculus, with Vectors, 2010, McGraw-Hill Book Company Inc.

Relevant Unitech Policies

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CS113: INTTRODUCTION TO ICT

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Introduction to ICT
Subject Code	AM 113
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**18**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject will develop the fundamental ICT concepts and principles. The subject also provide technical skills needed to prepare the students to be able to use these skills in the other areas of their studies and give a broad perspective of what is covered in their preceding years.

Subject Topics

1. Hardware

   Desktop, laptop, tablet and smartphone systems. Primary and secondary storage devices. Input/output devices, including keyboards, pointing devices, touch screens, networks and printers

2. Operating Systems

   Windows and UNIX systems. Graphical User Interfaces (GUI) and command line interfaces

3. Application Software

   Office systems, graphics programs, web browsers, email clients, etc.

File Management: Types of files. File properties. File systems. Directory trees. File manipulation (naming, renaming, storage, retrieval, viewing content, updating content, moving, and deleting). Read-only and hidden files. File backup. File editors.

4. Graphics Pixels and images. Image size and resolution. Bitmap images. Graphics compression standards. Using a graphics program to manipulate images. Creating animations from still images
5. Word Processing Formatting and styles. Tables. Drawing objects. Mailing lists.
6. Spread Sheet
7. Database
8. VBA Programming

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

LO 1. Describe the hardware components of their workstation or laptop computer;

LO2: Describe the components of their computer's operating system;

LO3: Save, manipulate and retrieve files from storage;

LO4: Set up a computer to access the resources of hard-wired and wireless networks;

LO5: Use a word processor to produce textual documents;

LO6: Use a spread sheet to solve real-world problems.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(35%)**
Assignment	**(15%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 15% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 3 tests contributing 35% towards the final grade for the subject.
Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Sawyer, W; Using Information Technology: A Practical Introduction to Computer & Communications, 6th Edition (McGraw HILL)

References

Celebic,G&D,Rendulic; Basic Concepts of Information and Communication Technology handbook, 2011, Open Society for Idea Exchange, Zagreb.

Relevant Unitech Policies

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CS123: ADVANCED ICT

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Advanced ICT
Subject Code	AM 123
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**18**
Delivery Mode	On campus
Prerequisites	CS113
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject will develop the fundamental ICT concepts and principles. The subject also provide technical skills needed to prepare the students to be able use these skills in the other areas of their studies and give a broad perspective of what is covered in their preceding years.

Subject Topics

1. **Introduction to Web Design:** The HTML protocol. HTML editors. Designing a simple web page. HTML tags for simple text formatting.
   HTML tags for tables, lists, images and anchors. Introduction to styles and cascading style sheets. Separating content from design.
2. **Introduction to Databases:** Database terminology. Comparison of databases and data files. Organization of information. Flat-file databases. Using a spreadsheet to create a simple database. Relational databases. Key fields and indexes. Hierarchical databases.
3. **Macro Programming:** Automating tasks using macros in spreadsheets, word processors and text editors. Recording and editing macros.

4. **ASCII Coding:** The ASCIIcharacter set. Hidden and control characters. Differences between operating systems. Manipulating ASCII codes. Other coding systems (e.g., MIME64). Binary files.
5. **Computer Graphics:** Pixels and images. Image size and resolution. Bitmap images. Graphics compression standards. Using a graphics program to manipulate images. Creating animations from still images.
6. **Sound**: Digitizing sound. Compression standards. Proprietary and free protocols. Application programs.
7. **File Compression**: Advantages and disadvantages of compression. Use of data compression programming.MD5 and SHA1 one-way digests.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

LO1: Design a simple web page;
LO 2: Construct and query a simple flat-file database.
LO3: Write simple macro programs in a spreadsheet, word processor or text editor;
LO4: Manipulate text and handle hidden text characters;
LO5: Edit graphics images and change the properties of images;

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(35%)**
Assignment	**(15%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 15% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 35% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Sawyer, W; Using Information Technology: A Practical Introduction to Computer & Communications, 6th Edition (Brookshear, J.G; 2000; Computer Science: An overview, 6th Edition (Addison Wesley Longman)

References

D. Evans, Introduction to Computing, 2011, Creative Commons. http://computingbook.org

Relevant Unitech Policies

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AM211: CALCULUS AND ANALYSIS

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Calculus and Analysis
Subject Code	AM 211
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Gradw 12 Mathematics A
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Fundamental concepts of Calculus and Analysis play a very crucial role in many science, engineering, economics and finance related applications. Hence it is important that one grasps the crucial theorems that govern the mechanics of such complex applications. This unit covers multivariable and vector calculus. Two very important notions in finding solutions to the applications such as the ones discussed above.

Subject Topics

1. Multivariable calculus: multivariable functions, limits and continuity, partial derivatives, higher-order derivatives, the chain rule, linear approximations and differentiability, differentials, gradients and directional derivatives, implicit functions, Taylor series and approximations, extreme values, double integrals, triple integrals, change of variables in multiple integrals, applications of multiple integrals.

2. Vector calculus: vector and scalar fields, conservative fields, line integrals, surfaces and surface integrals, oriented surfaces and flux integrals, gradient, divergence and curl.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Demonstrate knowledge of the basic mathematical theory of differential an integral calculus for functions of 2 or more variables defined explicitly and implicitly.
2 Apply calculus techniques to determine series approximations and extrema in an unconstrained and constrained setting, for functions of 2 or more variables.

Demonstrate knowledge of the mathematical theory of vector fields and apply calculus techniques to such fields including the development of versions of the Fundamental Theorem of Calculus for integrals of vector fields.

3 Draw on a range of knowledge and thinking skills to solve problems.

4 Decompose a problem into smaller parts, solve these and hence solve the original problem setting out calculations clearly and using consistent mathematical notation.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Adams RA & Essex C (2010) Calculus: A Complete Course, 7th edition, Pearson Edu. Canada Inc

References

1. Anton H, Bivens I & Davis S (2002) Calculus: Early Transcendentals, 7th edition, John Wiley & Sons Inc.
2. Kaplan W (2003) Advanced Calculus, 5th edition, Addison-Wesley Higher Mathematics.

Relevant Unitech Policies

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AM212: LINEAR ALGEBRA II

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Linear Algebra II
Subject Code	AM 212
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	AM 125 Linear Algebra
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Many difficult problems can be handled easily once relevant information is organized in a certain way. This subject aims to teach students how to organize information (in cases where certain mathematical structures are present) about vector spaces in a way that makes problems involving linear functions of many variables easier (or at least tractable) to analyse and solve. On completion of this subject students should be able to define Euclidean space and its subspaces, find general solution of linear system of equations, solve eigenvalue problems, perform matrix diagonalization, compute matrix functions, define vector spaces, perform linear transformation, calculate inner product, show orthogonality and orthonormal vectors, use technique for decomposing a matrix(Gram-Schmidt Process and QR-Decomposition), calculate best approximate solution, fit models to data and analyse the accuracy of the fit, carry out function approximation.

