Postgraduate Courses Handbook

2019

PNG University of Technology
Private Mail Bag Services,
Lae 411, Morobe Province
Papua New Guinea
T: +675 473 4456; F: +675 475 6776
www.unitech.ac.pg
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>ii</td>
</tr>
<tr>
<td>Preface</td>
<td>iii</td>
</tr>
<tr>
<td><strong>Postgraduate Program in Agriculture</strong></td>
<td>1 - 21</td>
</tr>
<tr>
<td>- Master of Science</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Programs in Applied Physics</strong></td>
<td>22 - 53</td>
</tr>
<tr>
<td>- Master of Science</td>
<td></td>
</tr>
<tr>
<td>- Master of Technology in Exploration Geophysics</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Programs in Business Studies</strong></td>
<td>54 – 70</td>
</tr>
<tr>
<td>- Master of Business Administration</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Programs in Civil Engineering</strong></td>
<td>71 - 89</td>
</tr>
<tr>
<td>- Master in Engineering (Civil Engineering)</td>
<td></td>
</tr>
<tr>
<td>- Master of Science in Solid Waste and Resource Management</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Programs in Communication and Development Studies</strong></td>
<td>90 - 117</td>
</tr>
<tr>
<td>- Master of Communication Studies</td>
<td></td>
</tr>
<tr>
<td>- Master of Arts in Organisational Leadership</td>
<td></td>
</tr>
<tr>
<td>- Certificate in Communication of Science and Technology</td>
<td></td>
</tr>
<tr>
<td>- Certificate Course on Student Centred Teaching</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Program in Electrical and Communication Engineering</strong></td>
<td>118 - 133</td>
</tr>
<tr>
<td>- Master of Engineering in Communication Engineering</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Programs in Forestry</strong></td>
<td>134 - 151</td>
</tr>
<tr>
<td>- Postgraduate Diploma</td>
<td></td>
</tr>
<tr>
<td>- Master of Science</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Programs in Mathematics and Computer Science</strong></td>
<td>152 - 167</td>
</tr>
<tr>
<td>- Postgraduate Diploma in Engineering Mathematics</td>
<td></td>
</tr>
<tr>
<td>- Postgraduate Diploma in Mathematics</td>
<td></td>
</tr>
<tr>
<td>- Postgraduate Diploma in Computer Science</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Program in Mechanical Engineering</strong></td>
<td>168 -184</td>
</tr>
<tr>
<td>- Master of Engineering in Mechanical Engineering</td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate Programs in Surveying and Land Studies</strong></td>
<td>185 - 222</td>
</tr>
<tr>
<td>- Master of Science in Remote Sensing and Geographic Information System</td>
<td></td>
</tr>
<tr>
<td>- Master of Science in Urban and Regional Planning</td>
<td></td>
</tr>
</tbody>
</table>
Introduction

In view of the development strategies introduced by the Department of Higher Education Research Science and Technology (DHESRT) which encapsulates Vision 2050 and the mission of the Government in terms of the StaRS and the MTDP III, the Universities, and PNGUoT in particular, must be aligned to implement programs that support those strategies. Developing our Strategic Assets for Responsible Sustainable Developing (StaRS) and Growing the Economy (MTDP III) must form the basis of the teaching and research programs here at the PNGUoT. The PNGUoT is striving to develop a knowledge bank and must be the Centre of Excellence in Research and Technology Transfer and provide solutions to national socio-economic development programs.

In this regard, the PNGUoT has made in-roads in revitalizing its postgraduate program in the Mid-2000s with about 5 – 10 students, the program has grown from strength to strength. Currently, there are about 200 registered students in MPhil, MSc and PhD programs in various academic departments. All the departments are now offering postgraduate course up to the PhD levels. Engagement of academics in postgraduate supervision and the research culture at the postgraduate level is looking bright. A strong link with industry-supported research is indicating positive change. Industry backed research paves the way for academics to realize the potential of developing the depth of knowledge that is relevant and significant for business development. The government is gradually realizing this potential and supporting research to address some of its development agenda as well.

Parallel developments in research and teaching is the core function of the University. This is the Charter that the PNGUoT is a part of, as a signatory to the Magna Charta Universitatum (MCU). The unique role of the University remains in academics with PhDs, acting as independent researchers and creating new knowledge. The new knowledge is built into the teaching curriculum and provides the platform for postgraduate students to conduct research with their innovative and creative minds to answer further research questions.

This approach places the PNGUoT as a significant partner in shaping the country’s innovation system and extra-ordinary importance towards nation building. Scientists and Technologist are required to build a nation. It is well known that without research, there can be no innovation and without innovation there cannot be sustainable national development. Research evidence informs all our teaching, so as to make sure that our programs are future proof and contribute to the creation of a scientific and technological knowledge-based society.

We congratulate the Pro VC (Academic), Dr Augustine Moshi; the Dean of Post Graduate School, Prof Shamsul Akanda; Professors and Lecturers and post graduate coordinators in the Departments with the publication of the of this Postgraduate Courses Handbook 2019, which will be fully searchable and available on the website.

DR ORA RENAGI
Acting Vice Chancellor
Preface

It is a real pleasure to present the *Postgraduate Courses Handbook 2019*. This is the updated version of the postgraduate courses handbook that was first compiled in 2016 and later updated in 2018. Previously, the postgraduate courses were printed along with those in the undergraduate handbook. As the postgraduate programs of the University are expanding under the umbrella of a separate Postgraduate School, it is right and proper that a separate and elaborate Course Handbook be created.

This handbook contains the course descriptions and syllabi of all the course-based postgraduate programs offered by the different academic departments of the PNGUoT. The compilation of the handbook reflects the commitment of the PNGUoT towards strengthening and promotion of postgraduate studies and research culture. In addition to these course-based academic offers, such as the Master of Science degree program, the Postgraduate Diploma programs and the Postgraduate Certificate programs, the University also offers research-based degree programs, such as the Doctor of Philosophy (PhD) and Master of Philosophy (MPhil) tracks. Currently, all 13 academic departments at the PNGUoT have postgraduate programs and all of them offer PhD-level study opportunities. Currently, there are a total of 21 PhD, 32 Masters, 3 PG Diploma and 2 Postgraduate Certificate courses on offer at the PNGUoT. The academic departments, namely Agriculture, Applied Physics, Business Studies, Civil Engineering, Communication and Development Studies, Electrical and Communication Engineering, Forestry, Mathematics and Computer Science, Mechanical Engineering and Surveying and Land Studies offer taught postgraduate programs along with research-based degree options. In addition, the Department of Communication and Development Studies and the Department of Surveying and Land Studies also offer their postgraduate programs in the distance mode. More distance mode MSc programs in *Agricultural Extension and Rural Development from the Agriculture Department*; and Urban and Regional Planning from the Department of Surveying and Land Studies have been approved.

The PNGUoT has the largest postgraduate program in the country with the number of students increasing every year. About two-thirds of the students are self-sponsored, while the others are either supported by a Graduate Assistantship Program (GAP), a scholarship program of the PNGUoT designed to attract high-calibre first-degree holders into academic careers, or by industry offered scholarships. These initiatives demonstrate the enthusiasm and demand for postgraduate studies and research in the larger PNG community.
This handbook will be very useful for current postgraduate students as well as for future students. It will be available on the PNGUoT website so that all potential students and stakeholders can obtain up-to-date and detailed information on the courses available for the programs of interest.

I would like to take this opportunity to thank Dr Augustine Moshi, Pro Vice Chancellor (Academic); and Acting Vice Chancellor, Dr Ora Renagi for their suggestions and encouragements to compile a separate Handbook for the University’s course-based postgraduate programs.

I would also like to thank the Heads of the Departments of Agriculture, Applied Physics, Business Studies, Civil Engineering, Communication and Development Studies, Electrical and Communication Engineering, Mathematics and Computer Science, Mechanical Engineering, and Surveying and Land Studies for providing digital copies of their course-based postgraduate programs, which made the tasks of compilation and editing easier.

Professor Shamsul Akanda, PhD
Dean, Postgraduate School
Head of Department
Dr. Rajashekar Rao B K, PhD, MSc.Ag, BSc.Ag (UAS, Bangalore, India).

Deputy Head of Department
Mr. Nick Kewa, MPhil., BSc. Ag, (UOT).

Professors
Dr. Shamsul Akanda, PhD (OSU, USA) MSc.Ag., BSc.Ag. Hons. (BAU, Bangladesh), Dean of Postgraduate School.
Dr. Gariba Danbaro, PhD (Kobe, Japan), MPhil.Ag, BSc. Ag (Hons), Dip.Ed. (Ghana).
Dr. Tom Okpul, PhD (UQ, Aust), MPhil.Ag; BSc.Ag (UOT), Dip.Ag (Vudal); Acting Director, Unitech Biotechnology Centre (UBC) and Environment Research and Management Centre (ERMC)
Dr. Shamsul Akanda, PhD (OSU, USA) MSc.Ag., BSc.Ag. Hons. (BAU, Bangladesh), Dean of Postgraduate School.

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

Senior Lecturers
Dr Macquin Maino, PhD (UOT), MSc (UQ, Aust), BSc.Ag (UOT), Dip. Trop. Agric. (Vudal), Dip. in Secondary Teaching (UPNG-GTC).

Lecturers
Dr. William Kerua, PhD. (Charles Sturt, Aust), MSc-RSM (UQ, Aust), BSc.Ag (UOT), Adv. Dip in Teaching (UPNG-GTC), Cert Trop Fish (NFC).
Mr. Nick Kewa, MPhil.Ag, BSc. Ag, (UOT).
Postgraduate Program

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

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

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

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

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

Research

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

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

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

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

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

### Agriculture Farm

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

Main functions of the farm are to provide:

1.1 Physical and financial data on various farming activities from a known and reliable source for teaching, demonstration and research,

1.2 Materials (e.g. land, crops, livestock, machinery) for demonstration and practical training in agricultural techniques,

1.3 Facilities for research and development work by the University staff and students, and for outside bodies,

1.4 The opportunity for the students to have an active and intimate association over a period of time with a farming situation,

1.5 Land for staff and student gardens.

1.6 Provide an annual physical and financial report to the Agriculture Department.

### Program Outcomes

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

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

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

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

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

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

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

### Rules for MSc in Agriculture with Course-Work

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

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

### Program Duration and Course Schedule

The MSc degree in agriculture is a full-time program of studies extending over four academic semesters (two years). The students will be taking
the courses as per the following schedule along with a research (thesis) component.

**Schedule of Courses for MSc in Agriculture**

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Contact Hrs/Wk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Semester</strong></td>
<td></td>
</tr>
<tr>
<td>Research Methodology and Scientific Writing (Core)</td>
<td>4</td>
</tr>
<tr>
<td>3 optional courses to choose. Each at 4hrs/wk</td>
<td>12</td>
</tr>
<tr>
<td><strong>Second Semester</strong></td>
<td></td>
</tr>
<tr>
<td>Biometry (Core)</td>
<td>6</td>
</tr>
<tr>
<td>3 optional courses to choose. Each at 4hrs/wk</td>
<td>12</td>
</tr>
<tr>
<td>Thesis</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
</tr>
</tbody>
</table>

| Year 2 | |
| **First Semester** | |
| Thesis | 6 |
| **Second Semester** | |
| Thesis | 6 |

<table>
<thead>
<tr>
<th>Courses to be taught</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG 501 Research Methodology and Scientific Writing</td>
<td>I</td>
</tr>
<tr>
<td>AG 502 Biometry</td>
<td>II</td>
</tr>
<tr>
<td>AG 503 Thesis</td>
<td>I, II</td>
</tr>
<tr>
<td>AG 504 Population Genetics</td>
<td>I</td>
</tr>
<tr>
<td>AG 505 Quantitative Genetics</td>
<td>II</td>
</tr>
<tr>
<td>AG 506 Plant Breeding</td>
<td>I</td>
</tr>
<tr>
<td>AG 507 Plant Genetic Manipulation Practical Techniques</td>
<td>I</td>
</tr>
<tr>
<td>AG 508 Advanced Crop Physiology</td>
<td>I</td>
</tr>
<tr>
<td>AG 509 Horticulture Science</td>
<td>I</td>
</tr>
<tr>
<td>AG 510 Tropical Farming Systems</td>
<td>II</td>
</tr>
<tr>
<td>AG 511 Crop Modelling and Climatology</td>
<td>II</td>
</tr>
<tr>
<td>AG 512 Chemistry of Soils and Fertilizers Analysis</td>
<td>I</td>
</tr>
<tr>
<td>AG 513 Methods of Soils and Plant</td>
<td>II</td>
</tr>
<tr>
<td>AG 514 Soil Microbiology</td>
<td>I</td>
</tr>
<tr>
<td>AG 515 Epidemiology and Plant Disease Management</td>
<td>I</td>
</tr>
<tr>
<td>AG 516 Integrated Pest Management</td>
<td>II</td>
</tr>
<tr>
<td>AG 517 Applied Insect Ecology</td>
<td>I</td>
</tr>
<tr>
<td>AG 518 Principles of Weed Science</td>
<td>II</td>
</tr>
<tr>
<td>AG 519 Monogastric Animal Production in Papua New Guinea</td>
<td>I</td>
</tr>
<tr>
<td>AG 520 Ruminant Animal Production in Papua New Guinea</td>
<td>II</td>
</tr>
</tbody>
</table>

**SUBJECT DETAILS**

**AG 501: RESEARCH METHODOLOGY AND SCIENTIFIC WRITING**

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

**Credit:** 12

**Learning Outcomes**

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

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

**Syllabus**

Brief history and development in science. Research defined; types of research - quantitative (mainly biophysical) and qualitative (mainly socio-economic), elements of research, research problem identification, formulating study objectives, research hypothesis, formulation of research hypothesis, types and characteristics of research hypothesis, and testing of hypothesis. Methodology and steps...
in research design, components in experimental design, research data collection, analysis and report writing.

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

Reference
Snooks and Co. 2002. Style for Authors, Editors and Printers. John Wiley and Sons Australia Ltd.

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 502: BIOMETRY

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

Learning Outcomes
Upon completion of this course, students will be able to:
1. Understand statistical distributions and hypothesis testing;
2. Summarize experimental and survey data;
3. Design various agricultural experiments and surveys;
4. Analyze and interpret the results using sound statistical principles and appropriate software.

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

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

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

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

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

References

Assessment
Continuous Assessment 50%
Final Examination 50%
AG 503: THESIS

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

**Credit:** 27

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

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

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

**Assessment**
As per the Higher Studies Regulations of the University of Technology

AG 504: POPULATION GENETICS

**Hours per week:** 4

**Credit:** 18

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

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

**Syllabus**
Introduction and probability. Review of the genetic material, protein synthesis and gene regulation. Genetic variation: causes of variation including mutation, drift, migration, transposable elements; measures of variation, methods of detecting genetic variation. Contribution from Mendelian sampling
Random mating: Mendelian inheritance, Hardy Weinberg equilibrium and allele frequency estimation. Linkage disequilibrium and test of disequilibrium, sex linked genes
Inbreeding and kinship: Inbreeding coefficient, pedigrees, effects of inbreeding, regular systems of mating, assortative mating
Selection: types of selection, inbreeding and selection, measures of Fitness, Constant Fitness Models, Selection on Quantitative Traits
Genetic drift and inbreeding, heterozygosity, Wright-Fisher model, fixation probabilities, effective population size, effects on effective population size
Mutation: basic ideas, mutation-selection balance, mutation and drift, mutation and Gene frequencies
Migration: Gene pools, Wahlund effect, models of migration, migration vs selection, estimation of gene flow, migrational load
Population structure: Heterozygosity, Wright’s F statistic, DNA typing using markers Molecular population genetics: neutral theory, molecular evolution, patterns of nucleotide and amino acid substitution, mitochondrial and chloroplast DNA evolution, molecular phylogenetics

**Reference**
**POSTGRADUATE COURSES HANDBOOK 2019**

**Assessment**
Continuous Assessment 50%
Final Examination 50%

**AG 505: QUANTATIVE GENETICS**

**Hours per week:** 4  
**Credit:** 18

**Learning Outcomes**
Upon completion of this course, students will be able to:
1. Understand the basic theory of inheritance of quantitative characters that underlies plant and animal breeding;
2. Carry out genetic evaluation of plants and animals;
3. Use linear models for the genetic improvement of plants and animals;
4. Design and assess breeding programs.

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

**References**

**Assessment**
Continuous Assessment 50%
Final Examination 50%

**AG 506: PLANT BREEDING**

**Hours per week:** 4  
**Credit:** 18

**Learning Outcomes**
Upon completion of this course, students will be able to:
1. Demonstrate the acquired knowledge on advanced principles and prospects of plant breeding; 
2. Apply the methods of plant breeding appropriately in crop improvement efforts in PNG context;
3. Apply one’s understanding of the current issues underlying in plant breeding and the technologies involved and be able to make management decisions in plant breeding programs;
4. Assess production constraints in crops and make sound decisions on developing appropriate plant breeding programs to address them.

**Syllabus**
Source of variations – plant genetic resources, induced mutations, interspecific hybridization by sexual means, chromosome manipulation and ployploidy, somatic hybridization, gene cloning and identification & the role of gene technology in plant breeding. 
Assessment of variation – Biometrical genetics in breeding, biochemical characterization of populations 
Manipulation of genetic systems – Self-and cross-incompatibility; male sterility; apomixes; micropropagation and somatic embryogenesis, andro- and parthenogenesis. 
Adaptations – genotype x environment interaction and adaptation, augmenting yield-based selection, resistance to abiotic stresses & resistance to parasites. 
Methods of selections – selection strategies and choice of breeding methods, marker-assisted; gametophytic and sporophytic & in vitro. 
Specific trait breeding – symbiotic nitrogen fixation, photosynthetic & respiratory efficiency, efficient root systems & utilization of renewable plant resources. 
References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 507: PLANT GENETIC MANIPULATION – PRACTICAL TECHNIQUES

Hours per week: 4
Credit: 18

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

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

References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 508: ADVANCED CROP PHYSIOLOGY

Hours per week: 4
Credit: 18

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

Syllabus
Introduction to crop physiology, advances in crop physiology, physiological basis of biological yield development, community of plants interaction, harvesting energy from the sun as food, feed and fiber. Crop yield magnitude and seasonal input of solar energy, Water and CO2 on crop yield, Crop productivity, crop canopy and its efficiency of photosynthetic conversion of the solar radiation into dry matter. Canopy structure and photosynthesis,
Biomass production and crop growth rate, intercepted solar radiation and crop growth rate, water availability in the soil, water use by plants, crop response to environmental stresses including water stress, salt stress and soil acidity.

References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG509: HORTICULTURE SCIENCE

Hours per week: 4
Credit: 18

Learning Outcomes
Upon completion of this course, students will be able to:
1. Illustrate the history of horticultural crops and the importance in the PNG economy;
2. Examine the advanced production system of major tropical and temperate horticultural crops grown in PNG;
3. Evaluate the different planting techniques and crop management practices;
4. Assess the merits and demerits of harvesting and post-harvest technologies;
5. Assess the potential use of growth regulators in horticultural crops;
6. Design and carry out advanced research with horticultural crops.

Syllabus

References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG510: TROPICAL FARMING SYSTEMS

Hours per week: 4
Credit: 18

Learning Outcomes
Upon completion of this course, students will be able to:
1. Describe farming systems as a dynamic farm enterprise in response to physical, biological and socio-economic environments;
2. Evaluate farming systems research and its potential;
3. Identify constraints and opportunities for small farm development in Atoll agriculture system;
4. Integrate potential cropping, grazing and livestock systems;
5. Design and carry out farming systems research.

Syllabus
Overview of tropical farming systems, agricultural systems, determinants of agricultural systems, physical, biological and socio-economic components of farming systems. Farming Systems Research.
(FSR), concepts and importance, characteristics, methodology of farming systems research, structures and dynamics of farm household system. Goals and performance criteria for productivity and sustainability, socio-economic aspect of farming systems, characteristics of cropping, grazing and livestock systems and its potentials, Atoll agriculture systems, productivity and identifying constraints and opportunities for small farm development. Holistic approach in FSR, integration of components in systems research.

References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG511: CROP MODELLING AND CLIMATOLOGY

Hours per week: 4
Credit: 18

Learning Outcomes
Upon completion of this course, students will be able to:
1. Describe the importance and basic concepts of crop modeling;
2. Explain various types of crop models and the parameters;
3. Compare the relative advantages and disadvantages of various crop models;
4. Demonstrate the crop modeling and simulation using the appropriate climate, crops and soil data and software to predict crop yield;
5. Use GIS to predict crop yield and management decisions.

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

References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 512: CHEMISTRY OF SOILS AND FERTILIZERS

Hours per week: 4 (2 Lect./2 Lab.)
Credit: 12
Learning Outcomes
Upon completion of this course, students will be able to:

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

Syllabus
Structural and colloidal chemistry of silicate clays, non-silicate clays and organic colloids ion exchange theories and chemical equilibria, adsorption theories, cation and anion exchange processes, concepts of PZC, layer theories and sorption Exchange phenomena between plant roots and soil matrices, nutrient cycles (major nutrients) Soil acidity, potential and reserve acidity in soil, role of Al, liming, liming requirements, liming materials. Salt affected soils, their appraisals; SAR, ESP, estimation of GR; assessment of quality of irrigation water (pH, EC, CI, CO₂ etc) and management of salt affected soils, HCO₃⁻, soluble cations, RSC Fertilizers, classification of fertilizers, common fertilizer sources for N, P and K, manufacture of them, transformation and fates in soil, fertilizer analysis and calculations of fertilizer requirement, residual acidity/alkalinity for various commercial fertilizers (generic ones) Transformation of major soil nutrients (nitrogen, phosphorous and potassium) including nutrient fixation. Study of organic manures, FYM, compost, oil cakes. Fertilizer recommendation based on soil tests.

References
Bohn, H. L., McNeal, B. L. and O’connor, G. A. 2001. Soil Chemistry (3rd Edn.), John Wiley and Sons, USA.

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 513: METHODS OF SOIL AND PLANT ANALYSIS

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

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

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

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

Sampling techniques for collecting soil and plants, sample preparation for lab analysis such as sieving, 2mm soil sample preparation, air drying Potentiometry and estimation of soil pH Measurement of total soluble salts- gravimetric and conductometric methods Analysis of soil water extracts for carbonates, bicarbonates and chlorides by titrimetric procedure Concepts of colorimetry, emission spectrophotometry, absorption spectrophotometry,
Beer-Lambert's law
Determination of OC content of the soil by wet oxidation method and combustion methods
Total N estimation by Kjeldahl method and combustion method
Digestion of plant materials and estimation of important nutrient elements by ICP-OES

References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 514: SOIL MICROBIOLOGY

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

Learning Outcomes
Upon completion of this course, students will be able to:
1. Discuss the role of microorganism in the vital soil functions;
2. Illustrate some of the important functions carried out by the soil microorganisms;
3. Assess the laboratory techniques followed in the study of soil microorganisms;
4. Use the microbes for the production of biofertilizers;
5. Predict the microbial population in the soil.