Subject Topics

Topic 1: The Euclidean space R^n

- a brief review of key matrix properties,
- facts about linear systems and the properties of matrix inverses;
- the notions of vector subspaces, spanning sets, linear independence,
- basis and dimension in R^n;
- the four fundamental subspaces of a matrix, rank and nullity,
- the general solution of a linear system of equations;
- the eigenvalue problem within the Euclidean space framework;
- matrix diagonalization; and
- computing matrix functions.

Topic 2: Arbitrary Vector Spaces:

- properties and structure of a general, arbitrary vector space;
- properties of vector subspaces;
- a brief introduction to linear transformations and change of basis.

Topic 3: Inner Product Spaces:

- inner products;
- orthogonality;
- orthonormal bases;

- Gram-Schmidt Process and QR-Decomposition;
- orthogonal projections;
- best approximation and least squares solutions;
- data fitting;
- function approximation.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Show an understanding of matrix analysis, vector spaces and inner product spaces.
2. Present mathematical arguments clearly and logically.
3. Use a computer algebra package to solve problems in linear algebra.
4. Apply the knowledge of linear algebra in practical situations.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Leon S (2006) Linear Algebra with Applications, 7th Edition, Pearson Education

References

Leon S (2006) Student Study Guide, Linear Algebra with Applications, 7th Edition, Pearson Prentice Hall

Larson, Edwards &Falvo (2004) Elementary Linear Algebra with or without solution manual, 5th edition, Houghton Mifflin

Relevant Unitech Policies

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AM224: MATHEMATICAL MODELING I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Mathematical Modeling
Subject Code	AM 224
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	AM 125 Linear Algebra
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This course is an introduction to mathematical modelling based on the use of elementary functions to describe and explore real-world phenomena and data. Linear, exponential, logarithmic, and polynomial function models are examined closely and are applied to real-world data in course assignments and projects. Other function models may also be considered. Throughout the course, computational tools (graphing calculators, spreadsheets, etc.) are used to implement, examine, and validate these models. Students are expected to actively engage in the modelling process by questioning phenomena, collecting or creating data, and using computational tools to develop their models and evaluate their efficacy.

Subject Topics

1. Functions; modeling with linear functions.
2. Linear regression; modeling with exponential functions.
3. Additional topics in exponential modeling, modeling with logarithmic functions; linear systems.
4. Modeling with polynomial functions.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Solve applications using a variety of problem-solving strategies including geometric and algebraic techniques.
2. Apply basic statistical sampling techniques and apply the fundamentals of experimental design; students will calculate measures of central tendency and measures of variation and use these measures in appropriate ways to describe sets of date; given a set of data from real-world situations and computer spreadsheet software or pencil and paper, students will produce statistical graphs and use information from these graphs to make inferences and solve application problems.
3. Solve applications involving linear equations, including interpreting the meaning of slope and intercepts, finding the line of best fit for a scatter plot, and systems of linear equations.
4. Given a non-linear equation of situation (especially quadratic, cubic, exponential, and logarithmic), construct tables of values, graph these functions, recognize significant features of the graphs (including vertices, symmetry, relative extreme intercepts, and asymptotes), and interpret the meaning of these significant features in the context of real-life applications.
5. Given a chart of values or a scenario (either linear or non-linear), construct a scatter plot and curve of best fit, perform regression analysis, make predictions using the regression equation, and recognize significant features of the graphs.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Functions, Data, and Models, Gordon and Gordon, The Mathematical Association of America, 2010.

References

Mathematical Modelling: An Introduction to College Mathematics, by Geoff Clement, 2010.

Relevant Unitech Policies

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AM225: STATISTICS II

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Statistics II
Subject Code	AM 225
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Statistics I
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

In today's technologically advanced world, we have access to large volumes of data. The first step of data analysis is to accurately summarize all of this data, both graphically and numerically, so that we can understand what the data reveals. To be able to use and interpret the data correctly is essential to making informed decisions. On completion of this subject students should be able to estimate relationship using linear regression & linear models, using method of least squares, perform choice modelling using basic interferences, use appropriate forecasting models, apply relevant sampling methods and models for categorical data, using ANOVA techniques in decision making as well as non-parametric techniques including Bootstrapping.

Subject Topics

Topic 1: Parametric Estimation

-Estimating Relationships via linear regression and linear models
- Analysis of the method of Least Squares

Topic 2: Basic Inference and Model Choice

- Forecasting Models & Application

Topic 3.: Introduction to Sampling Methods in a Practical Context

-Models for Categorical Data

Topic 4: Introduction to the Design of Experiments

- Analysis of Variance (ANOVA)
-Non-Parametric Techniques including Bootstrapping

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

SLO1: Fit and assess statistical models of independent data via model formulation and parametric estimation.
SLO2: Develop linear statistical models relating a response variable to specified covariates via regression, and use these models for the purposes of prediction and understanding
SLO3: Have an understanding of the statistical considerations in designing experiments, and be able to use these to fit linear statistical models to such experimental data
SLO4: Enhance the following generic capabilities:
(a) Communicate in writing, graphically and orally appropriate to context,
(b) Apply knowledge in practical situations,
(c) Engage analytical thinking skills,
(d) Work in a team and collaborate with fellow workers,
(e) Draw on a range of knowledge and thinking skills to solve problems.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Johnson R.A. and Bhattacharyya G.K., Statistical Concepts and Methods, 2nd edWiely, 2010.

References

Chase W,Bown F., 2010, General Statistics, Wiley

Relevant Unitech Policies

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AM226: NUMERICAL METHODS I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Numerical Methods I
Subject Code	AM 226
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Gr 12 mathematics A
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Many real world problems are not solvable analytically. It is therefore imperative that numerical methods be developed to solve these problems. Thus it is essential to be equipped to handle such problems. Numerical Methods is that branch of mathematics which investigates the numerical solution of categorised problem types. This unit provides you with an introduction to the formal numerical methods necessary to obtain the numerical solution of these problem types.

Subject Topics

1. Errors: Rounding, truncation, idea of ill-conditioning, induced and inherent instability.
2. Solution of Non-linear equations and systems of linear equations using both direct and iterative methods, Convergence of iterative methods and acceleration techniques.
3. Recurrence equations: solution and stability.
4. Polynomial approximation including interpolation and spline interpolation.
5. Numerical integration methods: Simpson, Newton-Cotes and Gauss quadrature methods. Idea of minimax approximation.
6. Numerical solution of ordinary differential equations
7. Euler, predicator-corrector and Runge-Kutta methods, Idea of stability.

8. Eigen-values and Eigen-vectors by power and similarity transform methods.
9. Matrix theory to support these numerical methods.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Use numerical methods for approximation,
2. solving linear equations,
3. do matrix manipulation,
4. integration and solving ordinary differential equations.
5. Solve applied problems in each of the above areas.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Turner. P.R., 2010, Numerical Analysis, Macmillan.

References

Atkinson K., 2011, Elementary Numerical Analysis, 2nded, Wiley

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM115: PROGRAMMING I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Programming I
Subject Code	AM 115
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Grade 12 Advanced mathematics (B or better)
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

To provide students with the fundamental programming concepts, principles and analytical processes that are involved in solving problems. This include analysing problems using flow charts and pseudo-codes and derive step-by-step approach in solving the problems.

Subject Topics

Topic 1: Introduction to programming languages

- History of programming languages
- Current languages and their use
- Data Types: Integer, Floating point, Characters, Strings, Boolean
- Introduce variables-local and global
- and objects in known programming language

Topic 2: Program Design

- Understanding the problem-analyse and derive flow charts and pseudo-code.
- Develop algorithms to solve problems

Topic 3: Using Integrated Development Environment

- Installing compilers
- Write simple programs using a given IDE and compile source codes to run programs
- Debugging code of errors: compile-time and run-time errors

Topic 4: Decision Constructs

- Introduce *if-then, if-then-else* statements and *nested if* logical statements
- Use of logical operators: AND/OR NOT
- Switch/case constructs
- Application of decision constructs to solve problems.

Topic 5: Iteration Constructs

- For loops
- While loops
- Do while loops
- Loop counters
- Infinite loops
- Breaking out of loops
- Using iteration to simplify task.

Topic 6: Functions and Procedures

- Writing and calling user-defined functions
- Passing parameters by value and by reference

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

Learning Outcomes:

LO1: Install a compiler and/or language IDE on a computer;
LO2: Develop algorithms to solve simple problems;
LO3: Design small programs to solve these problems;
LO4: Write programs illustrating an understanding of variables and data types;
LO5: Write programs using functions, selection and iteration to solve problems.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(20%)**
Lab	**(6%)**
Assignment	**(14%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 14% towards the final grade for the subject.
Assessment 2 - **Lab:** There will be 3 lab contributing 6% towards the final grade for the subject.
Assessment 3 - **Test:** There will be 3 tests contributing 20% towards the final grade for the subject.

Assessment 4 - **Final written examination:** A 2 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Introduction to Programming I-using NetBeans-A Student Manual (Florence Tiu Balagtas, Version 1.3, June 2006)
2. Introduction to Programming Using Java (David J. Eck, Version 6.0, June 2011)

References

Recommended Programming Tools: NetBeans and Eclipse

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM125: PROGRAMMING II

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Programming II
Subject Code	AM 125
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Programming I
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

To provide students with the fundamental programming concepts, principles and analytical processes that are involved in solving problems. Furthermore, to provide students with the opportunity to implement algorithms in programs to solve problems.

Subject Topics

Topic 1: Using Characters and Strings

- Converting between characters and strings. String manipulation (joining strings, sub-strings, extracting characters from strings, etc.).

Topic 2: Data Structures: Arrays: Using Arrays to store and manipulate data.

Topic 3: Using Algorithms: Sorting using Arrays

Topic 4: Manipulating File:

b. File types. Opening, reading from, writing to, appending to and closing text files.

Topic 5: Programming Approaches:

- Modular Programming-Top-down program design
- Object-Oriented Programming- Introduction to classes and objects. Creation of simple objects. Use of library classes.
- GUI and Event-triggered Programming: Using buttons, edit boxes, images, lists, etc. Tying code to controls.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

Learning Outcomes:
LO1: Write programs that manipulate characters and strings;
LO2: Use arrays to solve problems like sorting data;
LO3: Read information from files into a program, and write program output to file;
LO4: Write programs using the principles of program design;
LO5: Create and use simple objects, and use library classes;
LO6: Write GUI programs utilizing various controls like buttons, lists, etc.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(20%)**
Lab	**(6%)**
Assignment	**(14%)**
Exam	**(50%)**

Assessment 1 -	**Assignment:** There will be 3 assignment contributing 14% towards the final grade for the subject.
Assessment 2 -	**Lab:** There will be 3 lab contributing 6% towards the final grade for the subject.
Assessment 3 -	**Test:** There will be 3 tests contributing 20% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 2 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. F. Balagtas, Introduction to Programming I-using NetBeans-A Student Manual (Version 1.3, June 2006)
2. D.J. Eck, Introduction to Programming Using Java (Version 6.0, June 2011)

References

1. Programming Tools: NetBeans and Eclipse

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM311: ORDINARY DIFFERENTIAL EQUATIONS

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Ordinary Differential Equations
Subject Code	AM 311
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

In mathematics, an ordinary differential equation (ODE) is a differential equation containing one or more functions of one independent variable and the derivatives of those functions. The term ordinary is used in contrast with the term partial differential equation which may be with respect to more than one independent variable.

Ordinary differential equations (ODEs) arise in many contexts of mathematics and social and natural sciences. Mathematical descriptions of change use differentials and derivatives. Various differentials, derivatives, and functions become related via equations, such that a differential equation is a result that describes dynamically changing phenomena, evolution, and variation. Often, quantities are defined as the rate of change of other quantities (for example, derivatives of displacement with respect to time), or gradients of quantities, which is how they enter differential equations.

Specific mathematical fields include geometry and analytical mechanics. Scientific fields include much of physics and astronomy (celestial mechanics), meteorology (weather modelling), chemistry (reaction rates), biology (infectious diseases, genetic variation), ecology and population modelling (population competition), economics (stock trends, interest rates and the market equilibrium price changes).

Many mathematicians have studied differential equations and contributed to the field, including Newton, Leibniz, the Bernoulli family, Riccati, Clairaut, d'Alembert, and Euler.