Syllabus
Microbial transformation of P, S and other micronutrients
Ecological interrelationships, associations, competition, amensalism, predation and Parasitism.
Microbiology of the rhizosphere- influence of the plant on microbes and influence of microorganisms on the plant, plant pathogens, mycorrhizae, microorganisms in soil aggregation
Biofertilizers, production and benefits
Isolation and enumeration of soil organisms, estimation of microbial biomass and enzyme activities

References
Alexander, M., 1977.Introduction to Soil Microbiology (2nd Edn.), John Wiley and sons, USA
Rangaswamy, G. 1966. Agricultural Microbiology, Asia Publishing House, India
Stevenson, F. J. 1986. Cycles of Soil, Wiley Inter science Publication, USA

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 515: EPIDEMIOLOGY AND PLANT DISEASE MANAGEMENT

Hours per week: 4
Credit: 18

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

References

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

**Syllabus**

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

**References**

Campbell, C. L. and Madden, L. V. 1989. Introduction to Plant Disease Epidemiology. John Willey and Sons, New York.

**Assessment**

Continuous Assessment 50%
Final Examination 50%

**AG 516: INTEGRATED PEST MANAGEMENT**

**Hours per week:** 4  
**Credit:** 18

**Learning Outcomes**

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

**Syllabus**

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

**References**


**Assessment**

Continuous Assessment 50%
Final Examination 50%

**AG 517: APPLIED INSECT ECOLOGY**

**Hours per week:** 4  
**Credit:** 18
Learning Outcomes
Upon completion of this course, students will be able to:
1. Describe insect associations within an agro-ecosystem and their responses to environmental change;
2. Relate different tri-tropic interactions within an agro-ecosystem;
3. Describe the influence of interactions on structure and dynamics of population;
4. Assess the effects of predator-prey and pathogen-host to pesticides;
5. Design and develop tools that are comparable to pesticide effects.

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

References
Schneider, M. F. 1999. Entomology: A textbook for students, agriculturalists and foresters. Bulolo University College, PNG.

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 518: PRINCIPLES OF WEED SCIENCE

Hours per week: 4
Credit: 18

Learning Outcomes
Upon completion of this course, students will be able to:
1. Describe the biology and ecology of weedy species;
2. Apply the biological knowledge of the different types of invasive weeds in varying ecosystems and their control;
3. Differentiate available tactics and their effects on weed control;
4. Apply economics into weed management and the importance of IWM in Integrated Insect Pest and Disease Management;
5. Evaluate successes of IWM.

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

References

Assessment
Continuous Assessment 50%
Final Examination 50%

AG 519: MONOGASTRIC ANIMAL PRODUCTION IN PAPUA NEW GUINEA

Hours per week: 4
Credit: 18

Learning Outcomes
Upon completion of this course, students will be able to:
1. Discuss the importance and distribution patterns of monogastric farm animals in PNG;
2. Explain the principles which underlie monogastric animal production;
3 Assess various systems of monogastric animal production;
4 Design husbandry programs and facilities for production of various monogastric farm animals in PNG.

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

**References**

**Assessment**
Continuous Assessment 50%
Final Examination 50%

---

AG 521: NUTRIENT REQUIREMENT AND QUANTITATIVE NUTRITION

**Hours per week:** 4
**Credit:** 18

**Learning Outcomes**
Upon completion of this course, students will be able to:
1. Assess the quality of feed;
2. Plan and conduct metabolic trials for assessing quality of feeds;
3. Prepare rations for different classes of animals based on its performance;
4. Prepare mineral mixtures for farm animals.

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

**Reference**
Fuller, M. F. (Ed) 2004. The Encyclopedia of Farm Animal Nutrition, CABI
Underwood, E. J. and Suttle, N. 1999. The mineral nutrition of Livestock (3rd Edn.), CABI.

**Assessment**
Continuous Assessment 50%
Final Examination 50%

**AG 522: FEED ANALYSIS AND FEED TECHNOLOGY**

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

**Credit:** 12

**Learning Outcomes**
Upon completion of this course, students will be able to:
1. Estimate important minerals, different fractions of fiber;
2. Conduct in vitro digestion trials;
3. Use different feed process for proper utilization of nutrients;
4. Equipped with basic knowledge of running a feed mill.

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

**References**
Fuller, M. F. (Ed) 2004. The Encyclopedia of Farm Animal Nutrition CABI
Underwood, E. J. and Suttle, N. 1999. The mineral nutrition of Livestock (3rd Edn.), CABI.

**Assessment**
Continuous Assessment 50%
Final Examination 50%

**AG 523: ADVANCED FARM MANAGEMENT**

**Hours per week:** 4

**Credit:** 18

**Learning Outcomes**
Upon completion of this course, students will be able to:
1. Understand farm planning, control methods and their applications to achieve farmer goals;
2. Prepare budgets and evaluate farm performance using performance indicators;
3. Develop farm program, analyze risk and uncertain situations;
4. Valuate farm inventory and calculate depreciation of farm equipment and machineries;
5. Use statistical tools to analyse competitiveness and efficiency of the farm.

**Syllabus**


**References**


**Assessment**

Continuous Assessment 50%
Final Examination 50%

---

**AG 524: AGRICULTURAL PROJECT PLANNING**

**Hours per week:** 4  
**Credit:** 18

**Learning Outcomes**

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

**Syllabus**

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

**References**


**Assessment**

Continuous Assessment 50%
Final Examination 50%

---

**AG 525: STRUCTURE AND EFFICIENCY OF AGRICULTURAL MARKETS**

**Hours per week:** 4  
**Credit:** 18

**Learning Outcomes**

Upon completion of this course, students will be able to:
1. Perceive and interpret the nature and structure of agricultural markets;
2. Understand and apply the approaches of agricultural marketing;
3. Evaluate the effects of different market structures in agriculture;
4. Articulate and appreciate the policies that governments in non-communist countries undertake to improve the efficiency of agricultural markets.

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

**References**

**Assessment**
Continuous Assessment  50%
Final Examination  50%

AG 526: CONTEMPORARY EXTENSION SYSTEMS IN SOUTH EAST ASIA

**Hours per week:**  4  
**Credit:**  18

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

**Syllabus**

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

**Assessment**
Continuous Assessment  50%
Final Examination  50%

AG 527: SOCIO–CULTURAL CHANGE

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

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

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

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

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

### References

### Assessment
- Continuous Assessment: 50%
- Final Examination: 50%

---

### AG 528: RURAL COMMUNITY DEVELOPMENT

#### Hours per week: 4
Credit: 18

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

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

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

#### References

#### Assessment
- Continuous Assessment: 50%
- Final Examination: 50%
### AG 529: CULTIVATION AND MECHANIZATION

**Hours per week:** 4  
**Credit:** 18

**Learning Outcomes**  
Upon completion of this course, students will be able to:  
1. Discuss the principles of operation and selection criteria of cultivation equipment in order to optimize the performance of the equipment;  
2. Test field machineries and equipment to propose best use of the same;  
3. Use statistical model to optimize use of farm machineries;  
4. Calculate depreciation costs and valuate farm machineries;  
5. Manage the operations of agricultural machines to get the best out of a mechanized agricultural production system.

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

** References**  

**Assessment**  
- Continuous Assessment: 50%  
- Final Examination: 50%

### AG 530: AGRICULTURAL PROCESSING AND STORAGE TECHNOLOGY

**Hours per week:** 4  
**Credit:** 18

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

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

** References**  
### AG 531: SOIL AND WATER CONSERVATION ENGINEERING

**Hours per week:** 4  
**Credit:** 18

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

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

**References**

**Assessment**
Continuous Assessment 50%  
Final Examination 50%

### AG 535: DIGESTION AND METABOLISM IN FARM ANIMALS

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

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

**Syllabus**

**References**
Bedford, M.R and Partridge, G.G. (2010). Enzymes in Farm animal nutrition. CAB international, UK.  

**Assessment**
Continuous Assessment 50%  
Final Examination 50%
DEPARTMENT OF APPLIED PHYSICS

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

Deputy Head of Department
E. Nagombi, MSc (Aust) BSc(PNGUT), BEng (PNGUT)

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

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

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

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

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

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

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

Soto, R. MSEE (Univ. of Houston, USA), BSEE, (ITESM, Mex), DIPT (USA)

Lecturer
Ampana S. MSc (Nagoya Univ. Japan), BSc (PNGUT)

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

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

E. Nagombi, MSc (Aust) BSc(PNGUT), BEng (PNGUT)

Principal Technical Officer

Kenny, M. BSc (PNGUT)

Senior Technical Officer

Technical Officer
Waimbo, N. Mathew BSc(PNGUT)

William Piel BSc (PNGUT)

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

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

Secretary II
Nasusu, C SecCert (Goroka Busines Col)
MASTER OF SCIENCE (M.SC.) IN APPLIED PHYSICS WITH ELECTRONICS AND INSTRUMENTATION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Administration of the Program
The intake into this program would be kept limited to such a level so as to foster students' development...
through intense and close interaction with the faculty under the expectation that such level of interaction with the faculty would provide the students opportunity for effective and in-depth learning of both theories and technical aspects of research works in respect of the proposed curriculum.

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

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

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

**COURSE STRUCTURE**

**Semester: I, First Year**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Hours/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>APM501</td>
<td>Mathematics for Physicists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>APM503</td>
<td>Classical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>Two elective subjects</td>
<td></td>
<td>(4 x 2) = 8</td>
</tr>
<tr>
<td>APM549</td>
<td>Research Project</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

**Semester: II, First Year**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Hours/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>APM509</td>
<td>Classical Electrodynamics</td>
<td>4</td>
</tr>
<tr>
<td>Two elective subjects</td>
<td></td>
<td>(4 x 2) = 8</td>
</tr>
<tr>
<td>APM 545</td>
<td>Lab</td>
<td>3</td>
</tr>
<tr>
<td>APM549</td>
<td>Research Project</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>21</td>
</tr>
</tbody>
</table>

**Semester: I, Second Year**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Hours/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two elective subjects</td>
<td></td>
<td>(4 x 2) = 8</td>
</tr>
<tr>
<td>APM547</td>
<td>Lab</td>
<td>3</td>
</tr>
<tr>
<td>APM549</td>
<td>Research Project</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

**Semester: II, Second Year**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Hours/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>One elective subjects</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>APM549</td>
<td>Research Project</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

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

**Subject Code | List of Subjects**
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>APM501</td>
<td>Mathematics for Physicists and Engineers</td>
</tr>
<tr>
<td>APM503</td>
<td>Classical Mechanics</td>
</tr>
<tr>
<td>APM505</td>
<td>Quantum Mechanics</td>
</tr>
<tr>
<td>APM507</td>
<td>Statistical Mechanics</td>
</tr>
<tr>
<td>APM509</td>
<td>Classical Electrodynamics</td>
</tr>
<tr>
<td>APM511</td>
<td>Modern Physics</td>
</tr>
<tr>
<td>APM513</td>
<td>Condensed Matter Physics</td>
</tr>
<tr>
<td>APM515</td>
<td>Materials Science</td>
</tr>
<tr>
<td>APM517</td>
<td>Atomic &amp; Molecular Spectroscopy</td>
</tr>
<tr>
<td>APM519</td>
<td>Fundamentals of Optics &amp; Laser Physics</td>
</tr>
<tr>
<td>APM521</td>
<td>Nano Science and Nanotechnology</td>
</tr>
<tr>
<td>APM523</td>
<td>Environmental Physics</td>
</tr>
<tr>
<td>APM525</td>
<td>Physical Oceanography</td>
</tr>
<tr>
<td>APM527</td>
<td>Physics of Earthquakes &amp; Tsunamis</td>
</tr>
<tr>
<td>APM529</td>
<td>Physics of Volcano Formation &amp; Eruption Styles</td>
</tr>
<tr>
<td>APM531</td>
<td>Physics of Earth's Atmospheric</td>
</tr>
</tbody>
</table>
APM533 Geophysical Techniques for Resource Exploration
APM535 Non-Destructive Testing Techniques
APM537 Fibre Optics and Optical Communications
APM539 Physics of Semiconductor Devices
APM541 Digital Electronics & Microprocessor
APM543 Microcontrollers & Digital Signal Processing
APM545 Experimental Methods in Physics - I
APM547 Experimental Methods in Physics – II
APM549 Research Project
APM551 Robot Manipulators: Modeling & Control

**STRUCTURE OF COURSES**

**MASTER OF SCIENCE IN APPLIED PHYSICS WITH ELECTRONICS AND INSTRUMENTATION**

**APM501: MATHEMATICS FOR PHYSICISTS AND ENGINEERS**

*Hours per week: 4 (4 lectures)*

*Credits: 18*

Pre-requisite: MA334

**Learning Outcomes**

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

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

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

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

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

**Syllabus**

Complex analysis, zeros and isolated singularities of analytic functions; Calculus of residues; Multivalued functions; Analytic continuation. meromorphic functions; The method of steepest descent.

Second order differential equations, Self adjoint operators, Green's functions; The Sturm-Liouville problem; Hypergeometric functions; Laguerre function, Bessel function, Beta function and gamma function.


**Textbook**


**Reference**


**Assessment**

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

**APM503: CLASSICAL MECHANICS**

*Hours per week: 4 (4 lectures)*

*Credits: 18*

Pre-requisite: AP274

**Learning Outcomes**

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

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

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

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

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

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

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

Syllabus

Textbook

Reference

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

APM505: QUANTUM MECHANICS

Hours per week: 4 (4 lectures)

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

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

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

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

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

Syllabus
### APM507: STATISTICAL MECHANICS

**Hours per week:** 4 (4 lectures)

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

**Learning Outcomes**  
On completion of this subject the student should be able to:  
LO1: Discover and Outline the modern aspects of equilibrium and non-equilibrium statistical physics  
LO2: Describe the features and examples of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics  
LO3: Examine and manipulate equations of state and thermodynamic potentials for elementary systems of particles; and use and develop mean field theory for first and second order phase transitions.

**Syllabus**  
Basic concepts, ensemble-microcanonical ensemble & thermodynamic connection, two state system and Einstein model of vibrating lattice, canonical ensemble, density matrix, partition function, thermodynamic function and equilibrium.  
Ideal gas-translational, vibrational and rotational motion, Para-, ortho-hydrogen, equipartition of energy, negative temperature, Grand canonical ensemble.  
Ideal, Fermi and Bose gas (both weakly and strongly degenerate), statistics of photon and phonon gas, Imperfect gases, Virial expansion and Van der Waal’s equation of states.

**Textbooks**  
Kroemer, H., *Quantum Mechanics*, Prentice Hall  

**Reference**  

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

### APM509: CLASSICAL ELECTRODYNAMICS

**Hours per week:** 4 (4 lectures)

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

**Learning Outcomes**  
On completion of this subject the student should be able to:  
LO1: Evaluate fields and forces in Electrodynamics and Magneto dynamics using basic scientific method.  
LO2. Prepare concepts of relativistic electrodynamics and its applications in branches of Physical Sciences.  
LO3: Explain and solve advanced problems based on classical electrodynamics using Maxwell's equation.  
LO4: Analyse radiation systems in which the electric dipole, magnetic dipole or electric quadrupole dominate.  
LO5: Understand the covariant formulation of electrodynamics and the concept of retarded time for charges undergoing acceleration.

**Syllabus**  
Maxwell's equations, Poynting vector, wave equation; Propagation of electromagnetic waves in dielectric and conducting media, skin effect; Optical dispersion in materials, resonance absorption, anomalous dispersion; Reflection and refraction of electromagnetic waves at the
interface between dielectric media, Brewster's law, reflection from conducting surfaces
Transmission lines; Wave guides, elementary theory of rectangular and cylindrical wave guides, Rectangular and cylindrical resonant cavities; Potential formulation, scalar and vector potentials, gauge transformations; Field of a uniformly moving charge, Lienard-Wiechert potentials, retarded potentials; Radiation from oscillating electric and magnetic dipoles and antennas.

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

**Textbooks**
Griffith, D, J, Introduction to Electrodynamics, Latest ed., Prentice Hall
Panofsky, W K. H. & Phillip, M., Classical Electricity and magnetism, 2nd Ed., Dover Books

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

**APM511: MODERN PHYSICS**

**Hours per week**: 4 (4 lectures)

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

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

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

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

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

**Syllabus**

**Textbooks**

**Reference**

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

**APM513: CONDENSED MATTER PHYSICS**

**Hours per week**: 4 (4 lectures)

**Credits**: 18

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

LO1: Assemble an extended knowledge of principles and techniques of solid-state physics
LO2: Develop an understanding of structure, thermal and electrical properties of matter

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

**Syllabus**

Structure of solids, lattice translation, symmetry, unit cell, simple crystal structures, diffraction - Bragg's law, structure factor, different methods for structure determination, point defects, dislocation.


Semiconductor: intrinsic and extrinsic semiconductors, hole, effective mass, impurity band conduction, p-n junction, Shottky barrier, quantum Hall effect.

Free electron theory. Periodic potentials in one dimension, electrons in weak periodic potential, tight binding approximation, bands, Bloch state, motion in magnetic field.

Optical properties, dielectric, ferroelectric, displasive and soft mode, magnetism, dia-, para-magnetism, Curie-Weiss law, Van-Vleck and Pauli para-magnetism, ferro-, anti- and ferrimagnetism.

Exchange interaction, spin wave, resonance absorption, dilute magnetic alloys, superconductivity: phenomenology, GL theory and some ideas of microscopic origin.

**Textbooks**


**Assessment**

Continuous Assessment - 50%

Written Examination - 50% (1x3 hrs)

**APM515: MATERIALS SCIENCE**

**Hours per week**: 4 (4 lectures)

**Credits**: 18
and detector, Fiber optics material and their application, Acoustic material and their application, Biomaterials, conductor.

**Textbook**

**Reference**

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

**APM517: ATOMIC & MOLECULAR SPECTROSCOPY**

**Hours per week**: 4 (4 lectures)

**Credits**: 18

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

- **LO1**: Explain in detail the structure of atoms and molecules.
- **LO2**: Discuss and explain the spectral behavior of atoms and molecules at different states of energy levels.
- **LO3**: Explain what it means to use spectroscopic methods for qualitative and quantitative analysis.
- **LO4**: Identify the terms in and describe deviations to Beer’s Law.
- **LO5**: Describe the effect of changing the slit width and the impact it will have on qualitative and quantitative analyses.
- **LO6**: Determine the relative error in absorbance measurements and estimate the optimal range for measurement purposes.
- **LO7**: Formulate the desirable features of a radiation source.
- **LO8**: Explain the advantages of a dual versus single-beam spectrophotometer.
- **LO9**: Explain the difference between a 2 and 4 level laser and why it is not possible to have a 2-level laser.
- **LO10**: Illustrate how a photomultiplier tube works and explain how an array detector works and describe the advantages of using an array detector.

**Syllabus**
Spectra of alkali atoms, vector atom model, LS and jj couplings, normal and anomalous Zeeman effect, Stark effect.
Fine structure of spectral lines, nuclear spin and hyperfine structure, spectra of diatomic molecules, polyatomic molecules.
Raman Effect and Raman Spectroscopy, magnetic resonance, Characteristics of Raman lines, Calculation of normal modes for Raman and IR activity C2v and C3v point groups by group theoretical considerations - Calculation of F and G matrices – Normal co-ordinate analysis for H2O and NH3 and molecules.

**Textbooks**

**Assessment**
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)
### APM519: FUNDAMENTALS OF MODERN OPTICS & LASER PHYSICS

**Hours per week:** 4 (4 lectures)

**Credits:** 18

**Learning Outcomes**

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

- LO1: Discuss the fundamentals of modern optics;
- LO2: Explain the theories of coherence, diffraction and interference;
- LO3: Illustrate reflection, refraction and polarization of light using Fresnel's equations;
- LO4: Discuss the processes of amplification of light;
- LO5: Discuss the operation and performance of typical laser systems;
- LO6: Describe the operation, performance and application of some optical devices.

**Syllabus**

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

**Textbook**


**Reference**


**Assessment**

Continuous Assessment - 50%

Written Examination          - 50% (1x3 hrs)

---

### APM521: NANOSCIENCE AND NANOTECHNOLOGY

**Hours per week:** 4 (4 lectures)

**Credits:** 18

**Learning Outcomes**

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

- LO1: Describe the crystal structure, vibration and energy levels that exist in materials.
- LO2: Discuss the emergence of nanotechnology as things gets very small.
- LO3: Classify the types of nano-crystal structures and the composition of materials.
- LO4: Recognize the new field on which new technological approaches are possible.

**Syllabus**

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

**Textbooks**

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

### APM523: ENVIRONMENTAL PHYSICS

**Hours per week:** 4 (4 lectures)

**Credits:** 18

**Learning Outcomes**

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

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

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

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

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

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

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

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

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

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

**Syllabus**

(a). Earth’s atmosphere: Composition; structure, weather and climate, atmospheric circulation and the Coriolis Effect, atmosphere-ocean interactions.

(b). Global Water Resources and Use: Freshwater and saltwater, ocean circulation, agricultural, industrial, and domestic use, surface and groundwater issues, global problems, conservation.

(c). Soil and Soil Dynamics: Rock cycle, formation, composition, physical and chemical properties, main soil types, erosion and other soil problems; soil conservation.


(e). Land and Water Use: Agriculture, feeding a growing population, controlling pests, forestry, transportation infrastructure, mining and fishing.

(f). Energy Resources and Consumption: Energy concepts, energy consumption, nuclear energy, hydroelectric power, renewable energy, energy conservation.

(g). Pollution: Pollution types, air pollution, air pollution, noise pollution, water pollution, water quality, solid waste, impacts on the environment and human health, hazards to human health, chronic effect, air pollutants, Hazardous chemicals in the environment, Economic Impacts

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

**Textbooks**

Monteith, J. L., & Unsworth, M. H., (1990), Principles of Environmental Physics, Chapman & Hall

**Assessment**

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

### APM525: PHYSICAL OCEANOGRAPHY

**Hours per week:** 4 (4 lectures)

**Credits:** 18

**Learning Outcomes**

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

LO1: Explain the important physical processes on both the conceptual physical principles and at the larger scale how these fit into the earth as a system

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

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

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

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

### Syllabus

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

**Textbook**


**Assessment**

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

### APM527: PHYSICS OF EARTHQUAKES AND TSUNAMIS

**Hours per week:** 4 (4 lectures)

**Credits:** 18

**Learning Outcomes**

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

LO1: Describe the physics of earthquakes, stress and strain, and follows the wave motion

LO2: Discuss the physics of tsunamis
LO3: Develop basic knowledge on the size of an earthquake, magnitude scale & felt intensity

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

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

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

**Syllabus**

Behavior of Earth as an elastic medium, theory of elasticity, stress and strain, elastic displacement vector, equation of motion, elastic stress tensor and elastic strain tensor, symmetry of the stress tensor, stress-strain relation, displacement-strain relation, infinitesimal strain theory, cubical dilation, the elasto-dynamic wave equation, elastic waves, phase change, lithosphere-asthenosphere boundary, mantle-core boundary.

Seismic waves and effect of boundaries on seismic waves, seismic phases, ray geometry and the ray parameter, travel time of seismic waves, inversion of travel time, time distance curves.

Seismographs and seismographic networks, geophysical observatories, seismic source, observation of travel-time of seismic waves from source to observatories, estimation earthquake source parameters.

Estimation of the earthquake size, intensity scale and magnitude scales of earthquake size estimation, various magnitude scales, relation between intensity and magnitude of earthquakes.

Earthquake faults and fault parameters, fault-plane solution.

Geodynamics and plate tectonic theory, different plate boundaries, causes and mechanisms of earthquakes, seismicity, tsunamis, volcanoes.

Tectonic setting of Papua New Guinea.

**Textbooks**


**Reference**

Kennett, B. L. N., (1983), Seismic Wave propagation in Stratified Media, Cambridge Univ. Press.


**Assessment**

Continuous Assessment - 50%

Written Examination - 50% (1x3 hrs)

**APM529: PHYSICS OF VOLCANO FORMATION & ERUPTION STYLES**

**Hours per week:** 4 (4 lectures)

**Credits:** 18

**Learning Outcomes**

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

LO1: Develop knowledge on volcanic structures, physical geology of a volcano & volcanic eruption styles

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

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

LO4L: Acquire knowledge on advanced monitoring techniques as forecasting tools for volcanic eruption, such as: Satellite imagery, Digital Elevation Models & InSAR

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

**Syllabus**

Formation, distribution and classification of volcanoes, geological aspects of volcanic systems, volcano stratigraphy, structure and tectonic influence, eruptive history, evolution of volcanic landforms, volcano forms, volcanic eruption style and progress, kinds of materials ejected during an eruption, pyroclastic flows, pyroclastic fallout, lahars, debris-flow avalanches, lava, dust, ash, volcanic gases, dispersal patterns of lava an
dash, analysis of real-time eruption observations, volcanic hazards. Geophysical aspects of volcanic systems, physical properties of volcanic rocks and magmas, heat flow studies; volcano seismology, geodesy and remote sensing, Geochemical and petrological aspects of volcanic rocks, magma genesis and evolution, crystallization, volatile compositions, solubility and degassing, volcanic petrography and textural analysis, hydrology, geochemistry and measurement of volcanic and hydrothermal fluids, volcanic gas emissions, fumaroles and springs, crater lakes, hydrothermal mineralization. Computational modeling and experimental simulation of magmatic and hydrothermal processes, eruption dynamics, magma transport and storage, plume dynamics and ash dispersal, lava flow dynamics, hydrothermal fluid flow, thermodynamics of aqueous fluids and melts. Volcano hazard and risk research, hazard zonation methodology, development of forecasting tools, assessment techniques for vulnerability and impact, Mechanisms of deformation monitoring, EDMs, Satellite and InSAR.

**Textbooks**
Sparks, R.S.J., Bursil, M.I., Carey, S.N. & Gilbert, J.S., (1997), *Volcanic Plumes*, John Wiley & Sons  

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

**APM531: PHYSICS OF THE EARTH’S ATMOSPHERE**

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

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

**LO2:** Analyze weather maps and develop basic weather forecasts; what are the severe weather and the tropical cyclones?  
**LO3:** Apply the concept of feedback mechanisms to specific examples of climate change.  
**LO4:** Develop an understanding on: Subjective & Objective Synoptic Meteorology, Structure of synoptic-scale weather systems, Jet Stream dynamics  
**LO5:** Explain the role of each major influence on climate and examine the factors influencing temperature and precipitation patterns on Earth.  
**LO6:** Examine Intra-seasonal & Inter-annual Climate variations, including El-Nino effect, aerosol, drizzle, rain, snow, freezing-rain, hailstorm etc.  
**LO7:** Distinguish different Meteorological instruments.

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

**Textbooks**

**Assessment**
Continuous Assessment - 50%  
Written Examination - 50% (1x3 hrs)
### APM533: GEOPHYSICAL TECHNIQUES OF RESOURCES EXPLORATIONS

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

**Learning Outcomes**
On completion of this subject the student should be able to:-  
LO1: Explain and illustrate various geophysical exploration methods

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

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

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

LO5: Formulate Interpretation of natural resources.

**Syllabus**
- General introduction to geophysical exploration principles geological properties of crustal structure that are favorable for the formation of petroleum and mineral deposits;
- Principles of gravity and magnetic methods, principles of field operations and data acquisition, data processing, interpretation and limitations; Field examples;
- Different electrical methods of geophysical exploration; Resistivity method, Equipments, electrode layouts and field procedure of resistivity method. Interpretation of resistivity data; strength and limitations of resistivity method.
- Induced polarization (IP) method, its principles, field operations, interpretation of IP data, Self-potential (SP) method; Mechanism of self-potential (SP) method, field procedure; interpretation of SP anomaly data,
- Electromagnetic (EM) surveying depth of penetration and detection of EM fields tilt-angle-, VLF – and AFMAG methods; Airborne EM surveying; Interpretation of EM data; Limitations of EM method; Telluric and Magnetotelluric field surveying methods.
- Sources and detectors used in Seismic exploration methods; Partitioning of seismic energy at an interface; Geometry of seismic wave paths; Characteristics of seismic events; characteristics of time distance graphs, Seismic refraction surveying; Computation, reduction and interpretation of seismic refraction data; Engineering applications of seismic refraction surveying.
- Seismic reflection profiling; Geometry of reflected ray paths; Multi-channel reflection profiling; Detector designs; CDP shooting; Acquisition of data in multiplexed format on land and water covered areas; Seismic data processing; Convolution and deconvolution; Correlation; Frequency filtering.
- Radiometric method; Principles of radioactivity and decay processes; Radioactive equilibrium; Age determination using radioisotopes; Instruments used for data acquisition, field operations and data interpretation.

**Textbooks**

**Reference**

**Assessment**
- Continuous Assessment - 50%
- Written Examination - 50% (1x3 hrs)
Department of Applied Physics

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>On completion of this subject the student should be able to:</td>
<td>On completion of this subject the student should be able to:</td>
</tr>
<tr>
<td>LO1: Explain the basic principles, techniques &amp; limitations of Non Destructive Testing (NDT) methods</td>
<td>loop tests, comparator - bridge tests absolute single-coil system, applications.</td>
</tr>
<tr>
<td>LO2: Develop capability for NDT such as: Visual, Penetrant, Magnetic particle, Ultrasonic, Radiography, Eddy current, Magnetic flux leakage methods</td>
<td>Other Methods: Acoustic Emission Methods, Acoustic methods, Leak detection &amp; Thermal inspection.</td>
</tr>
<tr>
<td>LO3: Develop an understanding on specialized NDT methods such as: Thermography, Acoustic emission, Stress/Strain measurements, Holography</td>
<td></td>
</tr>
<tr>
<td>LO4: Discuss and interpret the Codes, Specifications &amp; Standards in NDT</td>
<td></td>
</tr>
<tr>
<td>LO5: Choose and adopt appropriate NDT method(s)?</td>
<td></td>
</tr>
<tr>
<td>LO6: Write Reports &amp; Recommendations based on NDT findings</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Syllabus</th>
<th>Syllabus</th>
</tr>
</thead>
</table>

Textbooks
Prakash, R, (2009), Nondestructive Testing Techniques, New Age Science

Reference

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

APM537: FIBRE OPTICS & OPTICAL COMMUNICATIONS

Hours per week: 4 (4 lectures)

Credits: 18

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

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO1: Outline the history and fundamentals of optical communication systems</td>
<td></td>
</tr>
<tr>
<td>LO2: Explain the wave theory, properties, phenomena related wave property of light including image formation.</td>
<td></td>
</tr>
<tr>
<td>LO3: Apply principles of optical fibres and their use in communication systems</td>
<td></td>
</tr>
<tr>
<td>LO4: Illustrate methods of ransmission of optical signals through optical fibres</td>
<td></td>
</tr>
<tr>
<td>LO5: Identify basic components of optical communication systems and do their characterisation</td>
<td></td>
</tr>
<tr>
<td>LO6: Develop practical optical communication system and its implementation for transmission and reception of infirmation.</td>
<td></td>
</tr>
</tbody>
</table>
**Syllabus**
Overview of optical communication systems: History of optical communications.
Characteristics of optical fibers: Wave propagation in multimode and single-mode optical fibers, coupling into and out of fibers, attenuation, group-velocity dispersion, optical nonlinearities, polarization-mode dispersion, fiber manufacturing, air-core fibers, test equipment and techniques.
Optical waveguides: Planar conducting waveguides, planar dielectric waveguides, optical fiber waveguides.
Review of digital communications: Baseband transmission, broadband transmission, Shannon's coding theorem, bit signaling and bit-group signaling methods, bit error rate and bit-group error rate, time-division multiplexing, frequency-division multiplexing
Optical sources and transmitters: Physics of light emission and amplification in semiconductors, Light-emitting diodes, semiconductor lasers, edge-emitting lasers, vertical-cavity surface-emitting lasers, optical transmitters.
Dispersion in optical communication systems: Dispersion in single-mode and multimode fibers, dispersion-induced pulse broadening in single-mode fiber, system implications and real-life examples, optical link design, power and noise budget, jitter and risetime budgets.
Manufacturing materials: silica, fluorides, phosphates, chalcogenides, practical issues: optical fibre cables, termination & splicing, free-space coupling, electric power transmission.

**Textbook**

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

---

**APM539: PHYSICS OF SEMICONDUCTOR DEVICES**

**Hours per week:** 4 (4 lectures)

**Credits:** 18

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

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

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

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

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

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

**Syllabus**
Properties of Semiconductors: Measurement of semiconductor properties; Junction Devices: Zener Diode, Varactor Diode: and Tunnel Diode and their principle of operation, structure and application; Bipolar junction Transistor and Power semiconductor Devices; Metal Semiconductor junction Diode.
Mos Devices: Energy band diagram, accumulation, depletion mode, inversion mode and C-V characteristics of MOS capacitor, constructional details IV- Characteristics, and principle of operation of depletion type and enhancement type MOSFET, equivalent circuit of MOSFET, short channel and narrow width effect, MOSFET scaling and hot electron effect, charged coupled devices (CCD) types of charged coupled device (SCCD and BCCD) application of charged coupled devices.
High Frequency Solid-State Devices: Frequency dependence of power gain and noise in BJT, Transit time effects in BJT, Transit time effect in FET and Transit time effect in MESFET, Structure, Principle of operation and application of high electron mobility.
transistor (HEMT), Principle of operation and application of ballistic transistors.
Negative Conductance Microwave Devices: Construction, Principle of operation and application of impact Avalanche Transit time (IMPATT) Diode, TRAPATT Diode, GUN Diode effect, the transferred electron mechanism, domain formation and various operating modes of GUN diode.

Textbooks

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

**APM541: DIGITAL ELECTRONICS & MICROPROCESSOR**

**Hours per week: 4** (4 lectures)

Credits: 18

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

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

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

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

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

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

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

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

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

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

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

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

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


**Reference**


**Assessment**

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

**APM543: MICROCONTROLLER AND DIGITAL SIGNAL PROCESSING**

**Hours per week:** 4 (4 lectures)

**Credits:** 18

**Learning Outcomes**

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

LO1: Perform the classification signal systems and mathematical analysis signals

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

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

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

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

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

**Syllabus**

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


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

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

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

Instruction set and program development: Instruction set types, MPASM, source code formats, labels, mnemonics, operands, comments, files with default extension, lists file format, error file format (EPR), operators, procedure, text strings, numeric constants and radix key to PIC 16/17 form instruction sets.

**Textbooks**

Embedded control hand book, volume 1995/96
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
</table>

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

**APM545: EXPERIMENTAL METHODS IN PHYSICS I**

**Hours per week:** 3 (3 Lab)

**Credits:** 4

**Learning Outcomes**
On completion of this subject the student should be able to:
- LO1: Carry out hands on experiments on the fundamental principles
- LO2: Perform practical experiments to verify the important theories and derive related outcome
- LO3: Develop an analytical capacity to arrive at statistically reliable results.
- LO4: Perform error analysis of the experiment carried out.
- LO5: Carry out advanced experiments

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

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

**Assessment**
Continuous Assessment - 100%

**APM547: EXPERIMENTAL METHODS IN PHYSICS II**

**Hours per week:** 3 (3 Lab)

**Credits:** 4

**Learning Outcomes**
On completion of this subject the student should be able to:
- LO1: Carry out hands on experiments on the fundamental principles
- LO2: Perform practical experiments to verify the important theories and derive related outcome
- LO3: Develop an analytical capacity to arrive at statistically reliable results.
- LO4: Perform error analysis of the experiment carried out.

**Assessment**
Continuous Assessment - 100%

**APM549: RESEARCH PROJECT**

**Hours per week:** Contact Hours varies

**Credits:** Varies

**Learning Outcomes**
On completion of this subject the student should be able to:
- LO1: Identify, select and develop small research projects relevant to the subjects studied.
- LO2: Carry out literature surveys related to the selected topics and identify gap areas.

Research work will be conducted on specific project as will be decided by the individual student in the area of his interest and in consultation with his supervisor.
<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LO3: Demonstrate the ability to plan a schedule of research activities to complete</td>
<td>complete the project in time.</td>
</tr>
<tr>
<td>LO4: Present the report of the research in a systematic way, preferably in the</td>
<td>format of research publication.</td>
</tr>
</tbody>
</table>

**Assessment**

Continuous Assessment - 100%

**APM551: RESEARCH PROJECT**

*Hours per week: Contact Hours varies*

**Credits:** Varies

Pre-requisite: Undergraduate degree

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

**Learning Outcomes**

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

- **LO1:** Identify, select and develop small research projects relevant to the subjects studied.
- **LO2:** Carry out literature surveys related to the selected topics and identify gap areas.
- **LO3:** Demonstrate the ability to plan a schedule of research activities to complete the project in time.
- **LO4:** Should be able to present the report of the research in a systematic way, preferably in the format of research publication.
- **LO5:** Publish the results / observations in a reputed journal as far as possible.

**Assessment**

Continuous Assessment - 100%
INTRODUCTION
No program on ‘Exploration Geophysics’ is offered at any University in PNG, although, there is a huge demand for such a specialist course in the Oil/Gas as well as Mining and Power industries, with the Geological Exploration Wings of the Mineral Resources Authority, PNG Chamber of Mines & Petroleum, PNG. In view of the above, the Master Program in Exploration Geophysics is planned in two fields of specialization – Hydrocarbon Exploration and Mineral & Geothermal Exploration. Details of the Course Curriculum are described below; the First Year of the Program (comprised of Two Teaching Semesters) is entirely devoted to Course Work where components of Field Reports are built into. The Second Year of the Program is exclusively devoted to independent Thesis work by the student in any of the chosen fields of specialization viz., Hydrocarbon or Mineral & Geothermal Exploration, under an Academic Supervisor. A written Thesis is to be submitted for Examination and Departmental Seminar is to be presented.

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

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

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

1. The typical locations of minerals, oil and gas deposits either on land or waters.
2. The identification of the minerals, oil, gas and other sister minerals that are present with the actual deposits and other symptoms.
3. Developing techniques needed to explore and locate the presence of Oil- Gas, Mineral and Geothermal resources.
4. Good communication skills – verbal, interpersonal and written to facilitate working in an industry having colleagues of multi-cultural background.
5. Academic expertise for undertaking field exploration using advanced methodology & equipment,
6. Developing adequate scientific knowledge for handling and interpreting field data to arrive at meaningful and geologically realistic conclusions,
7. Working in a time-bound frame, under varied field conditions, to achieve the set goal
8. Capability to learn and keep abreast with scientific methods that are continually developed.
RATIONALE
The Exploration Geophysics graduates are needed in the country that is specialized in that field. When specialized work such as seismic refractive or reflective survey, subsurface mapping techniques, potential field data interpreter is needed, all companies import skilled workers from overseas on contractual basis. This kind of work can be done by graduates who are trained indigenously in the area of exploration geophysics which will reduce employing overseas professionals through contractual agreements. When we have our own graduates, this will create employment for our nationals which can solve unemployment, poverty, less school leavers and other socio-economic benefits to our nation.

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

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

(i) Schedule

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Contact Hrs/Wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR 1</td>
<td></td>
</tr>
<tr>
<td>Semester 1</td>
<td>4 core subjects</td>
</tr>
<tr>
<td>Semester 2</td>
<td>3 Elective subjects</td>
</tr>
<tr>
<td>Student Field Report</td>
<td>1 subject (MEG 569)</td>
</tr>
<tr>
<td>Total Hrs/Wk</td>
<td>32</td>
</tr>
<tr>
<td>YEAR 2</td>
<td></td>
</tr>
<tr>
<td>Semester 1</td>
<td>Thesis</td>
</tr>
<tr>
<td>Semester 2</td>
<td>Thesis</td>
</tr>
</tbody>
</table>

(ii) Subject Outline

<table>
<thead>
<tr>
<th>Subject</th>
<th>Code</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravity &amp; Magnetic Exploration</td>
<td>MEG 551</td>
<td>I</td>
</tr>
<tr>
<td>Interpretation of Well logs</td>
<td>MEG 553</td>
<td>I</td>
</tr>
<tr>
<td>Seismic Prospecting</td>
<td>MEG 555</td>
<td>I</td>
</tr>
<tr>
<td>Research Project</td>
<td>MEG 557</td>
<td>I</td>
</tr>
<tr>
<td>Elective Subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airborne Geophysics</td>
<td>MEG 559</td>
<td>II</td>
</tr>
<tr>
<td>Subsurface Mapping Techniques in Petroleum Geology</td>
<td>MEG 561</td>
<td>II</td>
</tr>
<tr>
<td>Petrophysics &amp; Reservoir Characterization</td>
<td>MEG 563</td>
<td>II</td>
</tr>
<tr>
<td>Geophysical Prospecting – I</td>
<td>MEG 565</td>
<td>II</td>
</tr>
<tr>
<td>Geophysical Prospecting – II</td>
<td>MEG 567</td>
<td>II</td>
</tr>
<tr>
<td>Industrial Training</td>
<td>MEG 569</td>
<td>II</td>
</tr>
<tr>
<td>Research Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thesis</td>
<td>MEG 571</td>
<td>I &amp; II</td>
</tr>
</tbody>
</table>
### MEG 551: GRAVITY & MAGNETIC EXPLORATION

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

**Credits:** 15

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

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

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

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

**Reference books**

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

### MEG 552: INTERPRETATION OF WELL LOGS

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

**Credits:** 15

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

1. Explore Borehole Wireline Log exploration methods.
2. Plan and execute exploration strategy in petroliferous basins.
3. Examine borehole logging techniques using geophysical methods through application of mathematical and physical principles.
4. Develop various logging procedures like: Spontaneous Log, Resistivity & Induction Logs, Neutron log, Focused Electrode logs.
5. Interpret various logs in terms of borehole lithology.
techniques like Quick-look method, Tornado chart, Saturation cross-plot, Shaly-sand analysis.

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

**Syllabus**


**Reference books**


**Assessment**

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

**MEG 553: SEISMIC PROSPECTING**

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

**Credits:** 15

**Learning Outcomes**

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

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

**Syllabus**

## Reference books


## Assessment

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

### MEG 554: RESEARCH PROJECT

**Hours per week:** 4 (Project)  **Credits:** 6

**Learning Outcomes**

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

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

**Syllabus**

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

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

**Assessment**

- Continuous Assessment: 100%

### MEG 555: AIRBORNE GEOPHYSICS FOR RESOURCE EXPLORATION

**Hours per week:** 4 (3 Lectures + 1 Practical)  **Credits:** 15

**Learning Outcomes**

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

1. Develop the Airborne Geophysics for data acquisition, processing and interpretation for resource mapping in PNG.
2. Evaluate the advanced instrumentation and applications in Airborne Geophysics for on-land & offshore exploration.
3. Use airborne geophysical data for further follow-up and ground-checks in exploration.
4. Evaluate the principles and concepts for interrelationship for interpreting the airborne geophysical data in reference to geological and environmental problems in PNG.

Syllabus

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

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

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

Reference books


Assessment

Continuous Assessment - 50%
Written Examination - 50%

MEG 556: SUBSURFACE MAPPING TECHNIQUES IN PETROLEUM EXPLORATION

Hours per week: 4 (3 Lectures + 1 Practical)
Credits: 15

Learning Outcomes

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

Syllabus


Reference books

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

MEG 557: PETROPHYSICS & CARBONATE RESERVOIR CHARACTERIZATION

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

Credits: 15

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

Syllabus
This course covers the major rock physics methods used in geophysical data interpretation; it has the following main components:
(a). Relations between rock properties, fluid type and distribution & seismic waves. A review of rocks (sedimentary, igneous and metamorphic), Physical properties of rocks and fluids that affect the distribution and movement of fluids such as oil, gas, water or contaminants in porous media.

Reference books

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

MEG558: GEOPHYSICAL PROSPECTING – I

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

Credits: 15
Learning Outcomes
On completion of this subject the student should be able to:

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

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

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

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

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

Reference books

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

MEG 559: GEOPHYSICAL PROSPECTING – II

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

Credits: 15

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

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

Syllabus
(a). Electrical method: Resistivity; Resistivity of rocks and minerals; Resistivitymeters; Field measurements—Electrical sounding, Line-Electrode mapping; Mis-A-La- Masse method; Data Interpretation.

(b). Induced Polarization method: Origin of I.P., Time- and Frequency-domain I.P. methods; Measuring the I.P. effect; Polarizability of minerals and rocks, Case history; Interpretation of I.P. results.