Subject Topics

1. First order differential.
2. Second order constant coefficients linear equations.
3. Fourier series and Laplace transform.
4. First order systems.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

SLO1: Understand the principles of differential equations and develop theoretical knowledge regarding it.
SLO2: Enable to identify, define and solve real world and purely mathematical problems using existing knowledge and knowledge developed in this unit.
SLO3: Able to demonstrate independence and self-reliance in retrieving and evaluating relevant information and in advancing student's learning.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 2 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Zill, D.G & Cullen, M. R. (2009) Differential Equations with Boundary-Value Problems, 7th edition, Thomson.
2. Anton, H. (2010) Calculus with Analytic Geometry, 10th edition, Wiley.

References

1. Zill, D.G & Cullen, M. R. (2009) Differential Equations with Boundary-Value Problems, 7th edition, Thomson.
2. Anton, H. (2010) Calculus with Analytic Geometry, 10th edition, Wiley.

Relevant Unitech Policies

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AM312: RESEARCH METHODS AND SKILLS

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Research Methods and Skills
Subject Code	AM 312
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

The course aims to introduce students to research and report writing and the computer skills necessary for research to become sufficiently competent to produce a good quality research report and to present to their research orally. This will provide students with a strong foundation in the conceptualization and operationalization of research, how to design a research project and 'hands-on' skills in the utilization of different research methods.

Subject Topics

1. The nature of research and scientific methods including hypothesis formation and testing,
2. Sampling Techniques and Surveying.
3. Experimental design and data analysis, interpretation and presentation
4. Critical readings and Report writing skills
5. Supervision and management of a research projects.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Locate, analyse and synthesis information about the diversity of esearch approaches.
2. Develop ability to apply effective, creative and innovative solutions to research problems via use appropriate technology, and use of statistical software's in modern data analysis to aid problem solving and critical thinking exercises in research, develop teamwork, and interpersonal skills in negotiating research programs.
3. Employ correct methods to critically evaluate the efficacy of virtual means of delivering or developing research strategies.
4. Encourage and develop skills that will enhance the fulfilment of ongoing and continuous learning and intellectual curiosity via independent and group learning exercises

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(10%)**
Project	**(25%)**
Lab	**(15%)**
Exam	**(50%)**

Assessment 1 - **Lab:** There will be 1 lab contributing 15% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 1 tests contributing 10% towards the final grade for the subject.
Assessment 3 - **Project:** There will be 1 project ontributing 25% towards the final grade for the subject.

Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Pittenger,D.J; 2003, Behavioural Research Design and Analysis, McGraw Hill,

References

Weathington, B, L; 2017, Research Methods for the Behavioural and Social Sciences, Wiley.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM312: FINANCIAL MATHEMATICS I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Financial Mathematics I
Subject Code	AM 314
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

To examine the mathematical bases of the elementary financial models used in Business Finance and Economics. When dealing with financial models, we are using the approach of deriving and using the mathematical formulas. The knowledge of a formula for a model, and an idea of how it was derived, should give an understanding of the logic of the model, and an idea of why it works, which is the primary aim of this subject.

Subject Topics

Topic 1: Percentage Variations

Percentage calculations, VAT calculations, discounts, price and other indexes

Topic 2: Simple and Compound Interest

Amount of simple interest, Amount of compound interest, continuously compounded compound interest – arithmetic series

Topic 3: Annuities

Amount of ordinary annuity, amount of annuity due, Present Value (PV) and Future Value (FV) of an annuity, applications of geometric progression,

Topic 4: Loan Models

Flat rate loan, reducing balance loan and interest only loan models

Topic 5: Mixed Investment Model

Combination of annuity with compound interest investments, changes in payment schedules or interest rates

Topic 6: Internal Rate of Return Model (IRR)

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Systematically develop logical mathematical arguments,
2. Use percentage variations in numeric calculations,
3. Use logarithmic and exponential functions,
4. Use the Simple Interest and Compound Interest models to calculate various unknown quantities,
5. Produce formulae for arithmetic and geometric series from first principles,
6. Calculate variables for ordinary annuities, present value of an annuity, and annuity due situations,
7. Calculate various types of loans, and termination of loans,
8. Calculate loan repayments with varying interest rates,
9. Calculate price adjustments.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Lab	**(15%)**
Exam	**(50%)**

Assessment 1 -	**Assignment :** There will be 2 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 2 tests contributing 40% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

J Robert Buchanan (2014) An Undergraduate Introduction to Financial Mathematics, Third Edition, Millersville University,

References

1. Lane P Hughston(2012), Finance at Fields, University College London, United KingdomEdited by: Matheus R Grasselli (The Fields Institute, Canada & McMaster University, Canada),

2. Harshbarger, R.J. & Reynolds, J.J., *Mathematical Applications for the Management, Life and Social Sciences* 12th ed. (Cengage Learning)

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM312: FINANCIAL MATHEMATICS I

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Financial Mathematics I
Subject Code	AM 314
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Financial Mathematics helps in solving problems in economics and finance. The module covers topics that include: theory and structure of different interest rates and mathematical analyses of financial transactions. Computer packages will be used to solve problems faced in business and finance.

Subject Topics

1. Mathematical models and quantitative techniques in economics and finance including portfolio models and analysis.

2. Theory and structure of interest rates - general accumulation and discounting functions, force of interest, discounting, varying interest, general annuities, varying annuities, continuous varying annuities.
3. Mathematical analysis of financial transactions in money, capital, equity markets and futures - valuation of securities in these markets.
4. Life annuities and life assurances - the life table, basic life table functions, life annuities and assurances, policy values.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Show an understanding of - modern portfolio theory (including its development and application), the issues associated with the management of a securities portfolio, continuous cash flows and the force of interest and - contingent payments.
2. Apply calculus techniques to solve economics and financial problems.
3. Engage thinking and problem solving skills.
4. Develop information literacy.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 -	**Assignment :** There will be 3 assignment contributing 10% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 40% towards the final grade for the subject.
Assessment 3 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. J Robert Buchanan (2014)An Undergraduate Introduction to Financial Mathematics, Third Edition, Millersville University, USA.