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

Reference books

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

MEG 560: INDUSTRIAL TRAINING

Hours per week: 4 (Industrial Training)

Credits: 6

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

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

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

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

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

Assessment
Continuous Assessment - 100%
MEG 561: THESIS (DISSERTATION)

Hours per week: 16 (Thesis) Credits: 24

Learning Outcomes
On completion of this subject the student should be able to:
1. Identify, select and develop a research topic that is relevant to the area of specialization.
2. Carry out literature surveys related to the selected topics and identify the knowledge gaps.
3. Undertake the research to complete the thesis on time.
4. Present the report of the research in the form of a written dissertation

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

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

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

Assessment
Continuous Assessment - 100%

LIST OF EXPERIMENTS FOR SOME OF THE SUBJECTS TO BE TAUGHT

MEG 551: GRAVITY-MAGNETIC EXPLORATION

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

MEG 552: INTERPRETATION OF WELL LOGS

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

MEG 553: SEISMIC PROSPECTING

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

MEG 555: AIRBORNE GEOPHYSICS FOR RESOURCE EXPLORATION

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

MEG 556: SUBSURFACE MAPPING TECHNIQUES IN PETROLEUM EXPLORATION

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

MEG 557: PETROPHYSICS & CARBONATE RESERVOIR CHARACTERIZATION

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

MEG 558: GEOPHYSICAL PROSPECTING – I

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

MEG 559: GEOPHYSICAL PROSPECTING – II

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

#### Head of Department
**Prof. Zhaohao Sun**
PhD (Bond U, AU), MSc (TU Cottbus, DE), MSc (Hebei U, CN), BSc (Hebei U, CN), MACS (Snr, CP), MIEEE, MAIS

#### Deputy Head of Department
**Mr Ishmael Inore**
DipComm, Bcomm (Business Economics) (PNGUoT)

### ACCOUNTING SECTION

**Ms Bernadette Bonoro**
Section Head/Lecturer
MPA - Master of Professional Accounting (Swinburne Uni of Tech), Bcomm (Accountancy) (PNGUoT), Dip Comm Accountancy (PNGUoT)

**Mrs Gynellevin Tanabi Hemetsberger**
Technical Instructor
BComm (Accountancy) (PNGUoT), Registered CPA (PNG)

**Ms Karen Katen**
Technical Instructor
PGDE-Education Divine Word Uni, DipComm (Accountancy) (PNGUoT), Bcomm (Accountancy) (PNGUoT)

**Mr Bapa Bomoteng**
Lecturer
EMBA (PNGUoT), BTBS (Business Studies (PNGUoT), Dip in Theo (CFNI Dallas, TX)

**Mr Gideon Koroka**
Technical Instructor
Bcomm (Accountancy) (PNGUoT), Bed (UOG)

**Mr Anthony Anugu**
Snr. Technical Instructor
Study Leave

**Mr Samson Tiki**
Lecturer
Study Leave

### ECONOMICS SECTION

**Prof. Thomas Paul**
Section Head/Professor
PhD (Gujarayat Uni, India), MA Economics (Kerala Uni.)

**Mr Gomi Gipe**
Lecturer
Mcomm (Wollongong), BEcon Hons (UPNG)

**Mr Jeffery Tange**
Lecturer
MSc (Econ) Unsri, PGDE (Com) UOG, BEcon (UPNG)

**Mr Ishmael Inore**
Technical Instructor
DipComm, Bcomm (Business Economics) (PNGUoT)

**Mr Issac Suanga**
Technical Instructor
MEcon (UQ, AU), Becon (UPNG)

**Mr Londari Yamarak**
Lecturer
Mec (Waikato, NZ) PGDipEcon (Waikato, NZ), PgD. Education (UoG), Becon (UPNG). Study leave

**Mr Alphonse Malipu**
Lecturer
MEc (Sydney), BEcH (PNG), BEc (PNG)

### MANAGEMENT SECTION

**Mr Richard Sauna**
Section Head/Lecturer
Master of Marketing (Griffith), Bcomm (Management) (PNGUoT), Cert IV in Training & Assessment (APC, AU), GradCert in Comm for Sci and Tech (PNGUoT)
Mr Adimuthu Ramasamy  
Lecturer  
MPhil Management (Annamalai Uni, India), M. Comm (Annamalai, India), Bed (Annamalai, India), B Comm (Bharathidasan Uni. (BDU, India)

Ms Frieda Siaguru  
Snr Lecturer  
MBA (James Cook), BComm (Management) (PNGUoT), Cert IV in Training and Assessment

Mr Ken Konafo  
Lecturer  
MComm Marketing (Wollongong), BComm (PNGUoT)

Mr Godfrey Langtry  
Snr. Technical Instructor  
LLB (UPNG)

IT SECTION

Mrs Francisca Pambel  
Section Head/Lecturer  
MIS (ANU, AU), BComm (Comm Computing) (PNGUoT)

Prof. Zhaohao Sun  
HOD/Professor  
PhD (Bond U, AU), MSc (TU Cottbus, DE), MSc (Hebei U, CN), BSc (Hebei U, CN), MACS (Snr, CP). MIEEE, MAIS

Mr Ian Cosmas  
Lecturer  
MDSEM (UTS, AU), MACS, DipComm, BComm (Comm Computing (PNGUoT)

Dr. Muhammad N Talib  
Lecturer II  
PhD (HUST, CHINA), MS (UEP, PK), BCS (HONORS), UOL, PK

Mr Rodney Naro  
Technical Instructor  
DipComm, IT. (PNGUoT), BComm, IT (PNGUoT).

ADMINISTRATIVE STAFF

Ms Christine Bolo  
Senior Secretary  
Cert. Basic Secretarial, (Lae Tech.), Office Etiquette & Professionalism (PNGUoT), Secretarial Etiquettes (PNGUoT),

Mrs Alita P Sari  
Senior Secretary  
Cert. Basic Secretarial, (Mt Hagen Tech.), Stenography (Goroka Tech.), Office Etiquette (PNGUoT),
MASTER OF BUSINESS ADMINISTRATION (MBA)

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

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

Program Outcomes (POs)

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

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

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

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

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

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

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

Overall Structure of the MBA Program

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

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>300</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hrs/Week</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBA531:</td>
<td>Management Information System (MIS)</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>MBA532:</td>
<td>Dissertation</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>MBA533:</td>
<td>Strategic Management</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>1 elective</td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Semester total: $4 \times 4 \times 15 = 240$

Program totals: $780 \times 195$

### List of 13 Electives

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

### SUBJECT DETAILS

#### MBA511: MANAGERIAL ECONOMICS

**Hours per week:** 4  
**Credit points:** 15

**Learning Outcomes**

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

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

**Syllabus**

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

**Textbook**

MBA512: ORGANIZATIONAL BEHAVIOUR

Hours per week: 4  
Credit points: 15

Learning Outcomes
On completion of the subject, the student will be able to:
1. Demonstrate team leadership and interpersonal skills required to lead and work effectively in diverse teams.
2. Explain and define key concepts and terms used in organizational behaviour.
3. Evaluate organizational behaviour issues faced by managers.
4. Apply various theoretical frameworks and principles needed to analyse workplace behaviour.
5. Understand how organizational structures affect human behaviour at the workplace.
6. Analyse how organizational systems, policies and practices can influence and affect organizational effectiveness.

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

Textbook

Assessments
Continuous Assessment: 50%  
Final Examination: 50%

MBA513: QUANTITATIVE BUSINESS ANALYSIS

Hours per week: 4  
Credit points: 15

Learning Outcomes
On completion of the subject, the student will be able to:
1. Analyse data using scatter diagrams, histograms, and summary statistics.
2. Calculate sample data using statistics such as confidence interval estimation, hypothesis testing, and regression analysis.
3. Build statistical decision analysis models, required to aid effective business decision making.
4. Compute optimal solutions using decision analysis models for management.
5. Develop analytical thinking skills necessary to analyse spreadsheet simulation models and decisions with uncertain outcomes.

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

Textbook

Assessments
Continuous Assessment: 50%  
Final Examination: 50%

MBA514: MARKETING MANAGEMENT

Hours per week: 4  
Credit points: 15
**Learning Outcomes**
On completion of the subject, the student will be able to:

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

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

**Textbook**

---

**Assessments**
Continuous Assessment: 50%
Final Examination: 50%

**MBA521: ACCOUNTING AND DECISION MAKING**

**Hours per week:** 4

**Credit points:** 15

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

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

**Syllabus**
Accounting Information for managers and other stakeholders: private, non-profit, statutory authorities, performance metrics, economic indices, management perspective of financial statements, maintaining capital, returns to suppliers of funds: accounting systems-cash vs. accrual accounting, cash flow management, analysis of operating performance, cost concepts, relevant costs for decisions, cost objects and measurement, costs of products, services, divisions, business performance reporting – controllable costs, short run decisions – opportunity evaluation, strategic planning and budgeting uncertainty, financial planning – commercialisation of opportunities.
MBA522: OPERATIONS MANAGEMENT

Hours per week: 4
Credit points: 15

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

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

MBA523: HUMAN RESOURCE MANAGEMENT

Hours per week: 4
Credit points: 15

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

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

Textbooks

Assessments
Continuous Assessment:  50%
Final Examination:  50%

MBA524: RESEARCH METHODOLOGY

Hours per week:  4
Credit points:  15

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

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

Textbook

Assessments
Continuous Assessment:  50%
Final Examination:  50%

MBA532: DISSERTATION

Hours per week:  4
Credit points:  15

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

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

**Syllabus**

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

**Textbooks**


**Assessments**

Dissertation: 100%

---

MBA531: MANAGEMENT INFORMATION SYSTEMS (MIS)

**Hours per week:** 4  
**Credit points:** 15

**Learning Outcomes**

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

1. Apply analysis and application of technology to business problems/goals/strategies;

2. Understand IS technology and how it can be used by managers and professionals to improve organizational performance, teamwork, and personal productivity;

3. Design and implement processes and best practices for successfully managing an IS change effort;

4. Apply MIS concepts and technology to the identification of opportunities for information systems;

5. Identify and acquire the information technology capability that is needed for an organisation to keep it efficient and effective;

6. Apply collaboration, decision support, database query, and Web searching software to support classroom assignments and future work activities; and


**Syllabus**

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

**Textbooks**


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


**Assessments**

Continuous Assessment: 50%  
Final Examination: 50%
<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
<th>Credit points</th>
<th>Learning Outcomes</th>
<th>Syllabus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MBA525: PUBLIC POLICY MANAGEMENT</strong></td>
<td>4</td>
<td>15</td>
<td>On completion of the subject, the student will be able to:</td>
<td>Fundamental theories in public policy and the processes required to formulate policy, advanced understanding of formulation and implementation of public policy, basic systems/mechanics of policy formulation, processes for scrutiny and implementation, skills for policy research and diagnosis of policy content and its application to meet government objectives, challenges of implementing public policy, national government policies since independence and their benefits to PNG, international law and treaties, impact on municipal laws and public policy implementation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Describe the nature of policy, its formulation and implementation process;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Determine how policy information and data is acquired and employ tools of logic to formulate and determine complex policy issues;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Discuss with other academics, supervisors and stakeholders on policy or general matters of interest with a higher degree of critical and analytical attitude.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Organise policy formulation and implementation;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. Formulate policy.</td>
<td></td>
</tr>
<tr>
<td><strong>MBA533: STRATEGIC MANAGEMENT</strong></td>
<td>4</td>
<td>15</td>
<td>On completion of the subject, the student will be able to:</td>
<td>Introduction to Strategic Management; evaluating a firm’s external environment; internal environment analysis; business level strategy; corporate level strategy; strategies for diversified organizations; international strategy; strategic leadership; corporate governance; organizational support for strategy execution, and strategy evaluation. The course is designed to give students a thorough understanding of the complexities surrounding strategic formulation, market positioning, implementation, and evaluation processes, with special attention to capabilities and competencies required to be developed by organizations in particular competitive environments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Understand the critical role Strategic Management plays in the long-term sustainability of any organization.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Familiarize with conceptual knowledge of strategic management concepts needed to formulate and implement various strategic choices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Critically analyse an organization’s strategic mix, its policies and practices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Apply various strategic frameworks and tools to conducting a situational analysis of external and internal factors facing a particular organization, and available alternative business strategies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. Develop a Business Plan on a particular real-life PNG organization’s intent to enter a particular foreign market(s), as a means to demonstrate mastery of knowledge acquired during the semester.</td>
<td></td>
</tr>
</tbody>
</table>

**Textbook**

**Assessments**
Continuous Assessment: 50%
Final Examination: 50%
### MBA534: INTERNATIONAL MANAGEMENT

**Textbook**  

**Assessments**  
Continuous Assessment: 50%  
Final Examination: 50%

**Learning Outcomes**  
On completion of the subject, the student will be able to:
1. Describe the basis for the internationalization of business and its frameworks of analysis;
2. Understand the differences in the economic, political-legal, social, and cultural environments of doing business internationally vis-à-vis domestically;
3. Assess the opportunities and threats created by the internationalization of business and the appropriate strategic responses, including the organizational structures and systems needed to implement them;
4. Understand alternative ways of entering and operating in international markets;
5. Identify the key factors for functional area excellence when operating internationally;
6. Describe the use of technology to gain international competitive advantage.
7. Integrate the ethical dimension and social and environmental responsibility in the discussion of various international management concepts.

**Syllabus**  
Market selection, modes of entry and operations, strategy choices on where abroad to operate and by what means, capability building for international advantage, structuring firms for organisational form advantage, consideration of alternative systems of exchange abroad, decision taking in risky and uncertain international contexts and managing under adverse conditions. Both smaller and large firm internationalisation is a feature of this course.

**Textbook**  

**Assessments**  
Continuous Assessment: 50%  
Final Examination: 50%

### MBA535: MANAGEMENT OF CHANGE

**Textbook**  

**Learning Outcomes**  
On completion of the subject, the student will be able to:
1. Demonstrate an understanding the impact of globalization on organizational change and the significance change management.
2. Identify and evaluate the various forces influencing the organizational change.
3. Understand the need for change and types of organizational changes as well as the role of change agents.
4. Explain the sources of resistance to change and how this resistance can be overcome.
5. Evaluate critically the change types such as technology, new-product, structural and culture/people.
6. Identify and understand critical success factors of change management.
7. Understand and apply the practical implication of renowned models for change management such as Lewin model, Mc Kinsey 7-S model and John Kotter’s 8 points strategy model.

**Syllabus**  
Introduction to change management; understanding the impact of globalization on organizational change; internal and external forces influence the organizational change; types of organizational change.
and role of change agents; sources of resistance to organizational change and strategy to overcome the resistance of change; critical success factors of change management; change management Strategies; renowned models for change management, such as Lewin model, McKinsey 7-S model and John Kotter’s 8 point strategy model.

**Textbook**

**Assessments**
Continuous Assessment: 50%
Final Examination: 50%

**MBA536: PROJECT MANAGEMENT**

**Hours per week:** 4
**Credit points:** 15

**Learning Outcomes**
On completion of the subject, the student will be able to:
1. Understand the various elements of effective project management.
2. Apply various project management concepts, tools & techniques to initiate, plan, execute, control, and lose projects.
3. Demonstrate competence of using project management tool such as PERT-CPM and its application through MS Project.
4. Identify and manage various project management stakeholders.
5. Calculate Earned Value Management parameters needed for project control.
6. Assess the real-life project management issues and risk management of projects being undertaken in their respective organizations.

**Syllabus**
Project management concepts; project initiation; project planning; project scheduling; project implementation and control; project closeouts; stakeholders management and conflict management; project risk management; earned value management and project cost control; quality management; MS Project.

**Textbook**

**Assessments**
Continuous Assessment: 50%
Final Examination: 50%

**MBA537: STRATEGIC HUMAN RESOURCE MANAGEMENT**

**Hours per week:** 4
**Credit points:** 15

**Learning Outcomes**
On completion of the subject, the student will be able to:
1. Understand and appreciate the critical role strategic human resource management plays to the long-term sustainability of any organization through effective acquisition and management of human assets.
2. Familiarize with conceptual models for the practice of strategic HR and also acquaint with trends that are affecting human resource management practice in the modern business organization.
3. Critically analyse the impact of various approaches to managing human resources, and explore how the effective management of human resources can be a source of sustained competitive advantage by sustaining the knowledge base of the organization.
4. Apply various frameworks and tools to design strategic human resource systems that facilitate the achievement of its strategic objectives.
5. Synthesize, through a group project, an in-depth examination of a selected topic related to strategic human resource management show mastering of knowledge acquired during the semester.
**MBA540: QUALITY MANAGEMENT**

<table>
<thead>
<tr>
<th>Hours per week:</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit points:</td>
<td>15</td>
</tr>
</tbody>
</table>

**Learning Outcomes**

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

1. Understand the various elements of effective quality management.
2. Apply various quality management concepts, tools & techniques needed to deliver quality products and services.
3. Demonstrate competence of using quality management statistical tools.
4. Calculate various quality parameters needed for management and control production processes.
5. Assess the real-life quality control issues in their respective organizations.

---

**Syllabus**

Context of strategic human resource management; an investment perspective of human resource management; social responsibility and human resource management; strategic management; the evolving/strategic role of human resource management; strategic workforce planning; design and redesign of work systems; Employment law; implementation of strategic human resource management staffing; training and development; performance management and feedback; compensation; labour relations; employee separation and retention management; global human resource management.

**Textbook**


**Assessments**

Continuous Assessment: 50%
Final Examination: 50%

---

**MBA542: LOGISTICS AND SUPPLY CHAIN MANAGEMENT**

<table>
<thead>
<tr>
<th>Hours per week:</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit points:</td>
<td>15</td>
</tr>
</tbody>
</table>

**Learning Outcomes**

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

1. Understand the various elements of an effective logistics and supply chain distribution management system.
2. Describe the key drivers of supply chain performance and sourcing decisions when managing the supply chain.
3. Identify, analyse, and develop appropriate supply chain solutions for a particular firm.
4. Demonstrate competence in the ability to develop appropriate procurement, inventory, revenue, pricing and distribution strategies.
5. Explain the importance of lean supply chain management to an organization's competitive advantage.
6. Apply appropriate techniques and metrics in evaluating the performance of the logistics and supply chain system.

---

**Syllabus**

Understanding quality concepts; dimensions of quality; different perspectives on quality; quality theory; global supply chain quality; international quality standards; strategic quality planning; customer driven quality; cost of quality; quality improvement tools; quality management systems; quality management tools; bench marking; TQM implementation in manufacturing and services.

**Textbook**


**Assessments**

Continuous Assessment: 50%
Final Examination: 50%
### Syllabus

Strategic importance of good logistics and supply chain design; material and physical distribution management; demand forecasting and aggregate planning in the supply chain network; inventories planning within the supply chain network; managing variability within a supply chain network; sourcing, transportation and pricing decisions in the supply chain network; external and internal supply chain risks; supply chain mapping and value stream-mapping tools; reverse logistics; strategic role of information technology in coordinating the logistics & supply chain network.

### Textbook


### Assessments

Continuous Assessment: 50%
Final Examination: 50%

---

### MBA543: FINANCIAL INSTITUTIONS AND MARKETS

**Hours per week:** 4  
**Credit points:** 15

### Learning Outcomes

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

1. Understand how the concepts of macroeconomics and finance are applied in financial institutions and markets and appreciate how the asymmetric information is prevalent in the financial markets and the role of financial institutions in mitigating it.
2. Appreciate the positive role played by the financial institutions and markets in the economy, and analyse the risks inherent in the working of the financial institutions and markets.
3. Analyse the capital markets, the bond and fixed income markets, and use the duration analysis for bond and fixed income markets, Similarly for capital markets especially stock markets.
4. Apply the efficient market hypothesis to real world problem.
5. Analyse various risks of the financial institutions: liquidity risks, interest rate risks, market risks, foreign exchange rate risks, and operational risks and their management.

### Syllabus

Asymmetric information, moral hazard, risk reduction: actuarial and portfolio risk reduction, maturity transformation and role of financial intermediaries; money, Interest rates, monetary policy, and The reserve bank's role in monetary policy; various classification of financial markets: money markets, capital markets, bond markets, stock markets, primary, secondary markets, domestic and international markets; bond markets: concepts of yield, yield to maturity, duration, convexity, calculations and immunization of interest and price change risks; theory of interest rates, bond trading strategies; stock markets and efficient market hypothesis; thrift institutions and finance companies, insurance companies and pension funds, investing banking and investment companies; banking and financial institutions risks and management: liquidity risks, interest rate risks, market risks, and foreign exchange rate risks and their management.

### Textbooks


### Assessments

Continuous Assessment: 50%
Final Examination: 50%
### MBA544: GLOBAL MARKETING

**Hours per week:** 4  
**Credit points:** 15

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

1. Understand and explain the principles and practices of the organization in terms of global marketing.  
2. Identify and critically analyse opportunities within international marketing environments.  
3. Apply various tools and methods and conduct a market analysis as well as market research to develop and design the segmentation and entry strategies for a new product in the international market.  
4. Conceive, develop, and implement an effective global marketing strategy.  
5. Analyse, evaluate and design customer – oriented, competitive marketing mix strategies on product, price, promotion and distribution for the international market.  
6. Design and develop the export and import management strategy for the global market.

**Syllabus**  
Globalisation imperative; economic environment; financial environment; global cultural environment and buying behaviour; political & legal environment; global marketing research; global segmentation and positioning; global marketing strategies; global market entry strategies; new product development for global market; global product policy decisions; global pricing strategies; global communication strategies; sales management; global logistics and distribution; export and import management; planning organisation, and control of global marketing operations.

**Textbook**  

### Assessments

Continuous Assessment: 50%  
Final Examination: 50%

### MBA545: INNOVATION & ENTREPRENEURSHIP

**Hours per week:** 4  
**Credit points:** 15

**Learning Outcomes**  
Upon successful completion of the subject, students will be able to:

1. Discuss the attitudes, values, characteristics, behaviour, and processes associated with possessing an entrepreneurial mindset and engaging in successful appropriate entrepreneurial behaviour.  
2. Describe entrepreneurship and explain how business concepts are developed into plans.  
3. Create a financial plan and a marketing approach.  
4. Describe the ways in which entrepreneurs perceive opportunity, manage risk, organise resources and add value.  
5. Develop a plan for implementing entrepreneurial activities in a globalised and competitive environment being responsible for the social, ethical and culture issues.  
6. Critique a plan for implementing entrepreneurial activities in a globalised and competitive environment being mindful of the social, ethical and culture issues.  
7. Engage in a continuing learning process through the interaction with peers in related topics, as individuals and as team members.

**Syllabus**  
Nature of enterprise and entrepreneurship, the role of the entrepreneur, innovation and technology in the entrepreneurial process, the development of growth oriented businesses - whether for-profit or not-for-profit, Entrepreneurship as a thinking and doing. The course content is relevant to those individuals thinking about starting a business or who are already in business - large or small, those who are interested in
commercialising their own innovations or of others, and those who advise entrepreneurs or engage in policy making in the entrepreneurship area.

**Textbooks**

**Assessments**
- Continuous Assessment: 50%
- Final Examination: 50%

---

### MBA546: FINANCIAL MANAGEMENT

**Hours per week:** 4  
**Credit points:** 15

**Learning Outcomes**
On completion of the subject, the student will be able to:
1. Employ the current practical methods used in making financial management decisions;  
2. Assess the relevance of developments in financial management theory to an enterprise; and employ theoretical models to make appropriate financial management decisions;  
3. Select the techniques most appropriate to optimize the employment of resources including the most effective method of financing the acquisition of fixed assets;  
4. Explain the operation of the financial systems, with particular reference to Papua New Guinea, and evaluate alternative sources of finance and assess investment opportunities;  
5. Communicate the consequences of financial management decisions to accountants or non-accountants.

**Syllabus**
Working capital management and capital budgeting techniques employed by finance managers, short term financing and long-term investing decisions, theories and models developed to facilitate the financial management of organizations.

**Textbook**

**Assessments**
- Continuous Assessment: 50%  
- Final Examination: 50%

---

### MBA547: INTERNATIONAL FINANCE

**Hours per week:** 4  
**Credit points:** 15

**Learning Outcomes**
On completion of the subject, the student will be able to:  
1. understand the International monetary and financial system.  
2. Appreciate the exchange rates theories  
3. Analyse exchange rates risks.  
4. Manage exchange Rate risk for Banks and Business.  
5. Analyse international financial markets.  
6. Explain the basics of financial derivatives in international finance.  
7. Have an exposure to international trade finance of banking.

**Syllabus**
International monetary system, gold standard, and Bretton woods systems; European Union, currency boards, currency crises; exchange rates theories, purchasing power parity, interest rate parity; trading in currencies, foreign exchange markets; currency swaps; exchange rates risk management for Banks; exchange risk management for business; international trade, Finance of banking.
<table>
<thead>
<tr>
<th>Textbook</th>
<th>Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Final Examination: 50%</td>
</tr>
</tbody>
</table>
## Department of Civil Engineering

### Head of Department
**Betasolo, M.**, Ph.D. (Technology Management), M.Eng (Civil Eng), BSGE, BSCE, CE, GÉ, PICE-Bahrain Chapter

### Deputy Head of Department
**Konzang, M.**, MPhil (Civil Eng) BEng (Civil)

### Associate Professor
**Revanuru S.**, Ph.D. (IIT-R), M.Tech. (Environmental Engineering), B.Tech. (Civil), MISTE, AMIE.

### Senior Lecturer
**Kobal, C.A**, ME (Cantab., NZ), MS (Iowa, USA), BEng (Cantab., NZ), BEng (PNGUT), MIEPNG; Reg. Eng.

**Sultan, Z.**, Ph.D (Civil, UK); M.Sc (Transportation Eng. Sweden); B.Sc (Environmental Management, Germany)

### Technical Instructors
**Embe, M.**, BEng. (Civil)

**Kasadimi, J.**, BEng (Civil)

### Lab Manager
**Isan, P.**, CertCEng

**Liuliu, D.**, CertCEng

### Principal Technical Officer
**Ialavake, V.**, Dip.CEng (LaeTech)

**Muyong, L.**, CertCEng

**Bafinu, S.**, CertCEng

### Senior Technical Officer 2
**Doaemo, W.**, BSc (PNGUT)

**Silip M.**, B. Sc. (PNGUT)

**Hiob, S.**, B.Sc. (PNGUT)

**Mark, J.**, DipCEng (Lae Tech)

**Jesmah, K.**, DipCEng (Lae Tech)

**Tep, J.**, CertCEng


**Lowun, P.**, A.P.T.C, POM. Cert.3. Eng., 2010

**Telue, B.**, Cert. Carpentry, Dregerhafen Vocational, 1970

**Bytek, T.**, Tech. Trade Cert. (Welding), Lae Tech, 2004


### Technical Officer 2
**Hulewe, Y.**, PETT Cert. Carpentry, 1973

**Kules, K.**, Cert. Vocational, 1996

**Kairi, K.**, A.P.T.C, POM, Cert. 3 (Engineering), 2015

**Elisa, F.**, Trade Certificate, 2006

### Assistant Artisan
**Gawara, T.**, Cert. Metal Fabricating, 1989

### Technical Assistant 2
**Epaparas, W.**, College of Distance Education - Gr 10 Cert. (Lae)

### Senior Secretary 1
**Koreng N.**, SecCert (Lae Tech), StenoCert, (Lae Tech).

### Senior Secretary 1
**Komati J.**, SecCert. (Highlands SecretaryCollege-Mt Hagen) SecClerical. (Commercial Training College – Lae)
BACKGROUND

The department has a Bachelor of Engineering in Civil Engineering recognized by the Institution of Engineers PNG (IEPNG) as fulfilling the educational requirement towards the Registration as a Professional Engineer. The Department also currently is offering postgraduate programmes by Research (MPhil and Ph.D.). And to complement research with the needed theoretical knowledge to advance the civil engineering field of specialization and science in solid waste and resource management to a higher level of critical thinking skills, to cope with the 21st century needed skills, coursework is incorporated in the 2016 master's degree curriculum offering.

The offering of the master's program is an answer to the department Vision to be the premier Civil Engineering School in PNG and the South Pacific. And, to attain the department's mission as:

• To provide an International Standard in Teaching & Learning, Research & Development, External Collaboration & Partnerships, Commercial Testing and Community Services in the discipline of Civil Engineering in PNG and the South Pacific.
• To produce competent and recognised graduates who can meet standards both locally and internationally and who can contribute and compete confidently in the civil engineering works.

Civil Engineers who graduated in a Master’s program are widely taking higher responsibility in the community and involvement in government associated employers such as:

• Department of Works & Transport
• Department of Mining & Petroleum
• Department of Rural Development
• Electricity Commission (PNG Pawa)
• National Housing Corporation
• Civil Aviation Authority
• Environment & Conservation
• National Institute of Standards & Industrial Technology (NISIT)
• PNG Ports Authority
• Water Board
• Provincial & Local Level Governments
• Universities and Technical Colleges

Also, their employment in the private sector in engineering consultancy, construction and contracting organisations, mining and petroleum industries and manufacturing also goes to a higher ranking and giving them more responsibility to take part in the shaping of the company they are in and the community they are serving.

Master in Engineering, Civil Engineering (M. Eng, CE) and Master of Science in Solid Waste & Resource Management (MSc, SWRM) aims to enable the candidate (graduate and current practitioners) to undertake a full-time or part-time course and research work. The study is leading to a formal qualification in civil engineering at the Masters level. The program also aims to advance their level of knowledge and skills in a range of areas relevant to the construction, structural, water, construction, and transport and geotechnical sectors of Civil Engineering.

MASTER IN ENGINEERING (CIVIL ENGINEERING) PROGRAM

Civil Engineering is an engineering profession under one name. These various professional disciplines include; Water and Wastewater Engineering, Environment Engineering, Geotechnical Engineering, Pavement and Traffic Engineering, Structural Engineering and Construction Management. As such, a Civil engineer is trained to perform a broad range of tasks, which include the following:

• Design, plan and construct bridges, roads, buildings, aerodromes, wharves, jetties, water treatment and supply systems, sewage treatment and disposal systems;
• Carry out feasibility studies and ground investigations for engineering structures, design of foundations systems for bridges, buildings, wharves, roads, water and sewage treatment facilities;
• Plan, control, monitor construction operations and their effects on the environment, and management of assets and resources

Since it is broad as its name, and to intensify its study, a Master's Degree in Engineering and Science programs were offered to start the year
2016, at the Department of Civil Engineering at the PNG University of Technology. The aim is to have mastery or high-order overview of a specific field of study or area of professional practice.

**PROGRAM OUTCOMES (POs) FOR MASTER IN ENGINEERING (CIVIL ENGINEERING)**

**PO1:** An ability to apply a body of knowledge that includes the understanding of current developments in a specialized practice.

**PO2:** An ability to apply knowledge of research principles and methods according to specialized practice.

**PO3:** A cognitive skills that demonstrates mastery of theoretical knowledge which is reflected in the way the learner thinks critically and scholarly according to chosen specialized practice.

**PO4:** A cognitive, technical and creative skills able to investigate critically, analyze and synthesize complex information, problems, concepts and theories or to apply established theories to different bodies of knowledge in the learner’s specialized practice.

**PO5:** A cognitive, technical and creative skills that is able to generate and evaluate complex ideas and concepts at an abstract level.

**PO6:** Possess a communication and technical research skills to justify and interpret theoretical propositions, methodologies, conclusions, and professional decisions that are according to chosen field of specialized practice.

**PO7:** Will have a technical and communication skills that is able to evaluate, analyze, design, implement, and theorize about developments that contributes to professional practice or body of knowledge.

**PO8:** Recognize the need for engaging in life-long learning to upgrade to higher learning and research activities and specialization.

**PO9:** Comprehensive knowledge of contemporary issues due to changing technical scenario and be able to plan and execute a substantial research or project based capstone.

**PO10:** Apply knowledge and skills that demonstrate autonomy, expert judgment, adaptability and responsibility as a learner.

**MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT**

The Master program provides the opportunity for the students to specialize in solid management and prepares them to become experts in this very important topic and emerging issues. The program also covers in detail all aspects of the environment (air, water, waste water) in as far as it is related to solid waste management. All topics are covered in the greatest detail. The subjects are presented in modular form. The content of each module has been drawn and prepared from the experiences of the participating partners, and each module is a stand-alone subject which can be presented in a designed programme. The programme provides the students with the potential to engage in a project from their work place or a selected project which may be based on current situation.

The curriculum for this MSc was developed in the frame of the EDULINK project CODWAP, coordinated by Aristotle University of Thessaloniki, Greece. Participating countries and universities included: Bremen University of Applied Sciences and Dresden University, both from Germany; University of Mauritius, Mauritius; University of Sierra Leone, Fourah Bay College, Faculty of Engineering; and, PNG University of Technology. The project also included the running of the Master programme at the University of Mauritius in 2011/2012, as a test case.
### PROGRAM OUTCOMES (POs) FOR MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT

**PO1:** An ability to apply a body of knowledge that includes the understanding of current developments, research principles in a specialized practice.

**PO2:** A cognitive skills that demonstrates mastery of theoretical knowledge which is reflected in the way the learner thinks critically and scholarly according to chosen specialized practice.

**PO3:** A cognitive, technical and creative skills able to investigate critically, analyze and synthesize complex information, problems, concepts and theories or to apply established theories to different bodies of knowledge in the learner's specialized practice.

**PO4:** A cognitive, technical and creative skills that is able to generate and evaluate complex ideas and concepts at an abstract level.

**PO5:** Possess a communication and technical research skills to justify and interpret theoretical propositions, methodologies, conclusions, and professional decisions that are according to chosen field of specialized practice.

**PO6:** Recognize the need for engaging in life-long learning to upgrade to higher learning and research activities and specialization.

**PO7:** Comprehensive knowledge of contemporary issues due to changing technical scenario and be able to plan and execute a substantial research or project based capstone.

**PO8:** Apply knowledge and skills that demonstrate autonomy, expert judgment, adaptability and responsibility as a learner.

### ADMISSION REQUIREMENT & PROCEDURE

Entry is open to students with a four (4) year Bachelor of Engineering degree or equivalent for Master in Engineering (Civil Engineering). Moreover, for the Master of Science in Solid Waste & Resource Management entry is open to any Science graduate having a four (4) year Bachelor of any Sciences program or its equivalent. The rules about admission, registration, supervision and administration of postgraduate programs shall be those of the PNG University of Technology Master in Engineering programs.

### CONTENT AND STRUCTURE

The candidate must complete a total of 96 credit points. There has to be 24 credit points for core units, 36 credit points of specialization, 36 credit points of Research. The candidate should undertake no more than 12 credit points on Specialist units. A comprehensive exam is required after completing 48 credit points, and a Pass mark is a pre-requisite in taking CEME516: Project/Research2.

### COMPREHENSIVE EXAMINATION GUIDELINES

**Introduction**

These Guidelines are philosophy of the Civil Engineering Department's policy on comprehensive examinations. This set of examinations requires the students to demonstrate an adequate background in their field of specialization. The comprehensive examining committees should have the freedom and responsibility to determine the range of material covered and the level of expertise demanded of the student.

**Comprehensive “Fields” and Number of Examinations**

Candidates must do two comprehensives within the following approved “fields” including mastery of relevant theory and methodology:

- 2 Core Subjects
- 2 Specialized subjects

Students may take more than one comprehensive examination in a field. Examining committees are charged with the responsibility of ensuring that where a student takes more than one examination in a field the examinations are in clearly different areas and are sufficiently comprehensive to merit the title comprehensive examinations.
### Content
Student’s supervisor and committee members should bear in mind that all comprehensive examinations must test the student’s knowledge of the relevant theory and methods (quantitative, qualitative, and/or interpretive) in that area.

### Timing
The Student supervisor or the Department Postgraduate coordinator in behalf of the student may organize a comprehensive examination at any time after the applicant student finishes 48 credit points, subject to the agreement of the academic staff members on the committee.

### Committees
Committees will have three academic staff members, all selected by the Head of the Department in consultation with the student supervisor. One member of the committee is selected to be the chair of the committee. This chair should be a regular, full-time Civil Engineering department academic staff member. Ordinarily, the other two members would be regular faculty appointments from the department.

### Organization and administration
Students may take comprehensives in one of three organization and administration: as a two-hour oral examination, as a six-hour written examination, or as a take-home examination with oral defense.

#### Oral examination
The examination should last about two hours. There can be as many rounds of questioning as the committee deems appropriate. The entire proceedings must be recorded.

There must be an agreed upon reading list, negotiated between the student and the committee, in no case containing more than 50 items.

#### Six-hour written
The examination will take the form of two three-hour sessions -- one in the morning, one in the afternoon – with a one-hour break between sessions. Separate sets of questions will be handed out for the morning and the afternoon sessions, with the answer booklets being collected after each session.

The reading list, negotiated between the student and the committee, may in no case contain more than 50 items.

Normally students would be required to answer two of four or five questions in each of the two sessions.

#### Take-home examination with oral defense
The comprehensive must take the form of a set of questions rather than a literature review. There must be an agreed upon number of questions, negotiated between the student and the committee. There must be an agreed upon reading list, negotiated between the student and the committee, in no case containing more than 50 items. The entire examination (not including references) cannot exceed 40 pages (double-spaced, 12-point font).

Once the examining committee has constructed the examination and given it to the student on a mutually agreed upon date, it must be completed within 60 days. Failure to submit within this time frame constitutes a failure of the examination. The oral defense must take place on an agreed upon date no more than 30 days later. The oral examination does not involve a presentation by the student. Normally the oral defense would not last more than two hours.

### Notification of Intent to Take a Comprehensive
Application for comprehensive examination is required at the end of completing the first year of study in the Master’s program. The application form is available at the Department of Civil Engineering or at the Dean of Graduate Studies of the Papua New Guinea University of Technology. Application is confirmed upon payment of a registration fee of K200. Application will generate a review of the student degree status by the graduate evaluators in the Graduate Studies.

The Chair of the Committee of the student who plans to take an oral or sit-down examination must notify the graduate officer in writing of their intention to do so at least one month prior to the examination date.

In the case of the take-home examination with oral defense, the student and committee agree upon a date that the questions will be given to the student of which notice should be at least one month. On that date it is the responsibility of the chair of the examining committee to inform the graduate chair in writing that a comprehensive has begun.

The notification must indicate the membership of the committee, the field/area of the examination, the name of the student, the date the examination questions were given to the student and the date agreed for submission of the completed set of answers.
The maximum of the **two-day** time period allowed for the submission of the written answers commences from the day the student receives the examination. This presupposes, of course, that the other preconditions specified above -- a committee struck, reading list agreed upon, number of questions agreed upon -- have been met. It is the responsibility of the chair of the examining committee to inform the graduate officer in writing if the written answers to the examination questions were returned within **two days** and if the oral examination was carried out within thirty days after the written answers were submitted.

### Supervision

**Six-hour written examination**

A member of the examining committee must preside over the administration of a written exam. She/he ensures that suitable space is provided and that all examination materials are provided. He/she must remain in the Department for the duration of the examination in case any questions or problems should arise. This responsibility may be shared with another member of the examining committee but may not be downloaded to a staff member.

**Oral examination**

The chair of the examining committee is responsible for the conduct of the orals (e.g. the number of rounds of questions) and for recording the proceedings.

### Reporting of Results

All comprehensive examinations are to be graded on a pass/fail basis.

**Oral examination**

The student will leave the examination room. Members of the examining committee will discuss the verdict (preferably immediately, but within 72 hours in any case) and inform the graduate officer in writing of their decision. If no consensus can be reached, then two favorable evaluations out of three are considered a pass. The chair of the committee should then (1) inform the candidate of the result; and then (2) inform the graduate officer in writing of the results. In the event two of three examiners fail the student, then the graduate officer (or his/her delegate) will convene a meeting of the examining committee to review the decision. Members of the examining committee may change their decision at the meeting.

### Six-hour written

Each of the three examiners will independently assign a grade (pass or fail) and provide written feedback on each answer, as well as a grade for the entire examination. These assessments (grades and comments) will be signed; i.e. not anonymous. In the case of passing answers, the feedback may be quite brief.

These comments and results will be transmitted in writing to the Graduate Officer (or his/her designate; normally the Chair) within three weeks of the date the examination was taken. Overall passing grades from two of the three examiners constitute a passing grade on the examination.

In the event that two of three of the examiners submit overall failing grades for a student, the Graduate Officer (or his/her designate) will convene a meeting of the examining committee to review the decision. Members of the examining committee may change their decision at this meeting.

As soon as possible after the committee members submitted their assessments to the Graduate Officer (normally within a week), she/he will inform the student in writing of the result of the examination. This includes a copy of the examiners’ written comments.

**Take-home examination with oral defense**

The examining committee decides at the end of the oral defense whether or not the written answers and the oral defense constituted a pass or fail. There are no rewrites or revisions. If the examining committee cannot come to a consensus on whether the exam is a pass or fail, then they must vote. Two votes in favor constitute a pass. After receiving the results from the graduate officer, a student may request to meet with his/her examiners individually or as a group.

### Appeals and Retakes

**Appeals**

Students may appeal their grades on **procedural** grounds according to the University Rules.

**Retakes**

A student has two chances to retake a failed comprehensive examination. They must take the examination in the same field, the same area, and same examining committee. A student can retake
the second time but with different field taken from the first retake exam. Students who failed the second time will received a PG Diploma.

Any retake of a failed comprehensive examination must be completed within 12 months of the notification. If registration is interrupted (e.g., if student changes to inactive status), the one-year time period will be based on total months of regular registration from the original notification that the student failed the comprehensive exam.

**DELIVERY**
Face to face and distance mode. 66 hours face to face/online lecture, 30 hours Residential/laboratory

**RESEARCH FACILITIES**
The Civil Engineering Department is housed in four main buildings containing research laboratories, a separate workshop and a field laboratory. These research laboratories are:

- Structural Laboratory
- Hydraulics Laboratory
- Geotechnical Laboratory
- Concrete Laboratory, and
- General Workshops:
  - Welding
  - Carpenter
  - Fabrication
- Field Laboratory (CRI-Yalu Site):
  - Asphalt Laboratory
  - Cement Testing Laboratory
  - Concrete Test Laboratory

With the Memorandum of Understanding finalized in the year 2014 with the China Railway International (CRI), contracting the four-lane road project from Nadzab Airport to Lae, extended the Department’s laboratory research facilities.

The department also operates a laboratory to serve industry. The laboratory calibrates mechanical equipment such as testing machines, pressure and force measuring devices and torque wrenches. It also offers a comprehensive range of material testing for soils, concrete and metals.

The research subjects being investigated in the Department include Concrete innovations, Material Resources, Cable Stayed Bridges, Steel Structures, Timber Structures, Sewage Lagoons, Roads Pavement Materials, Earthquake Resistant Structures, Soil Properties, Disaster Research, Accident Analysis, Pavement Design, Cost-Benefit Criteria for Developing countries, Rural Water Supply and Sanitation and Waste Management.

**MASTER IN ENGINEERING (CIVIL ENGINEERING), M. Eng**

**STRUCTURE OF COURSES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1  First Semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEME511: Method of Research</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>CEME512: Entrepreneurship for Engineers</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Select from Specialist Unit</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Select from Specialist Unit</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td></td>
</tr>
<tr>
<td>Year 1  Second Semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEME513: Sustainable Technology &amp; Engineering</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>CEME514: Solid Waste &amp; Resource Management</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Select from Specialist Unit</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Select from Specialist Unit</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td></td>
</tr>
<tr>
<td>Year 2  First Semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEME515: Project/Research 1</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Select from Specialist Unit</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Select from Specialist Unit</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td></td>
</tr>
<tr>
<td>Year 2  Second Semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEME516: Project/Research 2</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td></td>
</tr>
</tbody>
</table>

**COMPREHENSIVE EXAM**
(After completion of 48 credit points, a pre-requisite in CEME516- M Project 2)

| Year 2  First Semester                                      |               |
| CEME517: Advance Project Planning & Control                 | 6             |
| CEME518: Design of Construction Operation                   | 6             |

**SPECIALIST UNIT**

**Construction**
- CEME517: Advance Project Planning & Control 6
- CEME518: Design of Construction Operation 6

**Structural**
- CEME519: Steel & Concrete Composite
**Department of Civil Engineering**

**POSTGRADUATE COURSES HANDBOOK 2019**

| Designs                                    | 6 |  |
| CEME520: Advance Material Technology       | 6 |

**Geotechnical**

| Geotechnical Model                          | 6 |
| CEME521: Geotechnical Modeling              | 6 |
| CEME522: Foundation Engineering             | 6 |

| Water                                      | 6 |
| CEME523: Advanced Hydrology                | 6 |
| CEME524: Urban Drainage                    | 6 |

**Transport**

| Transport                                  | 6 |
| CEME525: Asphalt Technologies              | 6 |
| CEME526: Road Engineering                  | 6 |

**MASTER OF SCIENCE IN SOLID WASTE AND RESOURCE MANAGEMENT (MSc, SWRM)**

**STRUCTURE OF COURSES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>First Semester</td>
<td></td>
</tr>
<tr>
<td>CEME511: Method of Research</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>CEME531: Introduction to Solid Waste</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEMEC532: Hazardous Waste Management</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>CEMEC 533: Waste Management Systems</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

| Year 1 | Second Semester                  |               |
| CEME513: Sustainable Technology & Engineering | 6  |
| CEME514: Solid Waste & Resource Management | 6   |
| CEMEC 535: Final Disposal / Land filling in Developing Countries | 6 |
| Select from Specialist Unit               | 6             |
|                                             | 24            |

**COMPREHENSIVE EXAM**

(After completion of 48 credit points, a pre-requisite in CEME516- Project/Research 2)

| Year 2 | First Semester                   |               |
| CEME515: ME Project l/Research1          | 12            |
| Select from Specialist Unit              | 6             |
| Select from Specialist Unit              | 6             |

| Year 2 | Second Semester                  | 24            |
| CEME516: ME Project/Research 2           |               |
|                                             | 24            |

**SPECIALIST UNIT**

| CEME536: International Environmental Policy | 6 |
| CEME537: Environmental Economics           | 6 |
| CEME538: Mining Waste Management           | 6 |
| CEME539: Sustainable Production Technologies | 6 |
| CEME540: Environmental Management Systems  | 6 |
| CEME541: Special Waste Management          | 6 |

**CORE SUBJECTS**

**CEME511 METHOD OF RESEARCH**

Hours per week: 10 (3 lectures + 3 labs + 4 tutorials)

Credit Hours: 6
PNG Credit: 27

**Learning Outcomes**

Upon completion of the subject, students should be able to:

1. Prepare their (Masters) dissertation proposals.
2. Determine best experimental design appropriate to his/her study.
3. Critically analyze and interpret results from their experimental designs.
4. Analyze various types of qualitative and quantitative data from all sources including manipulation of software in the analysis.
5. Conduct and present research results to research committee.