References

1. Hughston, L. P(2012), Finance at Fields, University College London, United Kingdom

Relevant Unitech Policies

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CS210: INTRODUCTION TO PROGRAMMING III

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Introduction to Programming III
Subject Code	CS 210
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Programming II
Co-requisites	Introduction to Programming II
Subject Coordinator	TBA

Synopsis

This will provide Object-Oriented Programming concepts. It covers designing Classes, Object and object referencing, Inheritance, Polymorphism, Abstraction and Encapsulation. Furthermore, the course covers String class and methods, Predefined and user-defined classes and objects. Use of existing data types and objects in the Java Library. Program creation using inheritance, polymorphism and interfaces. Introduction to applets, class construction, methods and message passing arrays, string processing, file processing,

Subject Topics

Topic 1: Intro. To OOP Objects and Classes

- What is OOP?
- What is a class?
- Class as an object container
- Constructor class & methods
- Object instantiation

Topic 2 Abstraction

- Abstraction
- Encapsulation

Topic 3: Inheritance and Polymorphism

- Inheritance
- Polymorphism

Topic 4: Abstract Classes and Interfaces

- Design and use abstract classes
- Design and use interfaces

Topic 5`: Application of OOP

- Derive a subclass from a superclass
- Invoke superclass methods using keyword super
- Access data and methods from using the protected modifier

Subject Learning Outcomes (SLOs)

On completion of this subject, students should be able to:
LO1: Develop understanding of Java objects and classes.
LO2: Develop understanding of user defined and predefined class (object) types.
LO3: Demonstrate ability to formulate algorithms, to solve problems and to implement those solutions using objects and classes
LO4: Develop skills in object-oriented design and use of appropriate applications such as applets
LO5: Develop an understanding of class construction using subprograms such as methods with basic data input output capability.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(30%)**
Assignment	**(14%)**
lab	**(6%)**
Exam	**(50%)**

Assessment 1 -	**Assignment :** There will be 3 assignment contributing 14% towards the final grade for the subject.
Assessment 2 -	**Test:** There will be 3 tests contributing 30% towards the final grade for the subject.
Assessment 3 -	**Lab:** There will be 3 tests contributing 6% towards the final grade for the subject.
Assessment 4 -	**Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

DePasquale, L, 2008, Java Foundations: Introduction to Program Design and Data Structures, Addison-Wesley.

References

1. Liskov, B; 2001, Program Development in Java, Addison-Wesley
2. Horstmann,C, 2005, Object-Oriented Design & Patterns, Second Edition, Wiley
3. Unhelkar, B; 2005, Practical Object Oriented Design, Thompson Social Science Press
4. Bloch,J; 2008, Effective Java, Addison Wesley
5. Internet resources.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM 325: NUMERICAL METHODS II

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Numerical Methods II
Subject Code	AM 325
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	AM 226 Numerical Methods I
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Many real world problems are not solvable analytically. It is therefore imperative that numerical methods be developed to solve these problems. Thus it is essential that an applied mathematician be equipped to handle such problems. Approximation methods are carefully studied to reach optimum solutions with higher degree of accuracy. This unit provide more additional numerical solutions to non –linear problems.

Subject Topics

Topic 1: Floating Point Arithmetic

Catastrophic cancellation and the quadratic equation formula. Efficiency and Horner's method.

Topic 2: Approximation

Lagrange interpolation. Uniqueness and existence of interpolants, Error estimates. Runge Kutta Method, Divided difference form of interpolant. Application to quadrature.

Topic 3: Linear Algebra

PDE example to introduce sparse matrices. Iterative vs. Direct methods. Examples of iterative methods (Jacobi, Gauss-Seidel), Vector Norms, Eigenvalues, eigenvectors, spectral radius, convergence criteria, error bounds, matrix norms, and condition number.

Topic 4: Solving Non-Linear Equations

Solution of nonlinear equations by the bisection method, fixed point iteration, and Newton's method. Discussion in one and two dimensions.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Understand theoretical and practical aspects of the numerical solution of linear and nonlinear equations.
2. Understand the approximation of functions by polynomials and the approximation of integrals via quadrature schemes.
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Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(35%)**
Assignment	**(15%)**
Exam	**(50%)**

Assessment 1 - **Assignment :** There will be 3 assignment contributing 15% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 35% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. EndreSuli and David Mayers, *An Introduction to Numerical Analysis*, Cambridge University Press 2003.

References

1. Richard L. Burden and J. Douglas Faires, *Numerical Analysis*, Brookes Cole 2004.
2. Desmond J. Higham and Nicholas J. Higham, *MATLAB Guide*, Second edition, SIAM 2005.

Relevant Unitech Policies

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AM 326: OPERATION RESEARCH

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Operation Research
Subject Code	AM 326
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Operations research helps in solving problems in different environments that needs decisions. The module covers topics that include: linear programming, Transportation, Assignment, and CPM/ MSPT techniques. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments.

Subject Topics

1. The general nature of Operations Research, Fundamentals of linear programming (LP). Formulation of LP problems.
2. Solution of LP problems using graphical method. Simplex method. Analysis of LP models (analytical approach), sensitivity analysis, finding dual of an LP.
3. Economic interpretation of dual problems, shadow prices. Computer solutions and sensitivity analysis using spread sheets. Network Analysis.
4. Project scheduling techniques (CPM and PERT). Transportation problems. Trans-shipment problems.
5. Assignment problems. Shortest-route problems. Computer solution of the network problems

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Formulate a real-life problem in mathematical terms;

2. Select and apply Operations Research techniques, tools and methods to solve and analyses a variety of problems in this area;
3. Use spreadsheet modelling and other computer based techniques;
4. Express the solution to a problem in both quantitative and qualitative form; and
5. Have a foundation for further studies in Operations Research.

.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment :** There will be 3 assignment contributing 10% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. EndreSuli and David Mayers, *An Introduction to Numerical Analysis*, Cambridge University Press 2003. 1. Taha, Hamdy, Operations Research, 7th edition, (USA: Macmillan Publishing Company), 2003

References

1. Winston W (1999) Rations Research Applications and Algorithms, Boston: Duxbury Press
2. Hillier FS (1995) Introduction to Operations Research, Oakland, Calif: Holden-Day
3. Gupta P K, Hira D K (2011) Operations Research, N. Delhi, S. Chand & Comp. Ltd.

Relevant Unitech Policies

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AM 327: PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATION

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Partial Differential Equations and Applications
Subject Code	AM 326
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

The focus of the course is the concepts and techniques for solving the partial differential equations (PDE) that permeate various scientific disciplines. The emphasis is on nonlinear PDE. Applications include problems from fluid dynamics, electrical and mechanical engineering, materials science, quantum mechanics, etc

Subject Topics

1. Terminology; boundary and initial value problems; well- and ill-posed problems.
2. Linear PDE.
3. More on nonlinear PDE.
4. Variation Methods.
5. Free-boundary value problems.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Demonstrate understanding of the meaning of a partial differential equation (PDE), its order and solution; the concepts of initial and boundary conditions; and initial boundary value problems (IBVPs).
2. Use physical laws such as the Fourier's law of heat conduction, Fick's law of diffusion, Newton's law on a vibrating string, and the conservation of thermal energy to derive the heat/diffusion, wave, and Laplace equations, respectively.
3. Solve initial boundary value problems for the heat/diffusion, wave and Laplace equations subject to different boundary conditions, using Fourier series and separation of variables.
4. Use the method of characteristics to solve the initial value problem for the wave equation on an infinite one-dimensional string, a semi-infinite string, and a vibrating string of fixed length.