**Syllabus**

The subject covers classic and contemporary research strategies, research designs and writing a research proposal, format and presentation, data management, research ethics, plagiarism and information sources, qualitative and quantitative research methodology, interviews and participant observations, organizing and analyzing qualitative data, quantitative research methodology using statistical software.

**Textbook**

### CEME512: ENTREPRENEURSHIP FOR ENGINEERS

**Hours per week:** 10 (3 lectures + 3 labs + 4 tutorials)
**Credit Hours:** 6
**PNG Credit:** 27

**Learning Outcomes**
- Upon completion of the subject, students should be able to:
  1. Create a full business plan, a virtual company website.
  2. Give several product presentations.
  3. Compete in both the end-of-semester competitions in campus and off campus.
  4. Present and discuss the critical importance of entrepreneurship to the world’s economy (employment, technology advancement, societal development, etc).
  5. Interact with entrepreneurs from various sectors of the economy: software, telephony, energy, light, water, bio- and medical sciences, social networks and enterprises, entrepreneurship, and finance.

**Syllabus**
The course focuses on business sectors that derive from disciplines and areas of study. Engineering Entrepreneurship is a full-immersion, multidisciplinary, engineering experience holistically designed to integrate the skills and knowledge of the students in a more in-depth exposure to new product and business development to the engineering profession. The subject covers: Entrepreneurial engineer’s readiness in 21st century, innovation, money, work, time, human behavior, ethics, organization and leadership, and assessment of technology opportunities.

**Textbook**

### Assessment
- **Continuous:** 50% (Individual class participation-20%, Weekly Assignment-30%)
- **Project Based:** 25% Paper write up and 25% oral presentation

### CEME513: SUSTAINABLE TECHNOLOGY & ENGINEERING

**Hours per week:** 10 (4 lectures + 2 labs + 4 tutorials)
**Credit Hours:** 6
**PNG Credit:** 30

**Learning Outcomes**
- Upon completion of the subject, students should be able to:
  1. Address sustainable development in built environment during any civil engineering activities
  2. Prepare a life cycle assessment strategies and analysis
  3. Discuss environmental ethics and create an eco-label application paper in his workplace
  4. Identify renewable energy and conservation strategy in PNG
  5. Discuss concepts in new urbanism, bioclimatic design, and ecological.

**Syllabus**
This course addresses the application and fundamental concepts of the sustainable development paradigm to the built environment in application to evolving technologies and engineering possibilities; the environmental / resources issues and industrial / construction metabolism. The course will discuss environmental ethics and environmental justice; ecological / environmental economics including Life Cycle Costing; building assessment (frameworks) and Eco labels. Additionally, this course develops basic knowledge about energy systems, entropy, energy conservation and renewable energy; Life Cycle Assessment, embodied energy, and materials. Concepts such as New Urbanism, bioclimatic design principles, ecological concepts, and passive design strategies will be discussed.

**Textbooks**
Kauffman, Joanne, LEE, Kun Mo (eds.) *Handbook of Sustainable Engineering*
Wiley & Sons Boston, 2001

### Assessment

<table>
<thead>
<tr>
<th>Continuous: 50% (Individual course problem-20%, Group Case Work- 30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Based:</strong> 50% Paper (Design &amp; Technologies)</td>
</tr>
</tbody>
</table>

#### CEME514: RECYCLING & RESOURCE MANAGEMENT

- **Hours per week:** 10 (4 lectures + 2 labs + 4 tutorials)
- **Credit Hours:** 6
- **PNG Credit:** 30

**Learning Outcomes**

Upon completion of the subject, students should be able to:

1. Assess recycling and resource management possibilities
2. Estimate cost analysis on recycling and resource management
3. Deliver case study on best practice of recycling and resource management
4. Identify threats, hazards of as is practices and with recycling
5. Deliver a project on PNG's recycling and resource management portfolio

**Syllabus**

Topics in recycling covers material and energy flow management and analysis, influences of production and consumption, ecological and economically valuation of substances, assessment of sustainability of material flows, optimization of material, energy and information flows, treatment technologies, design of material flows, treatment technologies, design for recycling, upgrading and repair, recycling and reuse, engineering cost estimation, regulatory aspects of waste management, waste minimization, basic unit process, application and utilization or reclaimed products. In Resource management covers are: people, facilities, communications and warning technologies, fire protection and life safety systems, pollution control systems, equipment, materials and supplies, funding, special expertise and information about threats and hazards.

**Textbooks**


### Assessment

<table>
<thead>
<tr>
<th>Continuous: 50% (Individual course problem-20%, Group Case Work- 30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Based:</strong> 50%Term Paper</td>
</tr>
</tbody>
</table>

#### CEME515: ME PROJECT I/RESEARCH 1

- **Hours per week:** 10 (4 lectures + 2 labs + 4 tutorials)
- **Credit Hours:** 6
- **PNG Credit:** 30

**Learning Outcome**

Upon completion of the subject, students should be able to:

1. Identify civil engineering project involving investigation, research and or field laboratory execution.
2. Plan a detailed schedule of activities (from start to finish) of the project.
3. Apply skills and knowledge in the execution of the project.
4. Present the thesis, and objectives in an organized research seminar.
5. Create and produce a written thesis and preliminary discussions.

**Syllabus**

Topics of the research project will be chosen in consultation with the supervisor in the area of interest or specialization. Students are expected to prepare objectives, carry out a literature review on the topic, use appropriate reference and citation protocols (APA or AMA) and propose a methodology of research. This will form the basis of seminar presentation by the student during the semester.

**Textbooks**

*Experimentation: Design and Analysis.* John Wiley and Sons, New York. 2001


**Assessment**

<p>| Continuous: 60% Research paper (Title, Objectives, Introduction and Literature Review), 40% Research Oral Presentation |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
<th>Credit Hours</th>
<th>PNG Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEME516</td>
<td>CEME516: ME PROJECT 2/RESEARCH 2</td>
<td>10 (4 lectures + 2 labs + 4 tutorials)</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Pre-requisite: CEME515&lt;br&gt;Passing a Comprehensive Exam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learning Outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upon completion of the subject, students should be able to:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Perform identified civil engineering project involving investigation, research and or field laboratory execution.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Perform the detailed schedule of activities (from start to finish) of the project.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Apply skills and knowledge in the execution of the project.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Present the thesis, discussions and result in an organized research seminar.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Create and produce a complete written thesis.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Syllabus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Full discussion of topics selected for the research project in consultation with the supervisor in the area of interest or specialization. Students are expected follow prepared objectives, carried out a complete literature review on the topic, used appropriate reference and citation protocols (APA or AMA) and follow proposed methodology of research. The student in this semester shall do exhaustive research to seek answers on his/her thesis either in experimental, scientific, qualitative and quantitative analysis as deemed appropriate in consultation with supervisor. This will form the basis of seminar presentation by the student during the semester. The dissertation will be examined by two external examiners approved by Higher Degree Committee.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Textbooks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous: 40% Research paper (Title, Objectives, Introduction and Literature Review), 30% Research Oral Presentation, 30% External</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examination (2 examiners)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEME531</td>
<td>CEME531: INTRODUCTION TO SOLID WASTE MANAGEMENT</td>
<td>10 (4 lectures + 2 labs + 4 tutorials)</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Learning Outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upon completion of the subject, students should be able to:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Determine different composition of waste generation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Identify international regulations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Determine biological treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Discuss principles of waste management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Identify technologies appropriate to changing environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Syllabus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The course covers waste generation and composition, national and international regulations for waste, waste avoidance, collection and transport of waste, separate collection of recyclables, sorting of recyclables, recycling technologies for paper, glass, metal, plastic, biological treatment of waste, waste disposal, ecological indicator systems, principles of waste management, polluter and producer pays principle, the precautionary principle, waste hierarchy, concept from cradle to grave.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Textbook</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous: 50% (Individual class participation-20%, Weekly Assignment-30%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project based: 50% (Course Paper-25%, oral presentation-25%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEME532</td>
<td>CEME532: HAZARDOUS WASTE MANAGEMENT</td>
<td>10 (4 lectures + 2 labs + 4 tutorials)</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Learning Outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upon completion of the subject, students should be able to:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Syllabus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Credit Hours: 6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Learning Outcomes
Upon completion of the subject, students should be able to:
1. Characterize hazardous waste
2. Classify hazardous waste
3. Calculate thermal and energy recovery
4. Identify alternative hazardous waste management program
5. Perform treatment and disposal of hazardous waste

Syllabus
The course covers hazardous waste treatment and disposal; hazardous waste identification, basic properties of hazardous waste, classification of hazardous waste, hazardous waste generation and characteristics, transportation and storage of hazardous waste, physical, chemical and biological treatment, thermal and energy recovery, stabilization and solidification and land disposal of hazardous waste, alternative hazardous waste management programs.

Textbook

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment-30%)
Project based: 50% (Course Paper-5%, oral presentation-25%)

CEME533: WASTE MANAGEMENT SYSTEMS

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Plan waste management in system view
2. Identify pollution and its prevention using proven methodology
3. Calculate economic evaluation of pollution prevention
4. Assess investment portfolio on various manufacturing processes waste disposal
5. Monitor and prevention of impact of solid waste to the environment

Syllabus
The course covers planning of waste management systems (costs, aims, basics) logistics, collection (storage systems), transport and transfer stations (policy, economics, planning) identification of pollution prevention, opportunities, implementation of proven methodology as defined by International Environmental Agencies (i.e. EPA), emphasis on economic evaluation of pollution prevention practices and investment for various manufacturing and post-consumer processes, monitoring.

Textbook

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment-30%)
Project based: 50% (Course Paper-5%, oral presentation-25%)

CEME535: FINAL DISPOSAL / LAND FILLING IN DEVELOPING COUNTRIES

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Plan and design landfill
2. Design methodologies on landfill construction on latest technologies
3. Describe a landfill system appropriate to PNG setting
4. Deliver case studies of landfill system from at least two (2) different developing countries.
5. Evaluate future energy production, maintenance, emission control and treatment.

Syllabus
The course covers landfill emissions, site requirements, landfill construction, monitoring landfill technology and operation, sitting and construction, design characteristics, life span, extraction of landfill gas – future energy production,
operation and maintenance, emission control and treatment.

**Textbook**

**Assessment**
**Continuous**: 50% (Individual class participation-20%, Weekly Assignment-30%)

Project based: 50% (Course Paper-5%, oral presentation-25%)

---

**SPECIALIZATION:**

**CEME517: ADVANCE PROJECT PLANNING & CONTROL**

**Hours per week**: 10 (4 lectures + 2 labs + 4 tutorials)

**Credit Hours**: 6

**PNG Credit**: 30

**Learning Outcomes**
Upon completion of the subject, students should be able to:
1. Plan and control small scale project portfolio
2. Plan and control large scale project portfolio
3. Conduct Performance Analysis in both small and large-scale projects
4. Employ computer based Project Management
5. Discuss human behavior in the project setting

**Syllabus**
Students taking this course should already have a comprehensive understanding of the basics of planning, monitoring and controlling in a construction project using Critical Path Method (CPM) and other related techniques. This course intend to developing expertise in dealing with problems such as uncertainty in the performance of resources, modeling repetitive construction work, and simulating construction processes. It will also provide understanding of the tools and methods necessary to be leading construction managers in the new century.

**Textbooks**

---


*Project Management Reference Guide*. Department of Main Roads

**Assessment**
**Continuous**: 50% (Individual class participation-20%, Weekly Assignment-30%)

50% Project based

---

**CEME518: DESIGN OF CONSTRUCTION OPERATION**

**Hours per week**: 10 (4 lectures + 2 labs + 4 tutorials)

**Credit Hours**: 6

**PNG Credit**: 30

**Learning Outcomes**
Upon completion of the subject, students should be able to:
1. Design theory as applied to construction,
2. Queuing and simulation model
3. Apply axiomatic design
4. Apply robust design
5. Create measurement and procedures for productivity

**Syllabus**
Design theory as applied to construction processes in the construction industry; building construction; queuing and simulation models; methodology on measurement procedures for productivity; job planning, layout planning, planning and design of production systems (construction oriented); reliability, availability, applications, axiomatic design, and robust design.

**Textbook**

**Assessment**
**Continuous**: 50% (Individual class participation-20%, Weekly Assignment-30%)

50% Project based
### CEME519: STEEL & CONCRETE COMPOSITE DESIGNS

**Hours per week:** 10 (4 lectures + 2 labs + 4 tutorials)<br>
**Credit Hours:** 6<br>
**PNG Credit:** 30

**Learning Outcomes**

Upon completion of the subject, students should be able to:
1. Identify different trends and development in structural steel and concrete design including high rise building.
2. Design a composite structure
3. Design a pre-stressed structure
4. Design a pre-cast structure
5. Design and Analyse steel and concrete composite structure in advanced way

**Syllabus**

Topics include trends and developments in structural steel and concrete design. It will discuss framing systems, floor systems; Plate girders; Composite construction; Design of braced frames; Connections and P-Delta effects. The course includes steel bridge design, design of long columns and columns subjected to biaxial bending, two-way slabs, flat plates, girders, and shells. Design of prefabricated structures, pre-stressed, pre-casts, post-tensions concrete, short and long-term deflections; strength loss and design requirements for shear, flexure, bond, and anchorage

**Textbooks**


**Assessment**

*Continuous:* 50% (Individual class participation-20%, Weekly Assignment- 30%)<br>
50% Project based

### CEME520: ADVANCE MATERIAL TECHNOLOGY

**Hours per week:** 10 (4 lectures + 3 labs + 3 tutorials)<br>
**Credit Hours:** 6

### CEME521: GEOTECHNICAL MODELLING

**Hours per week:** 10 (4 lectures + 2 labs + 4 tutorials)<br>
**Credit Hours:** 6<br>
**PNG Credit:** 29

**Learning Outcomes**

Upon completion of the subject, students should be able to:
1. Calculate and analyze properties of materials
2. Create an advance material innovation
3. Practice Non-destructive testing analysis on materials
4. Compare different advance materials
5. Discuss advances in Rapid Prototyping and Manufacturing Using Laser-Based Solid Free-Form Fabrication

**Syllabus**


**Textbook**


**Assessment**

*Continuous:* 50% (Individual class participation-20%, Weekly Assignment- 30%)<br>
50% Project based
collected
3. Demonstrate the technical issues of the subsoil model
4. Apply knowledge of modelling techniques in the area of interest
5. Deliver the Geotechnical 3D model for presentation

Syllabus
Geotechnical modeling considers the nature, validity and consequences of the supporting soil assumptions. Topics cover: Introduction to geotechnical modeling, soil constitutive modeling, introduction to physical modeling, centrifuge modeling, theoretical modeling, numerical modeling and applications, and empirical models.

Textbook

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment- 30%)
50% Project based

CEME522: FOUNDATION ENGINEERING

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify and analyze foundation failures
2. Perform foundation preventive maintenance
3. Perform foundation engineering forensic work
4. Examine legal issues associated with foundation failure issues
5. Analyse and design foundations applicable to different soil conditions.

Syllabus
Foundation engineering covers loads, the soil bearing capacity, and effect of loads that will undergo settlement. Lateral pressures. Foundation, drainage and waterproofing. Footings types (spread and Strip footings, etc). Pile foundations, retaining walls, caissons. Sheet piling walls and braced cofferdams. Cellular cofferdams. Anchors. Foundation failure analysis, forensic and legal implications. Also includes preventive maintenance, and improvement of foundations.

Textbooks

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment- 30%)
50% Project based

CEME523: ADVANCED HYDROLOGY

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Determine the rate of movement of contaminants in surface water and groundwater
2. Statistically analyze hydrologic data, including extreme events, time series, and spatial data.
3. Use remote sensing, automated data collection, forecasting, and advanced computer methods in hydrology
4. Calculate the rate of rainfall, evaporation, infiltration, groundwater flow, snow-melt, and stream flow
5. Determine the rate of movement of contaminants in surface water and groundwater

Syllabus
Hydrologic cycle, systems concept, hydrologic model classification; Reynolds Transport Theorem; continuity equation, momentum equation, and energy equation; Atmospheric hydrology; Hydrologic processes, precipitation, evaporation, surface flow, sub-surface flow, and groundwater flow; Unit hydrograph, various response functions and their interrelationships; Hydrologic statistics, statistical parameters, fitting a probability distribution, testing goodness of fit, frequency analysis, and reliability analysis.
Textbook

Assessment
*Continuous*: 50% (Individual class participation- 20%, Weekly Assignment- 30%)
50% Project based

**CEME524: URBAN DRAINAGE**

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

**Learning Outcomes**
Upon completion of the subject, students should be able to:
1. Identify reliable methods for urban drainage design
2. Estimate the magnitudes of floods and mitigate their effects
3. Assess water usage for a city or an irrigation project
4. Select reliable methods for urban drainage design
5. Develop solutions for cleaning up and preventing pollution of surface water and groundwater in urban areas.

**Syllabus**
Topics of study include the hydrology and drainage requirements of urban areas. An introduction to the effects of urbanization on the hydrological cycle, develop basic methods of hydrological analysis including rainfall-runoff models and flood frequency analysis. Rainfall analysis and hydraulics, in application to storm, foul and combined sewer for design. Also included are sewer flow and quality models, storm water management and the increasing influence of ‘sustainability principles’. Formulate integrative goals regarding to hydrologic, environmental and social consequences for a sustainable urban storm water management.

**Textbook**

Assessment
*Continuous*: 50% (Individual class participation- 20%, Weekly Assignment- 30%)

**50% Project based**

**CEME525: ASPHALT TECHNOLOGIES**

Hours per week: 10 (4 lectures + 3 labs + 3 tutorials)
Credit Hours: 6
PNG Credit: 29

**Learning Outcomes**
Upon completion of the subject, students should be able to:
1. Make/create asphalt mixtures in Lab, optimizing the components and analyzing the results
2. Use new technological approach using Computer software and Labs (Marshall Test)
3. Create, test and analyze two (2) different sorts of asphalt mixtures
4. Present a technical report of two (2) asphalt mixtures.
5. Make a scientific based prediction on the mechanical behavior and durability of any asphalt specification.

**Syllabus**
To introduce a more applied approach covering the state-of-the-art in asphalt technologies. The course covers the basic principles of bitumen & asphalt as construction material, bitumen modification, new technological approach, effects & problems during application etc. Student will have the opportunity to make/create asphalt mixtures in Lab, optimizing the components and analyzing the results, eventually using new technological approach. Computer software and Labs (Marshall Test), Penetration Tests, are necessary.

**Textbook**

Assessment
*Continuous*: 50% (Individual class participation- 20%, Weekly Assignment- 30%)
50% Project based: 50% (Course Paper-25%, oral presentation-25%)
CEME526: ROAD ENGINEERING

Pre-requisite subject: CEME525
Hours per week: 10 (4 lectures + 3 labs + 3 tutorials)
Credit Hours: 6
PNG Credit: 29

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Construct (almost) any road meant for various purposes
2. Analyze and predict the behavior and durability of the pavement as a whole.
3. Use shell software in pavement design
4. Calculate pavement design using manual and software.
5. Analyze existing road condition in PNG setting for road engineering project

Syllabus
The subject introduces calculating the construction using various pavement materials (asphalt, concrete, element block) and based on various conditions (purpose of the road, traffic intensities, axle loads differentiation, type of subgrade & sub-base, weather conditions, project budget, material available, controlling/checking procedures etc.). The way of constructing asphalt pavement on a concrete or steel bridge as well as on swamp area is incorporated, next to making a comparison and an economic balance due to the use of different pavement materials.

Textbook

Assessment
Continuous: 50% (Individual class participation- 20%, Weekly Assignment- 30%)
Project based: 50% (Course Paper-25%, oral presentation-25%)

CEMEC536: INTERNATIONAL ENVIRONMENTAL POLICY

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Identify solutions on environmental problems supported by environmental policy
2. Analyze policies from the perspective of developed and developing countries
3. Prepare a case study relative to international environmental policy
4. Present a case in relation to PNG setting
5. Develop a policy framework appropriate for PNG

Syllabus
The course covers methods and strategies for promoting solutions to global environmental problems, policymaking from perspective of developed and developing countries, the United Nations system, international financial entities, and non-governmental interest groups, progress of international community, obstacles preventing effective international solutions, links between politics, policy and the environment, origins and evolution of different forms of environmental policy, different stages of the environmental policy process, study of academic research papers.

Textbooks

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment- 30%)
Project based: 50% (Course Paper-25%, oral presentation-25%)

CEMEC537: ENVIRONMENTAL ECONOMICS

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Calculate monetary value on environmental problems
2. Analyze environmental instruments
3. Analyze implications of economic activity for PNG
4. Calculate ecological footprints
5. Design using economic tools an effective environmental management

**Syllabus**

The course covers internalizing an externality, instruments of environmental policy, monetary valuation of environmental problems, basic economic principles to assist environmental analysis and management, implications of economic activity and development of environmental quality, and the economic tools and framework, participatory method, cost-benefit analysis, multi-criteria assessment, sustainability indicators (i.e. ecological footprints).

**Textbooks**


**Assessment**

Continuous: 50% (Individual class participation-20%, Weekly Assignment- 30%)

Project based: 50% (Course Paper-25%, oral presentation-25%)

**CEMEC538: MINING WASTE MANAGEMENT**

**Hours per week:** 10 (4 lectures + 2 labs + 4 tutorials)

**Credit Hours:** 6

**PNG Credit:** 30

**Learning Outcomes**

Upon completion of the subject, students should be able to:

1. Characterize mining waste
2. Assess risk of mining facilities
3. Review of techniques for the prevention of abatement of pollution generated by mining waste
4. Learn decision support tool for minimizing the impact

**Syllabus**

The course covers methods for the characterization of mining waste, risk assessment of mining facilities including old/abandoned mining waste facilities, review of techniques for the prevention of abatement of pollution generated by mining waste, examples of decision support tool for minimizing the impact of the mining industry on the environment.

**Textbooks**


**Assessment**

Continuous: 50% (Individual class participation-20%, Weekly Assignment- 30%)

Project based: 50% (Course Paper-25%, oral presentation-25%)

**CEMEC539: SUSTAINABLE PRODUCTION TECHNOLOGIES**

**Hours per week:** 10 (4 lectures + 2 labs + 4 tutorials)

**Credit Hours:** 6

**PNG Credit:** 30

**Learning Outcomes**

Upon completion of the subject, students should be able to:

1. Plan sustainable development and sustainable production
2. Evaluate impact of production processes on the environment
3. Prepare and assess sustainable production processes in an industrial setting
4. Deliver CDM project
5. Tap or propose opportunities-financing economies of CDM

**Syllabus**

The course covers introduction to sustainable development and sustainable production, impact of production processes on the environment, sustainable production, impact of production processes on the environment, sustainable production process in the chemical, metal and ceramic industries, purpose and implementation of CDN/JI, Kyoto Protocol, CDM Market, Investments,
Department of Civil Engineering

incentives, opportunities-financing economics of CDM/JI projects.