5. demonstrate understanding of the main properties of the Sturm-Liouville eigenvalue problem and of the concept of fundamental solution.
6. describe how the properties of the Fourier, Fourier sine, Fourier cosine and Laplace transforms are used to solve some partial differential equations.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Haberman, Richard. Applied Partial Differential Equations with Fourier Series and Boundary Value Problems (5th ed.). Upper Saddle River, NJ: Pearson Education Inc., 2012.
2. Carrier, George F., and Carl E. Pearson. Partial Differential Equations: Theory and Technique. 2nd ed. Boston, MA: Academic Press. 1988. ISBN: 9780121604516.

References

Kevorkian, J. Partial Differential Equations: Analytical Solution Techniques. Texts in Applied Mathematics, vol. 35. 2nd ed. New York, NY: Springer, 2000. ISBN: 9780387986050.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS220: PROGRAMMING IV

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Programming IV
Subject Code	CS 220
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	Programming III
Co-requisites	Programming III
Subject Coordinator	TBA

Synopsis

This course covers advanced programming techniques. This includes testing and debugging, genericity, collection frameworks, recursion and dynamic programming and some event handling and Graphical User Interface (GUI) programming as well as documentation of code.

Subject Topics

Topic 1 Testing and Debugging
- Debugging programs: handling exceptions
- Testing Activities-Integration testing, function testing, Acceptance testing
- Unit Testing (such as using JUnit in Java)
    - Static Testing (at compile time)-code walk through, code inspection
    - Dynamic Testing (at runtime)-black box testing, white box testing

Topic 2: Java Collections Framework
- List -- Array List, Linked List, Vector, Stack
- Queue – Priority Queue, Array Queue
- Set – Hash Set, Tree Set

Topic 3: Graphical User Interface Programming:
- Principles,
- Event-driven programming,
- Model-View-Controller architecture, JavaFX Framework

Topic 4 Recursion and Dynamic Programming (DP)
- Reducing problems into smaller problems in order to solve larger problems
- Using Memorization for DP algorithms

Topic 5 Generics
- Generic Types/Parameterized types
- Bounded/Unbounded Types
- Wildcard Subtyping
- Erasure and Restrictions on Generic Types

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

Learning Outcomes:
LO1: Develop understanding of writing testing and debugging code
LO2: Develop understanding in Java Collection Frameworks and API libraries.
LO3: Develop understand of designing GUI for applications in Java
LO4: Develop skills in recursion and dynamic programming techniques to solve problems
LO5: Demonstrate ability to formulate algorithms, to solve problems and to implement solutions using genetic algorithms.
LO6: To learn how to write annotations and documentation of code.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(30%)**
Lab	**(6%)**
Assignment	**(14%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 14% towards the final grade for the subject.
Assessment 2 - **Lab:** There will be 3 tests contributing 6% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 3 tests contributing 30% towards the final grade for the subject.

Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Haberman, Richard. *Applied Partial Differential Equations with Fourier Series and*
Liang,D,Y; 2011, "Introduction to Java Programming", 8th Edition, Prentice Hall,.

References

1. Eck, D. J., 2011; Introduction to Programming Using Java, Version 6.0,
2. Handouts
3. Internet resources

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM411: INTRODUCTION TO STOCHASTIC MODELING

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Introduction to Stochastic Modelling
Subject Code	AM 411
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	AM 225
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Many systems evolve over time with an inherent amount of randomness.
The purpose of this course is to develop and analyses probability models that capture the salient features of the system under study to predict the short and long term effects that this randomness will have on the systems under consideration. The study of probability models for stochastic processes involves a broad range of mathematical and computational tools. This course will strike a balance between the mathematics and the applications.

Subject Topics

1. Conditional probability and Conditional Expectation
2. Markov Chains in Discrete Time
3. The Poisson Process
4. Markov Processes in Continuous Time

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

LO 1: Have a sound understanding of the basic concepts and application of stochastic and statistical modelling in analysing processes and data interpreting real problems;

LO2: Appreciate the value of the principles and methods of stochastic and statistical modelling and the necessary mathematical tools;

LO3: Have developed skills in recognition of situations, identification of variables, choosing appropriate models and using mathematical tools;

LO4: Have developed generic skills in problem tackling, collaborative and individual work, written and oral communication, and appropriate technical methods;

LO5: Have understood the relevance of the work of this unit to problem-solving and interpretation in all the courses in which students likely to be involved, or in all the areas with which you may have contact: mathematics, all the sciences, engineering, information technology, business, law, education, health, social sciences.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(30%)**
Assignment	**(20%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 20% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 30% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Nelson, B.L., (2010), Stochastic Modeling: Analysis and Simulation, MacGraw-Hill Inc.

References

1. Ross, S.M., 2007, Introduction to Probability modelling, 9th edition, Academic Press, Elsevier Inc.

2. Internet Resources

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM413: REAL ANALYSIS

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Real Analysis
Subject Code	AM 413
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Real analysis stems from the concept of the real numbers. Where each numbers on the real number line are understood as partitions with infinite enumerations. It tries to analyse the relationship between partitions. Its application can be clearly seen in the computer world, engineering, etc.

Engineers and physicists need to solve differential equations. Most differential equations are impossible to solve symbolically. Instead, one obtains a numerical solution by either approximation methods or infinite series. Analysis was invented to understand the circumstances under which these methods produce correct answers. For example, when does the formal power series solution of a differential equation converge to the actual solution?

Subject Topics

1. Sequences.
2. Series.
3. Continuity.
4. Differentiability

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Understand the basic concepts of limit and convergence (of real sequences, series and functions).
2. Enable to indicate how these are treated rigorously.
3. Enable to show how these ideas are used in the development of real analysis.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(38%)**
Assignment	**(12%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 12% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 38% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Haggerty, R.,1993, Fundamentals *of Mathematical Analysis*, second edition, Addison-Wesley.

References

1. Lecture notes provided by dept. of MCS

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM424: COMPLEX VARIABLES

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Complex Variables
Subject Code	AM 424
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	Nil
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Unlike negative numbers and fractions that have direct fairly elementary applications, complex numbers are mostly of use in more advanced work.

The first application was in solving real cubic and quartic equations. When the (real) solution is unique, the formulae work out without using complex numbers, but when there is more than one real solution, complex numbers are involved in an intermediate step, although the imaginary parts cancel in the final answer.

The solution to linear differential equations is a combination of exponential and trigonometrically functions. It is fairly easy to find an exponential solution by substituting exp(ax) into the equation and solve for a. If a is complex we can use Euler's formula exp(i u) = cos(u) + i sin(u) to rewrite the solution as a combination of exponential and trigonometrically functions. This is what lies behind complex impedance used in alternating current theory.

There are many other applications. E.g. the wave function in quantum mechanics, contour integration and conformal mappings.

Subject Topics

1. Complex numbers and variables.
2. Analytic functions.
3. Contour integration of functions.
4. Standard integration contours.
5. Laplace transforms and their properties.
6. Fourier transforms, their properties and inverses.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Demonstrate knowledge and understanding of the use of complex integration for solving real integrals and their role in transform method theory;

2. Demonstrate knowledge and understanding of the use of complex transform methods for solving differential equations and their application to circuit stability;
3. Analyze systems to determine whether they are amenable to certain advanced mathematical techniques;
4. Systematically solve problems relevant to engineering;
5. Perform a range of algebraic and numerical calculations;
6. Systematically tackle problems with multiple stages and components;
7. Demonstrate organizational and time-management skills, and have a developed sense of responsibility for your own learning.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(38%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Priestley, H.A., 2003, An introduction to complex analysis, Oxford UP. QA 331.
2. Spiegel, M.R., 2007, Theory and problems of complex variables (Schaum) McGraw Hill. QA 331.

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References

1. Wylie,C, & Barrett, L.C., 1982, Advanced engineering mathematics McGraw Hill.
2. Kreyszig,E ., 2011, Advanced engineering mathematics, 10th edition, Wiley.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM425: CLASSICAL MACHANICS

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Classical Mechanics
Subject Code	AM 425
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	AM 122 & AM 327
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Mathematics play an integral part in ways where many real world problems are solved. Advanced vector calculus integrated with differential equations solves many mechanical problems like computational fluid dynamics in the field of mechanical engineering. This unit provides you with the necessary tools to rigorously approach some of those problems.

Subject Topics

Topic 1: Newtonian Mechanics of systems of particles

Review of Newton's laws; centre of mass; basic kinematic quantities: momentum, angular momentum and kinetic energy; circular motion; 2-body problem; conservation laws; reduction to centre of mass frame.

Topic 2: Lagrangian formulation of Mechanics

Lagrange's equations and their equivalence to Newton's equations, generalized coordinates; constraints; cyclic variables; examples.

Topic 3: Potential wells and oscillations

Particle in a potential well; coupled harmonic oscillators; normal modes; wave equation on a finite string and Fourier modes.

Topic 4: Rotating frames and the Rigid Body

Rotating frames in 2-D; centrifugal and Coriolis forces; moments of inertia, parallel axes theorem. Rotations in 3-D; free rigid body rotation, Euler's equations.

Topic 5: Hamiltonian Formulation

Hamilton's equations, equivalence with Lagrangian formulation; canonical transformations in one degree of freedom, equilibria; stability; conserved quantities.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Model simple mechanical systems, both in inertial and rotating frames, using Lagrange's equations.
2. Analyse the dynamics of systems near equilibrium; find the normal modes of oscillation.
3. Relate the Hamiltonian and Lagrangian approaches.
4. Understand the basics of waves in infinite 1-dimensional domains; determine the group and phase velocities of such waves.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(35%)**
Assignment	**(15%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 15% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 35% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Taylor, J.R., 2011, Classical Mechanics, Null Edition, University Science Books,

References

1. e Books

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

AM425: ALGEBRAIC STRUCTURES

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Algebraic Structures
Subject Code	AM 425
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**20**
Delivery Mode	On campus
Prerequisites	AM 125
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

Many ideas in abstract algebra ones taught of as merely abstract notions in mathematics are now slowly finding their way into many real world applications in science and engineering. For that reason, it has become increasingly important that the training of any mathematician must include fundamental notions in abstract algebra. This unit provides the student an insight into the different algebraic structures and the various operations on these structures as well as a look at certain geometric constructions.

Subject Topics

1. Preliminaries: Induction, Equivalence relations, Functions.
2. Groups: Groups and symmetries, Finite groups, Cyclic groups, Subgroups, Permutation groups, Cosets and Lagrange's Theorem, External direct product, Normal subgroups and factor groups, homomorphisms, The structure of finite abelian groups.
3. Rings: Introduction to rings, Integral domains, Ideals and factor rings, Ring homomorphisms.
4. Polynomial Rings: Division Algorithm, Unique Factorization of Polynomials, Divisibility in Integral Domains.
5. Fields: Extension Fields, Algebraic Extensions, Finite Fields.
6. Geometric Constructions: Constructible numbers, trisecting an angle, duplicating a cube, Squaring a circle.

Subject Learning Outcomes (SLOs)

After completing this unit students will be able to:

1. Understand the basics of groups, rings, integral domains and fields.
2. Understand several groups and the properties of integers and polynomials.
3. Understand the origin of the mathematical ideas studied and the logical structure of the subject.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(40%)**
Assignment	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 3 assignment contributing 10% towards the final grade for the subject.

Assessment 2 - **Test:** There will be 3 tests contributing 40% towards the final grade for the subject.

Assessment 3 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Gallian, J. 2012, Contemporary Abstract Algebra, 8th Edition,Brooks/Cole Cengage Learning.

References

Electronic books
Weekly Tutorial worksheets

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS325: INTRODUCTION TO DATA SCIENCE

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Introduction to Data Science
Subject Code	CS 325
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**17**
Delivery Mode	On campus
Prerequisites	CS 221 & CS 314
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject requires that students have a good background in programming, data structures and algorithms, as well as statistics. The subject introduces fundamental concepts of data science and uses Python as a programming tool.

Subject Topics

Topic 1: Python programming

Language basics. IDE (IDLE, Anaconda, …). Constructs (decision and loops). Basic data types. Advanced types/structures: dicts, lists, tuples, sets. Functional and OOP concepts. Python modules. Python package and distribution.

Topic 2: Basic introduction to data science

What is Data Science? What is Big Data and Analytics? Use cases of data science. What is data mining? What is machine learning?

Topic 3: Data visualization

Introduction. Basic data visualization techniques using Matplotlib: bar charts, line charts, scatter plots, etc. Data exploration and data communication.

Topic 4: Linear algebra

Basic algebra. Vectors, matrices, and their operations, and implementations of these in Python. Exploring NumPy. Using NumPy to solve mathematical problems.