Textbooks

Sustainable production technologies. CODWAP

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment-30%)

Project based: 50% (Course Paper-25%, oral presentation-25%)

CEMEC540: ENVIRONMENTAL MANAGEMENT SYSTEMS

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Audit environmental impact using EMAS, EMS, ISO 1400 and ISO 14001
2. Develop a mock EMS manual for an organization
3. Implement ISO 1400 compliant EMS within an organization

Syllabus
The course covers integration of environmental issues on sustainability in business, key elements of the Eco-Management and Audit Scheme (EMAS) and ISO 14001, principles and elements of environmental management systems, environmental management and reporting, examples of Environmental Management System (EMS) manual, developing a ‘mock’ EMS manual for an organization, developing and implementing an ISO 1400 compliant EMS within an organization.

Textbook

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment-30%)

Project based: 50% (Course Paper-25%, oral presentation-25%)

CEMEC541: SPECIAL WASTE MANAGEMENT

Hours per week: 10 (4 lectures + 2 labs + 4 tutorials)
Credit Hours: 6
PNG Credit: 30

Learning Outcomes
Upon completion of the subject, students should be able to:
1. Design hazardous health care from hazardous waste
2. Identify potential health hazards
3. Audit industrial health program
4. Deliver special waste management project

Syllabus
The course covers introduction, definition of hazardous health care waste, infectious waste, genotoxic waste, waste sharps, biomedical waste-categories and composition, sources of health care wastes, hospital waste management, potential health hazards, legislation and policies on health care waste management, Works Health Organization guidelines, industrial waste definition, industrial waste audit, industrial waste management, hospital and industrial wastes collection, treatment and disposal.

Textbook

Assessment
Continuous: 50% (Individual class participation-20%, Weekly Assignment-30%)

Project based: 50% (Course Paper-25%, oral presentation-25%)
Department of Communication and Development Studies

DEPARTMENT OF COMMUNICATION AND DEVELOPMENT STUDIES

Head of Department
Associate Professor, Sali, G., PhD in Development Sociology (VUW), BAHons & BA (UPNG)

Deputy Head of Department
Wrondimi, G., MASW (Victoria Univ. NZ), BASW (UPNG)

Professors
Gilder, E., PhD in Communication (Ohio State Univ.), MA in Speech Communication & Drama/Radio-TV-Film (Univ. of N. Texas), BA in Communication /Political Science (Univ. of Texas/Arlington)
Khan, G., PhD in Sociology (Syd. Univ.), PhD in Sociology (Bombay Univ.), MA in Sociology (Dhaka Univ.), BA (Hons) in Sociology (Dhaka Univ.)

Associate Professor
Sali, G., PhD in Development Sociology (VUW), BAHons & BA (UPNG)

Senior Lecturers
Aisoli-Orake, R., PhD in Education (Newcastle Univ) MLitt Hons (ANU), BEd (UPNG), PGCCST (UOT)
Mishra, K. D. PhD in Communication & Journalism (SRM University), MPhil Mass Communication and Journalism (JSS University), MA Mass Communication & Journalism (University of Mysore), BSC (University of Mysore).
Yarapea, A., PhD in Linguistics (ANU), MPhil in Linguistics (Syd Univ), MA in Appl. Ling. (Syd Univ), BAHons & BA (UPNG), PGCCST (UOT)

Principal Technical Instructor
Eva-Gwale, R., MAOL (UOT), MLib (UCW), DLIS, BSc. (UPNG), PGCCST (UOT)

Lecturers
Aisi, M., MA (UOT), BEd (UOG), DipST (UPNG-GTC)
Winuan, M., MA (Applied Edu.) & PGDip. Sec. Lang. Teach (Waikato); BEd (Hons) (UOG); BEd (UPNG); DipST (UOG)
Ambelye, I., MA (TESOL) (UOQ), BEd (UOG), DipST (UOG). Makara, S., MA (UOT,) BTCD & DTCD; (UOT).
Kuri, F. J., MA (CSU) BEd (UPNG-UOQ)

Molus, W., MA (UOT), BEd (UOG), DipEd (Balob) (on study leave)
Harry, M., MA (UOG) BA (UNE), Dip (UOG)
Maino, L., MA (UOT), BEd (UOG), DipST (UPNG-GTC)
Sefo, J., MA (UOT), BEd (PAU), CertT (Balob)
Wrondimi, G., MASW (Victoria Univ. NZ), BASW (UPNG)

Senior Technical Instructor
Mitio, N., BA Hons & BA (UPNG), PGDip in Sociology (Essex)

Principal Technical Officer
Jack, E., BCom (UOT), DipCom (UOT), Cisco CCNA ICND (UOT)

Administrative Officer 2
Lero, M., BA in Public Policy & Social Development (UPNG)

Senior Secretary 2
Senginawa, A. Cert in Secretarial Studies, (Lae Tech)

Secretary
Gamong. P., Trade Cert in Bus. Studies (Lae Tech)
Postgraduate Programs

The Department offers the following postgraduate programs: Master of Communication Studies (MCS), Master of Arts in Organizational Leadership (MOAL), Postgraduate Certificate in Communication in Science and Technology (SCICOM), and Postgraduate Certificate in Student-Centred Teaching and Learning (PGCSCT).

The Department also has Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) programs in Communication and Development Studies by research.

The MCS is a two-year program consisting of coursework and a dissertation component. In the first year, candidates take eight subjects (four in each semester), and complete a thesis by research in the second year. The MAOL program, which is for three years, is offered through the Distance Mode in partnership with Development Associates International (DAI) of the USA. The participants are expected to register and enroll for required subjects which are completed via the Distance Mode. They come in for two residencies for a week in a year. The PGCCST program is offered to graduates occasionally according to perceived needs. The MPhil program is offered to suitable candidates who wish to pursue their postgraduate studies by research alone, without having to do coursework. The PhD program is offered to those who wish to pursue their studies to the highest level demonstrated by meeting set academic requirements, including a well-developed PhD research proposal.

MCS Program Details

Program Goal
To provide a high-quality postgraduate education at the Masters level to meet the manpower needs of the government departments, non-government organisations and the private sector industries in Papua New Guinea and the wider global community, particularly to the Pacific Island countries.

Program Outcomes (POs)

a) Impart to the students a broader understanding and appreciation of the various structures and dynamics of society and their connections to patterns of human behavior and individual life changes.
b) Offer various communication theories and their applications that sets forth the foundation for further analysis and research in the field of development communication.
c) Teach and equip the students with knowledge and skills to communicate socio-economic and political development issues and agendas of society.
d) Provide advanced training in writing by creating an academic environment for students to develop critical awareness of the organization, linguistic features and the production of selected academic writing genres.
e) Educate the students not only to understand the knowledge, skills and techniques in planning and carrying out independent research but also to grasp the key methods of data processing using relevant computer software programs.
f) Produce high quality dissertations reflected by skills and knowledge, originality of scholarly research, critical assessment, logical structure and scholarly discussion of findings to address research questions and problems.

Rules for Master Degree with Coursework

This program shall be offered in accordance with and within the meaning of the rules governing the University's Master Degree through the coursework and dissertation mode.

In consultation with the University Higher Degrees Committee, the Department shall, from time to time, make such adjustments where necessary, particularly in the program's course structures.

Program Structure

The candidate for the Degree of Master of Communication Studies (MCS) shall register for eight (8) units of coursework and dissertation (MCS 520) built into four (4) semesters of the two-year program. The course-structure is presented below:

<table>
<thead>
<tr>
<th>Year 1 First Semester</th>
<th>Code</th>
<th>Subject</th>
<th>Weekly Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCS 501</td>
<td></td>
<td>Communication Theories</td>
<td>4</td>
</tr>
<tr>
<td>MCS 502</td>
<td></td>
<td>Sociological Thought</td>
<td>4</td>
</tr>
<tr>
<td>MCS 503</td>
<td></td>
<td>Advanced Research Methods</td>
<td>4</td>
</tr>
<tr>
<td>MCS 504</td>
<td></td>
<td>Media Editing &amp; Reporting</td>
<td>4</td>
</tr>
<tr>
<td>MCS 520</td>
<td></td>
<td>Dissertation</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 1 Second Semester</th>
<th>Code</th>
<th>Subject</th>
<th>Weekly Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCS 505</td>
<td></td>
<td>Advanced Writing Skills</td>
<td>4</td>
</tr>
</tbody>
</table>
Department of Communication and Development Studies

MCS 506  Participatory Communication & Community Development  4
MCS 507  Sociology of Crime & Deviance  4
MCS 508  Public Relations, Advertising & Campaign  4
MCS 520  Dissertation  1

Year 2 First Semester  14
MCS 520  Dissertation  6

Year 2 Second Semester
MCS 520  Dissertation  8

TOTAL HOURS  48

Duration of the Course
Consistent with the Higher Degrees rules, the following duration of study shall apply:
A candidate shall normally have a minimum of twelve calendar months and a maximum of twenty-four calendar months. A special extension may be sought, if the student has valid reason/s for not completing his/her work. If, however, a student does not complete his/her studies without any valid reason/s, his/her studies may be terminated by the University Academic Board upon recommendation from the Higher Degrees Committee.

SUBJECT DETAILS

MCS 501: COMMUNICATION THEORIES

Hours per week: 4 (3 Lectures + 1 Tutorial)  
Credits: 15

Learning Outcomes
1. Know contemporary communication theories on Western perspectives;
2. Understand major communication theories and application in their societies;
3. Understand studies on media and society, invention of reality (mediated realities), classic studies on media effects will be discussed to expand the foundation of students to keep pace with the concept of modern media use to enrich their professional capacity;
4. Apply knowledge of theoretical aspects of relationship between mass communication and society; effects of mass media; media and violence; and needs, expectations and gratifications of media will be brought into discussions so that the students can plan further to take mass media channels as part of effective communication in future.

Syllabus
Introduction to Communication Theory:
What is Communication? What is a Theory? Theoretical scholarship, Good Vs. Bad Theories Assumptions Behind Communication Theories:
Reality, Knowledge and Values Researching Theory in Communication: Inductive vs. Deductive, Quantitative vs. Qualitative Verbal Communication Processes Nonverbal Communication Processes History of Communication Study Theories of Interpersonal Communication Theories of Group Communication Theories of Organizational Communication Theories of Mass Communication Theories of Intercultural Communication Theories of Gender Communication

References

Assessment
Examination  50%
Continuous Assessment  50%

MCS 502: SOCIOLOGICAL THOUGHT

Hours per week: 4 (3 Lectures + 1 Tutorial)  
Credits: 15

Learning Outcomes
1. Understand the roots of both classical and contemporary sociological theories;
2. Know the pioneering works of Augustine Comte, Karl Marx, Emile Durkheim, and Max Weber for their modern ideas of society;
3. Examine the major theoretical perspectives of Talcott Parsons and Robert Merton;
4. Emphasize on the relevance of theories for socio-economic and political transformation in
5. Look at how various sociological theories explain the ‘driving force’ of social change in the contemporary Papua New Guinea.

**Syllabus**

**Precursors to Sociological Theory:** Of the social contract: Jean-Jacques Rousseau; Enlightenment: Immanuel Kant; Division of labor: Adam Smith.

Development of Sociology as a Science of Society: Augustine Comte and sociology; Perspectives of sociology; Wright Mills and sociological imagination; Social science research methodology

The Sociological Theory of Karl Marx and Friedrich Engels: History and class struggle: Manifesto of the Communist Party; Capitalism and the labor process.

The Sociological Theory of Emile Durkheim: The rules of sociological method; Solidarity and modern life; The division of labor in society; Origins of collective conscience; The elementary forms of religious life; Anomie and suicide

Sociological Theory of Max Weber: Objectivity in social science; Basic sociological terms; The distribution of power within the political community; The types of legitimate domination and the ideal bureaucracy.

Structural-Functional Analysis:

Talcott Parsons: The position of sociological theory; the notion of the social system Structural components of the social system Robert Merton: On sociological theories of the middle range; Social structure and anomie

Contemporary Sociological Thought or Modern Social Theory:

Democracy: Socialism and capitalism; Modernization theory; Dependency theory: development of underdevelopment; Globalization and the global community; Social theory and social change in Papua New Guinea

**Textbook**


**References**


**Assessment**

Examination 50%
Continuous Assessment 50%

**MCS 503: ADVANCED RESEARCH METHODS**

**Hours per week:** 4 (3 Lectures + 1 Tutorial)

**Credits:** 15

**Learning Outcomes**

1. Understand research techniques and employ the qualitative and quantitative methods;
2. Write research proposals;
3. Apply theoretical perspectives by interpreting social reality in order to enhance participation in research;
4. Undertake independent research using various methods and styles of research;
5. Chose topics, gather, analyze, interpret and report data;
6. Learn the techniques in planning and carrying out research, competently design questionnaires and understand the key methods of data processing and analysis;
7. Understand ethical issues in conducting research.

**Syllabus**

The Nature of Inquiry: The search for truth; Two conceptions of social reality; Strengths and criticisms of positivist and interpretive paradigms; The assumptions and nature of science.

Research proposal: Elements of research proposal; Problem or Objective; Literature Review; Subjects for study; Measurement; Data Collection methods; Analysis; Schedule, and Budget.

Aspects of Research: The tools of science; The
scientific method; Research and evaluation; Research, politics and policy-making and Characteristics of good research, validity and reliability issue
The Ethics of Social Research: Informed consent; Access and acceptance; Ethics of social research; Sources of tension; Voices of experience; Ethical dilemmas; Privacy and anonymity; Confidentiality; Betrayal and deception and Research and regulation
The Research Process: The problem identification; Data collection and analysis; Data interpretation and reporting and Actioning research findings
Data Preparation and Analysis: Data summary and summary sheet; Tabulation and graphs; Computer software and Correlational statistics (univariate, bivariate, multivariate, and others).
Quantitative Research Methods: The survey style; The experimental style; Correlational style and Content analysis
Qualitative Research Methods: The case study style; Observation (non-participant and participant); Ethnographic and anthropological style; Historical analysis and Action research

References
Guthrie, G. (ed), (1984), Basic Research Techniques, University of Papua New Guinea, Port Moresby: Education Research Unit.

Assessment
Examination 50%
Continuous Assessment 50%

MCS 504: MEDIA EDITING AND REPORTING

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes
1. Understand the skills and techniques of editing and reporting for media communication under the rubric of citizens’ journalism, crisis journalism and journalism as a factor of national development;
2. Develop practical skills of reading and producing media content in various forms;
3. Use editing and reporting tools in print and electronic media as appropriate;
4. Provide students a broad range of writing and production procedures in the print sector, broadcasting and electronic media, such as radio production, journalism and information technology;
5. Deal with media editing and reporting across a broad range of professional domains, including government, corporate and NGO sectors, in which communication skills and knowledge of media platforms could be obtained.

Syllabus
Media reporting: Under the three models considering both “Hard News” and its structure; “Soft News” and its structure; Report seminars, workshops, meetings, speeches, Parliament proceedings, etc.; Reporting social, economic, political and cultural events for print and electronic media.
Newsroom and news copy: Editing copies; re-writing copies; headline writing; photo editing; caption writing; Editing and page design processes for broadsheet and tabloid newspaper: obtaining balance, harmony, unity and coherence in media outputs.
Critical analysis of the settings of journalism practices in the “post-journalist” age: print and video processes and practices in citizen media (blogs, etc.). crisis journalism and changing journalism practices in developing countries.

References

Assessment
Examination 50%
Continuous Assessment 50%
### MCS 505: ADVANCED WRITING SKILLS

**Hours per week:** 4 (3 Lectures + 1 Tutorial)
**Credits:** 15

**Learning Outcomes**
1. Develop critical awareness of the linguistic features and academic writing genres;
2. Emphasize accurate production of text types of writing and outcomes-based approaches to achieve this goal;
3. Know theoretical foundations of the writing process relating to the theory that informs writing practices;
4. Produce grammatically accurate written products and apply the principles of genre analysis in writing;
5. Produce texts that show higher degree of linguistic complexity and use and use appropriate language and style in writing.

**Syllabus**
- Writing and learning;
- The writing process: pre-writing and actual writing phases; developing a voice in writing
- Academic writing: process and product viewpoints
- Trends in writing instruction. On the use of models in writing instruction
- Writer-oriented vs. Reader-oriented writing
- Language and style: coherence, fragments vs. complete sentences, subordination, dangling modification, sentence variation, faulty parallelism, wordy phrases and expressions, obscure words, sexist language, etc.
- Argumentation: claims, arguments, support, counterarguments, refutation.
- Substantiation: use of sources, citations, status of claims, the concept of face, politeness strategies
- Discourse Elements: signposting, topic development, cohesion, grammatical choices, lexis.
- Approach to genre analysis: Linguistics and genre analysis; Sociology and genre analysis, cross-cultural factors in genre analysis
- Language description of written products, direction words in writing
- Editing: grammatical forms, spelling, punctuation, redundancies, capitalization, etc.
- Research genres in academic settings: research article abstracts, research article introductions, etc.
- Genre analysis in action: job application letters, newspaper editorials, project proposals,
  assignments and term papers, etc.

**References**

**Assessment**
- Examination 50%
- Continuous Assessment 50%

### MCS 506: PARTICIPATORY COMMUNICATION AND COMMUNITY DEVELOPMENT

**Hours per week:** 4 (3 Lectures + 1 Tutorial)
**Credits:** 15

**Learning Outcomes**
1. Know theoretical perspectives of participatory communication and community development and establish the role of communication and participation in community;
2. Apply principles of adult learning theories relevant to participatory development communication approaches emphasising dialogue across disciplines as central to development;
3. Make efforts to design communication strategies using action research for sharing of knowledge and for enhancing community empowerment.

**Syllabus**
- Review of modernization theory in relation to development communication focusing on rural peoples’ knowledge, participation and empowerment. Discussions will be on concepts such as development communication, development, participation and action-research. Role of various stakeholders will also be defined in using
communication to facilitate community participation within specified contexts.

Explore how the concept of adult learning can be applied to enable people to discuss developmental issues and to strengthen decision making at the community level. Participants of this course will draw from experiential learning, social learning and community learning theories to facilitate dialogue in transdisciplinary teams to build capacity of communities to use communication and other essential services to improve their own livelihoods.

Introduce approaches for planning communication strategies and to facilitate the active involvement of different groups in the local community, to collectively identify problem situations and the potential and seek potential solutions. The process involves critical analysis of the community livelihood issues followed by planning, implementing, monitoring and evaluating and sharing and using of information derived from the communication program. Discuss some communication tools within the participatory approaches for multi-stakeholder learning to enable changes in the local community.

References

Assessment
Examination 50%
Continuous Assessment 50%

MCS 507: SOCIOLOGY OF CRIME AND DEVIANCE

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes
1. Know classical and contemporary criminological theories;
2. Understand the major contributions of sociologists and criminologists, who explained various aspects of crime in society;
3. Enrich students’ understanding of how these crime theories explain the criminal activities that occur in the world;
4. See how the media influences crime especially through the television and movie industries;
5. Examine the social and economic costs of crime and assess how the criminal justice system attempts to prevent criminal activities;
6. Understand the state responses to crime in different societies and alternative strategies aimed at preventing the occurrences of crime in the society;
7. Assess how criminal justice system is organized to prevent crime;
8. critically analyse current crime policy approaches and suggest constructive alternatives.

Syllabus
Classical and Neo-Classical Theories: the classical school; new-classical school; positivist school
Individual Theories Crime: biological and psychological approaches
The Sociological Theory Theories of Crime: social Disorganization; sub-culture; social control; situational; labelling; and radical.
Modernization and Crime: organic solidarity; mechanical Solidarity; colonialism; westemism; rural-urban migration; urbanization; and squatter settlements.
Crime and the Criminal Justice System: police; courts; and prison systems
Approaches to the study of mass communication effects
Impact of television advertising
Impact of mass media on social issues like crime,
violence, crisis and social disorder
White collar crime, violent crime and transnational crime
Children’s learning from mass media
Media Reporting of Crime
Capital punishment
State Responses and Crime Alternatives

References

Assessment
Examination 50%
Continuous Assessment 50%

MCS 508: PUBLIC RELATIONS, ADVERTISING AND CAMPAIGN

Hours per week: 4 (3 Lectures + 1 Tutorial)
Credits: 15

Learning Outcomes
1. Grasp important themes of communications as public relations, advertising and campaigns;
2. Work professionally in business organizations, media houses, government and non-government offices and community relations departments;
3. Practice the art of public relations (PR) activities and foster an understanding of PR ethics;
4. Undertake case studies in PR and advertising through the lens of the strategic communications planning matrix;
5. Know the history of advertising and PR in print and electronic media;
6. Know the role of politics in communities and how it affects PR campaigns.

Syllabus
Theories and practical aspects of public relations; Building image and goodwill of organizations; Managing internal and external public(s) of organizations; Public opinion and persuasion; Looking at crisis management as PR personnel; Public Relations ethics; Studying cases of public relations and community relations problems; Preparing press releases, brochures, folders, media kits and campaign materials.
The course will take the students through the Strategic Communications Planning Matrix as designed by Wilson and Ogden, and have them also analyze case studies of successful and unsuccessful PR campaigns via the model. Relevant analysis of individual theoretical and applied studies from the literature will also be employed.
Students will finally learn to apply these PR insights into the political context of nation and communities.

References

Assessment
Examination 50%
Continuous Assessment 50%

MCS 520 DISSERTATION

Hours per week: (1 hour first semester, first year) + (1 hour second semester first year) + (6 hours first semester second year) +8 hours second semester second year) = 16 hours
Total Hours 16: (0 Lecture + 16 tutorial)
### Credits: 36

#### Learning Outcomes
1. Produce a high quality dissertation paper based on original research;
2. Address research problems and questions considering the relevant subject-matter of the research dealt with;
3. Discuss and declare the originality of scholarly research, critical assessment, logical structure and research findings;
4. Build a clear argument on the major objectives of the dissertation in a logical and consistent manner through orderly progression of work.

#### Instructions
The students will be supervised by department approved faculty and to complete within the stipulated time and submit a dissertation for the partial fulfillment of a Master of Communication Studies (MCS). They will select topic, finalize methodology and complete literature review in the first semester to present them at a seminar. The remaining part of the research such as data collection, analysis, and writing should be completed and presented at a seminar and submit the dissertation at the end of the second semester of second year.

The candidate will be provided with specific instructions on dissertation style, methods, techniques, contents, volume and other details to support him/her in writing the dissertation.

#### References

### Assessment
Satisfactory or Unsatisfactory

#### MASTER OF ARTS IN ORGANISATIONAL LEADERSHIP (MAOL)

##### Program Mode: Distance Education (Blended Learning)

##### Program Goal
To provide high quality postgraduate education at the Masters level to significantly enhance the effectiveness and integrity of Christian leaders in various institutions and organizations in order to maximize the quality, relevance and value of the products and services they deliver. Additionally, to provide an educational experience which results in a qualitative change in the leader’s life, relationships, and leadership practices.