Topic 5: Statistics, probability, and inference

Data sets. Correlation and causation. Simpson' paradox. Exploring SciPy or pandas. Probability: Dependence and independence. Conditional probability. Bayes's Theorem. Random variables. Continuous distributions. Normal distribution. Central Limit Theorem. Exploring SciPy.stats library. Hypothesis and inference: Statistical hypothesis testing, (Example: Flipping a coin), Confidence intervals, P-hacking, Bayesian inference.

Topic 6: Getting data and working with data

Getting data: Piping program output (stdin and stdout), Reading files, Scraping the Web, Finding and using APIs (JSON and XML). Working with data: Exploring your data, Cleaning and munging, Manipulating data, Rescaling, Dimensionality reduction. Using panda's library.

Topic 7: Modelling, Similarity, Neighbours, and Clusters

Machine learning: Modelling, Overfitting and under fitting, Correctness, Bias-variance trade-off, Feature extraction and selection. K-Nearest neighbours: The model, Curse of dimensionality. Naïve Bayes: Creating a sophisticated spam filter (example). Simple regression: The model, Using gradient decent, Maximum likelihood estimation. Multiple regression: The model, least squares model, Fitting and interpreting the model, Digression, Standard errors of regression coefficients. Logistic regression: The model, The logistic function, Support vector machines. Clustering: The Idea, The model, (examples), Bottom-up hierarchical clustering.

Topic 8: Decision trees and Neural networks

Decision trees: The idea, the entropy of a partition, Creating and applying decision trees, The random forests. Neural networks: The idea, Perceptrons, Feed-forward neural networks, Backpropagation, (examples).

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO17: Develop knowledge of Python programming.
SLO18: Apply concepts of linear algebra in data science using Python.
SLO19: Apply concepts of statistics and probability in working with data using Python.
SLO20: Use data gathering and manipulation techniques.
SLO21: Create visual graphics for data sets.
SLO22: Apply different statistical models including machine learning in data processing.
SLO23: Understand and use decision trees and neural networks in data processing.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(18%)**
Assignment	**(24%)**
Quiz	**(8%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 4 assignment contributing 24% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 2 tests contributing 18% towards the final grade for the subject.
Assessment 3 - **Test:** There will be 2 quiz contributing 8% towards the final grade for the subject.

Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Grus, J. (2015). *Data science from scratch: First principals with Python*. O'Reilly Media

References

1. EMC Education Services (2015). *Data science and big data analytics: Discovering, analysing, visualizing, and presenting data*. John Wiley & Sons Inc.
2. Other online resources and learning sites such as Coursera.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

CS314: DATA STRUCTURE AND ALGORITHMS

Course(s)	Bachelor of Science in Applied Mathematics (NQF Level 7)
Subject Name	Data Structure and Algorithms
Subject Code	CS 314
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	**19**
Delivery Mode	On campus
Prerequisites	CS 220
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject covers fundamental data structures and algorithms and highlights the tradeoffs between different implementations of these abstractions. It includes theoretical analysis, implementation, and application, lists, stacks, queues, heaps, dictionaries, maps, hash trees and balanced trees, sets, and graphs; as well as searching and sorting algorithms. It also shows Java's collections framework as an example implementation of basic algorithms.

Subject Topics

Topic 1: Algorithm Analysis

How to estimate the time required for a program? How to reduce the running time of a program? The results of careless use of recursion. Very efficient algorithms to raise a number of a power and to compute the greatest common divisor of two numbers.

Topic 2: List, Stacks and Queues

Introduce the concepts of Abstract Data Type (ADTs). Show how to efficiently perform operations on lists. Introduce the stack ADT and its use in implementing recursion. Introduce the queue ADT and its use in operating systems and algorithm design.

Topic 3: Trees and Hashing

See how trees are used to implement the file system of several popular operating systems. See how trees can be used to evaluate arithmetic expressions. Show how to use trees to support searching operations in O(logN) average time, and how to refine these ideas to obtain O(logN) worst-case bounds. Discuss and use the Tree Set and Tree Map classes. See several methods of implementing the hash table. Compare these methods analytically. Show numerous applications of hashing. Compare hash tables with binary search trees.

Topic 4: Priority Queues (Heaps)

Efficient implementation of the priority queue ADT. Uses of priority queues. Advanced implementations of priority queues.

Topic 5: Sorting

There are several easy algorithms to sort in O(N2), such as insertion sort. There is an algorithm, Shell sort, that is very simple to code, runs in o(N2), and is efficient in practice. There are slightly more complicated O (N logN) sorting algorithms. Any general-purpose sorting algorithm requires _ (N logN) comparisons.

Topic 6: Graph Algorithm

Show several real-life problems, which can be converted to problems on graphs. Give algorithms to solve several common graph problems. Show how the proper choice of data structures can drastically reduce the running time of these algorithms. See an important technique, known as depth-first search, and show how it can be used to solve several seemingly nontrivial problems in linear time.

Topic 7: Algorithm Design Techniques

See the general approach. Look at several examples (the exercises at the end of the chapter provide many more examples). Discuss, in general terms, the time and space complexity, where appropriate.

Subject Learning Outcomes (SLOs)

After completing this unit, students will be able to:

SLO1: Formulate and apply object-oriented programming, using java, as a modern tool to solve engineering problems.
SLO2: Demonstrate an understanding of basic data structures (such as an array-based list, linked list, stack, queue, binary search tree) and algorithms.
SLO3: Demonstrate the ability to analyze, design, apply and use data structures and algorithms to solve engineering problems and evaluate their solutions.
SLO4: Demonstrate an understanding of analysis of algorithms. Study an algorithm or program code segment that contains iterative constructs and analyze the asymptotic time complexity of the algorithm or code segment.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Test	**(30%)**
Assignment	**(10%)**
Quiz	**(10%)**
Exam	**(50%)**

Assessment 1 - **Assignment:** There will be 2 assignment contributing 10% towards the final grade for the subject.
Assessment 2 - **Test:** There will be 3 tests contributing 30% towards the final grade for the subject.
Assessment 3 - **Test:** There will be 5 quiz contributing 10% towards the final grade for the subject.

Assessment 4 - **Final written examination:** A 3 hour written examination weighs 50%.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Weiss, Mark A, *Data Structures and Algorithm Analysis in Java, 3rd Edition,* Pearson Education, Inc.

References

1. Michael T. Goodrich & Roberto Tamassia, *Data Structures and Algorithm in Java, 4th Edition,* John Wiley & Sons, Inc.
2. Online tutorial
3. Departmental electronic resources (books, relevant web articles, computer software).

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/