##### Program Outcomes
This program prepares candidates to create and lead transformative organizations that improve the well-being of all stakeholders in terms of Kingdom values by means of a cohort-based Christian education that emphasizes:

a. Value-based leadership competencies required for envisioning and leading performance-oriented organizations;

b. Team-oriented managerial competencies that create well-run systems to serve the organization mission and the well-being of all stakeholders;

c. The professionalism of the leader/manager through enhanced mission competence, commitment, and vision as well as problem solving abilities;

d. A worldview and understanding that is grounded in biblical foundation for critical reflection, ethical integrity, thoughtful integration and personal spiritual growth and character development of the leader in Christian discipleship and maturity;

e. An interactive forum in which curricula matters are focused on understanding one’s organization and context so as to be able to apply what is learned to one’s current work setting; and

f. A social network of peers and mentor supporting the leader in the task of developing
the skill and wisdom essential for navigating the sometimes chaotic and confusing environment of their world.

**Program Partners**

This program is initially the proposal of four partnering institutions/organizations, and these are:

a. The Papua New Guinea University of Technology (PNG Unitech)

b. Development Associates International (DAI)

c. The Christian Leadership Training College of Papua New Guinea (CLTC)

In partnership with DAI, CLTC and Pioneers of Australia, the program is expected to be offered through the PNG University Technology housed by the Department of Communication and Development Studies.

**Program Delivery Method**

Today there are a wide range of different distance learning models; from paper based correspondence courses to completely online web-based e-learning. This program is somewhere in between. This program is usually called hybrid or blended learning.

The candidates will complete the program based on a cohort learning model. That is a group of participants who stay together throughout a degree program. The cohort model brings students together in a collaborative, team-focused learning experience, with the goal of developing a learning community. This model encourages participants to draw upon both their peers and instructors for support. The program will be delivered as follows:

a. Participants will come together for a residency 2 times per year for a total of two weeks (one week each residency)

b. All courses are completed via the appropriate distance education curricular formats. These methods will incorporate course workbook, readers and other additional materials.

c. Dialogue with course teachers, supervisors and students will be by a variety of means including face to face meetings, e-mail, telephone and fax according to the location of participants and institutions.

d. Institution mentors are responsible for coaching and facilitating the dialogue with their cohort group, both individually and collectively, during this specific course period.

e. Participants have practical projects where they have to apply what they are learning to their current leadership role, as well as teach it to others and complete written assignments and course papers.

f. The participants should be able to produce a high quality dissertation reflected by his technical competence, originality of scholarly research, critical assessment, logical structure and scholarly discussion of findings to address research questions and problems. The dissertation must be a coherently organized sequence of chapters that should show clear headings and sub-headings. In all, the object of the dissertation is to build a clear argument in a logical and orderly progression.

**Program Coordination**

CLTC will assist UNITECH to provide the program coordination which includes:

a. Marketing and Communication

b. UNITECH will provide the teaching location in Lae.

c. CLTC will provide the teaching location in Port Moresby.

d. UNITECH will arrange collection of tuition, accounting and distribution of those funds to partners.

**Rules Governing this Program**

This program shall be offered in accordance with and within the meaning of the rules governing the University’s Master Degree program.

In consultation with the stakeholder partners (PNG Unitech, DAI and CLTC) the CDS Department shall, from time to time, make such adjustments where necessary particularly in the program’s course structures.

**Exams and Marking**

Assessment of the students will be based on 60% continuous assessment and 40% examination administered in each semester.

The current grading system used by PNG UNITECH will be applied for processing the marks and grades. The CDS Department will submit the marks and grades for record keeping purposes.
Quality Assurance Strategy
The program shall be reviewed after its first academic year, and thereafter three years, to assess its relevance, suitability and quality. The CDS Department with its partners shall form the review committee. In the review processes, other stakeholders from government and industries shall be consulted as a means of wider community participation in the program.

Admission to Candidature
In accordance with the Unitech’s rules governing the Master program, an application for admission to candidature in this program shall have:

a. A Postgraduate Diploma of the University or of a tertiary institution approved by the Higher Degrees Committee; or
b. A Bachelors Degree of the University or of a tertiary institution approved by the Higher Degrees Committee in any field of study; or

In all a and b above, the candidate must have the potential to provide significant leadership in their organizations or communities.

An application for admission into candidature for the degree of MAOL shall be approved by the Higher Degrees Committee only on the recommendation of the Head of Department in consultation with its program partners.

Duration of the Course
Consistent with the Higher Degrees rules, the following duration of study shall apply:
The candidate shall have 36 calendar months (3 years) for this program. A special extension may be sought, if the student has valid reason/s for not completing his/her work. If, however, a student does not complete his/her studies without any valid reason/s, his/her studies may be terminated by the University Academic Board upon recommendation from the High Degrees Committee in consultation with CDS Department and its partners.

Course Structure & Delivery
The candidate for the Degree of Master of Arts in Organization Leadership (MAOL) shall register for 11 (eleven) courses and a dissertation component in 3 years, of which 3 courses will be taken in the third year from 6 (six) optional courses. The matrix below indicates the course-structure.

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject Details</th>
<th>Average Weekly Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 First Semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOL511 Leadership: Making Human Strength Productive</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>MOL512 Teaching and Learning for Impact</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Year 1 Second Semester
MOL513 Strategic Thinking 4
MOL514 Women in Leadership 4

Year 2 First Semesters
MOL521 Integrity and Financial Management 4
MOL522 Research Methodology 4

Year 2 Second Semester
MOL523 Spiritual Formation 4
MOL524 Conflict Management and Resolution 4

Three subjects to be taken from optional subjects in year 3 during semester 1 and 2, and dissertation is obligatory.

Year 3 First Semesters
MOL531 Ethics for Decision Making 4
MOL532 Development and Social Change 4
MOL533 Mentoring 4

Year 3 Second Semester
MOL534 Culture, Ethnicity and Diversity 4
MOL535 Fundraising 4
MOL536 Partnership 4
MOL611 Dissertation 8

TOTAL HOURS 52

SUBJECT DETAILS

MOL 511: LEADERSHIP – MAKING HUMAN STRENGTH PRODUCTIVE

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15
### Learning Outcomes

1. Investigate and critique the traditional perception of leadership in the participant's context.
2. Develop a comprehensive understanding of servant-hood in the theological and historical context of Jesus.
3. Evaluate the applied foundational principles of servant-hood in a range of core issues related to leadership in an organization.
4. Assess analytically the application of leading as a servant to the present context of the participant's leadership role.

### Syllabus

<table>
<thead>
<tr>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1: Can I Be a Leader?</td>
</tr>
<tr>
<td>Unit 2: Leader - Know Yourself</td>
</tr>
<tr>
<td>Unit 3: Power</td>
</tr>
<tr>
<td>Unit 4: Leading Change</td>
</tr>
<tr>
<td>Unit 5: Setting Vision</td>
</tr>
<tr>
<td>Unit 6: The Right Person for the Right Job</td>
</tr>
<tr>
<td>Unit 7: Motivating Individual Excellence and Fulfillment</td>
</tr>
<tr>
<td>Unit 8: Developing Others</td>
</tr>
<tr>
<td>Unit 9: Team Building</td>
</tr>
<tr>
<td>Unit 10: Organizational Accountability</td>
</tr>
</tbody>
</table>

### References

- Engel, J. F., "Clarification of Mission".
- Foster, R J., “Destructive Power” from *Money, Sex & Power*.
- Henderson, D., *Through the Dust*, Chapter 1
- Hayes, E., “Effective Boardmanship”.

### Assessment

- Examination: 40%
- Continuous Assessment: 60%

### MOL 512: TEACHING AND LEARNING FOR IMPACT

- Hours per week: 4 (3 Lectures + 1 tutorial)
- Credits: 15

### Learning Outcomes

1. Examine what can be learnt about teaching methods of Jesus and describe how they can be applied in facilitating learning.
2. Identify the five key factors that trigger learning and describe how a facilitator can help learners address each factor.
3. Examine the importance of selecting learning outcomes in the learning process, and describe how to express and evaluate them.
4. Evaluate a variety of different methods of facilitating learning and indicate when it is appropriate to use a particular method.
5. Explore a variety of different settings for learning environment and decide on an appropriate approach for selected learning outcomes.
6. Plan, prepare and facilitate a learning experience for a minimal group of learners.

### Syllabus

<table>
<thead>
<tr>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1: Introducing Teaching and Learning</td>
</tr>
<tr>
<td>Unit 2: What we know about adult learners</td>
</tr>
<tr>
<td>Unit 3: Understanding Learning Styles</td>
</tr>
<tr>
<td>Unit 4: Factors underpinning Effective Learning</td>
</tr>
<tr>
<td>Unit 5: Facilitating Effective Learning</td>
</tr>
<tr>
<td>Unit 6: Communication and Learning Methods</td>
</tr>
<tr>
<td>Unit 7: Designing and Delivering Learning</td>
</tr>
<tr>
<td>Unit 8: Listening and Asking Questions</td>
</tr>
<tr>
<td>Unit 9: Learning through Feedback</td>
</tr>
<tr>
<td>Unit 10: Evaluating Learning</td>
</tr>
</tbody>
</table>

### References


### Assessment

- Examination: 40%
- Continuous Assessment: 60%

### MOL 513: STRATEGIC THINKING

- Hours per week: 4 (3 Lectures + 1 tutorial)
- Credits: 15

### Learning Outcomes

1. Analyze the roots of management and strategic thinking that lie within Scriptures.
2. Develop positive attitude towards strategic thinking as a God-led process, seeing ministry and work as a base upon partnership between God and decision making.
3. Outline, critique, and explain various elements of strategic thinking process.
4. Construct strategic statements for an organization using learned steps and process.
5. Evaluate personal approaches to strategic thinking, focusing on areas needed insights, to enable change in patterns of engaging in work or ministry.

Syllabus
Unit 1: What Strategic Thinking is All About
Unit 2: Mission, Vision and Purpose
Unit 3: Research the Situation
Unit 4: What Resources Do We Have?
Unit 5: Strategy and Action
Unit 6: Evaluation

References
Dayton, E. and Fraser, D., Planning Strategies for World Evangelization, “Perspectives,” “Assumptions”
Engel, J., “Doing the Right Things to Extend
Engel, J., “Clarification of Mission”
Engel, J., “The Spiritual Decision Process”
Engel, J., “Audience Receptivity”
Engel, J., “Using Survey Research to Help Understand Your Target Audience”
Rickett, D., “Seven Mistakes Partners Make and How to Avoid Them”
Engel, J. and Dyrness, W., “A Preoccupation with Numerical Success”
Plueddemann, J., “Measurable Objectives, No! Faith Goals, Yes!”
Engel, J. and Morey, J., “Impact Evaluation of the Jesus Film Project: Executive Summary”

Assessment
Examination 40%
Continuous Assessment 60%

MOL 514: WOMEN IN LEADERSHIP & GENDER ISSUES

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes
1. Explore and be familiar with the assumptions about what the Bible says about women.

2. Study the importance of authority of scripture, and discover some of the challenges of interpreting it.
3. Review and be acquainted with that changing one’s beliefs can be biblical.
4. Analyze and understand the importance of studying biblical roles of women.

Syllabus
Unit 1: Choosing the Better Part
Unit 2: God’s Perfect Plan for Relating and Working Together
Unit 3: God’s Perfect Plan for Us to Rule His Garden
Unit 4: Tragedy and Redemption
Unit 5: How Do We Interpret God’s Word for Today?
Unit 6: First Timothy
Unit 7: First Corinthians 7, 11 and 14
Unit 8: Ephesians 5
Unit 9: How Do I Choose the Better Part?

References
Cunningham, L. and Hamilton, D., Why Not Women? Chapters 1, 12, 16, 17
Articles found at www.cbeinternational.org
Giles, K., “The Doctrine of the Trinity and Subordination”
Bilezikian, G., Beyond Sex Roles, Chapter 1, God’s Creation Design
The Place of Women in the 21st Century—Reports from around the world
Gill, D., God’s Women Then and Now, Chapters 6, 9 and 10
Fee, G. & Stuart, D., How to Read the Bible for All It’s Worth, Second Ed., A Guide to Understanding the Bible Chapter 1: Introduction: The Need to Interpret
Tucker, R., Women in the Maze: Questions & Answer on Biblical Equality, Chapters 20-23

Assessment
Examination 40%
Continuous Assessment 60%
MOL 521: INTEGRITY & FINANCIAL MANAGEMENT

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes
1. Articulate the need for integrity in society and the life of Christian organizations.
2. Define integrity and show how it is relevant to many contexts of life, including finances.
3. Describe how one can develop a character of integrity that is biblically based.
4. Investigate and discuss the enemies of integrity and explain how to avoid them.
5. Create a basic budget and interpret it.
6. Analyze and interpret the meanings of basic financial spreadsheets and financial ratios.

Syllabus
Unit 1: The Importance and Meaning of Integrity
Unit 2: Values: The Foundation of Integrity
Unit 3: Conscience: The Inner Compass to Keep us on the Track of Integrity
Unit 4: Personal Accountability
Unit 5: Motivation and Rewards for Integrity
Unit 6: Leading with Integrity
Unit 7: Money and Stewardship
Unit 8: Debt and Contentment
Unit 9: Financial Policies, Procedures and Statements
Unit 10: Financial Planning and Budgeting

References
Freeman, J., 1989. Living with your conscience without going crazy.
Josephson Institute for Ethics, The Six Pillars of Character: http://www.josephsoninstitute.org/MED/MED-6pillars.htm
Center for Character Development: http://www.charactercenter.com
The Content of our Character Project: http://www.contentofourcharacter.org/toolkit.html
Verhey, A., Remembering Jesus, Erdmans 2002
Leading with Integrity: http://www.teal.org.uk/dl/integrity.htm

Assessment
Examination 40%
Continuous Assessment 60%

MOL 522: RESEARCH METHODOLOGY

Hours per week: 4 (3 Lectures + 1 tutorial)
Credits: 15

Learning Outcomes
1. Explore the value and components of empirical, field research.
2. Demonstrate the basic skills of field research by writing a mini-project involving all elements of a research process.
3. Research and produce a final Master's thesis project.

Syllabus
Unit 1: Starting Where You Are
Unit 2: Selecting and Clarifying the Concern Behind Your Thesis
Unit 3: Selecting a Focus for Your Mini-Project
Unit 4: Evaluating other People's Research
Unit 5: Designing Your Strategy
Unit 6: Drafting, Refining and Testing Your Field Questions
Unit 7: Doing Your Field Research
Unit 8: Writing Your Mini-Project Research Report
Unit 9: Writing Your “So What” Document
Unit 10: Building from Your Mini-Project to Your Full Thesis
Unit 11: Ending Where You Want to Be: as a Different Kind of Leader

References
• Nussbaum, S., Breakthrough! Steps to Research and Resolve the Mysteries in Your Ministry (GMI, 2007)
• Sogaard, V., Research in Church and Mission (William Carey Library, 1996)
• Robson, C., Real World Research, 2nd Edition (Blackwell, 2002)

Assessment
Examination 40%
Continuous Assessment 60%
### MOL 523: SPIRITUAL FORMATION

**Hours per week:** 4 (3 Lectures + 1 tutorial)  
**Credits:** 15

**Learning Outcomes**

1. Explore the nature and depth of longing for God, and a healthy life in Christ.
2. Discover the complexity of reasons Christians experience “mid-life crisis” in their spiritual lives.
3. Examine range of God’s provisions which links to spiritual giftedness, vocation and spiritual disciplines, and describe them as hard work and as an expression of God’s grace.
4. Diagnose weaknesses and habitual patterns of sin; discern good and bad habits as well as true from false forgiveness and examine their spiritual health and plan for regular discipline.
5. Identify the God’s call to discipleship and describe activities that, if done regularly, would make significant differences in spiritual and vocational life of continued development and change.
6. Identify the wholeness of life and describe how God takes the lost through suffering to new levels of engagement with Himself and the business of His Kingdom

**Syllabus**  
(With associated spiritual discipline)  
Unit 1: Thirsty for God: Restoring our Passion for God (Solitude and Silence)  
Unit 2: Images of Spiritual Formation: What's the Goal of Life in Christ? (Study)  
Unit 3: The ABCs of Spiritual Formation: Reviewing the Foundation (Prayer)  
Unit 4: Obstacles: Why Aren't We Making It All the Way? (Fasting)  
Unit 5: Spirituality: What It Is and What It Isn't (Service)  
Unit 6: The Spiritual Aspects of the Disciplines (Meditation)  
Unit 7: The Hard Work of Spirituality (Submission)  
Unit 8: Person, Place and Provision (Celebration)  
Unit 9: The Cardinal Sins: Radical Solutions for Radical Sins (Simplicity)  
Unit 10: Forgiveness and Reconciliation: Remedies for Individuals and Communities (Confession)  
Unit 11: The Life of Integrity: Discernment, Steadfastness and Forthrightness (Guidance)

### Unit 12: Adversity and Crisis: Getting Ready (A week without Disciplines)  
Unit 13: Getting Ready for the Rest of Life (Worship)

**References**  
Foster, R. and Smith, J.B., Devotional Classics: Selected Readings for Individuals and Groups, Revised and Expanded (Harper San Francisco, 2005)

**Assessment**  
Examination: 40%  
Continuous Assessment: 60%

### MOL 524: CONFLICT MANAGEMENT & RESOLUTION

**Hours per week:** 4 (3 Lectures + 1 tutorial)  
**Credits:** 15

**Learning Outcomes**

1. Describe problems and potentials in managing and resolving conflict in the context of ministry and organizational leadership.
2. Examine case studies as examples for evaluation and learning how to deal with conflict through actual events and histories that demonstrate the models used in the course.
3. Examine Biblical texts for the purpose of managing conflicts and working towards resolution of issues from Biblical perspectives.
4. Discover the significances of understanding human cultures in conflict management.

**Syllabus**

Unit 1: How Should Christian Leaders Think about Conflict?  
Unit 2: What Obstacles do Christian Leaders Face in Handling Conflict?  
Unit 4: How Do Christian Leaders deal with Conflict?  
Unit 5: How do Christian Leaders Manage Socio-political Conflict?  
Unit 6: The Incarnation: The Supreme Model for Conflict Management & Resolution
**Textbooks**

**References**

**Assessment**
- Examination 40%
- Continuous Assessment 60%

**MOL 531: ETHICS FOR DECISION MAKING**

**Hours per week:** 4 (3 Lectures + 1 tutorial)

**Credits:** 15

**Learning Outcomes**
1. Identify how Christian world-view influences ethical life and leadership, and examine the relationships of ethics to the Christian life.
2. Evaluate authoritative sources of ethical norms used by Jesus and Apostle Paul, and critique His teachings about exercising authority in ministry of Christian leaders.
3. Examine works of the Holy Spirit which enables us to live and lead ethically, and look at examples of ways in which African, Islamic, secularist/postmodern world-views influence moral behavior.
4. Analyze ethical decisions of biblical characters, and describe what it means to manage one-self and state why this is important.

5. Recognize ethical issues; work with ethical decision-making process tools designed to assist in positive moral action by Christians to live according to the gospel.
6. Explore ways in which conformity to the expectations of culture and submission to the authority of the State may create tensions with commitments to obey God.

**Syllabus**
- Unit 1: How do ethics fit into the Christian life? (The significance of Christian ethics)
- Unit 2: Where do we find dependable ethical guidance? (The role and moral impact of divine revelation)
- Unit 3: What is the central challenge of Christian ethics? (How we treat other people)
- Unit 4: How do we live ethically in our relationships? (Loving others according to the pattern of Jesus)
- Unit 5: What is critical to the ethics of leadership? (It starts with managing ourselves)
- Unit 6: How do we make ethical decisions? (A process for ethical decision making)

**References**

**Assessment**
- Examination 40%
- Continuous Assessment 60%

**MOL 532: DEVELOPMENT AND SOCIAL CHANGE**

**Hours per week:** 4 (3 Lectures + 1 tutorial)

**Credits:** 15

**Learning Outcomes**
1. Discover God’s concerns for poor and oppressed, for the entire creation, and describe how it impacts how we live and what we do.
2. Search and explain how scripture records about Jesus and his disciples acted upon his mission and ways in which churches through the centuries have been faithful to the mission of Jesus.
3. Identify how local churches in student’s context can respond to issues regarding
### Syllabus

<table>
<thead>
<tr>
<th>Unit 1: An Introduction to Development and Social Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 2: A Theology for Christian Activism: Part 1</td>
</tr>
<tr>
<td>Unit 3: A Theology for Christian Activism: Part 2</td>
</tr>
<tr>
<td>Unit 4: In the Footsteps of Christ-God’s Mandate to the Church: Part 1</td>
</tr>
<tr>
<td>Unit 5: In the Footsteps of Christ-God’s Mandate to the Church: Part 2</td>
</tr>
<tr>
<td>Unit 6: In the Footsteps of Christ-God’s Mandate to the Church: Part 3</td>
</tr>
<tr>
<td>Unit 7: Transformation - A Kingdom Agenda for Development and Social Change</td>
</tr>
<tr>
<td>Unit 8: Transformation – Part 1 Principles for Community Transformation</td>
</tr>
<tr>
<td>Unit 9: Transformation – Part 2 From Kingdom Theory to Kingdom Practice</td>
</tr>
</tbody>
</table>

### Reference


In addition to the texts indicated above, several key articles were obtained from the following internet sites:
- Association of Evangelical Relief and Development Organizations (AERDO). http://www.aerdo.org

### Assessment

<table>
<thead>
<tr>
<th>Examination</th>
<th>40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment</td>
<td>60%</td>
</tr>
</tbody>
</table>

### MOL 533: MENTORING & COACHING

**Hours per week:** 4 (3 Lectures + 1 tutorial)

**Credits:** 15

### Learning Outcomes

1. Define the word ‘mentoring’, and explore Biblical models of mentoring, in both Old and New Testament.
2. Describe what makes a mentoring relationship effective or ineffective, and articulate the different roles that a mentor can play.
3. Assess the values of mentoring, identify a range of strategies including storytelling, and write a development plan for mentoring.
4. Define the expectations in a mentoring relationship, identify the strengths and personal...
style of mentoring, and expand mentoring skills through empathetic listening, giving and receiving feedback.
5. Expound the differences between mentoring and coaching, and identify different models used in coaching.
6. Critique and identify appropriate forms or techniques for coaching, plan and describe how to choose the right coach and evaluate it.

**Syllabus**

| Unit 1: Introduction and Case Study – Mama Mary |
| Unit 2: Mentoring Basics and Examples |
| Unit 3: Mentoring Roles and Competencies |
| Unit 4: Your Story as an Effective Mentoring Tool |
| Unit 5: Mentoring Skills |
| Unit 6: Mentoring Relationships |
| Unit 7: Tools for Mentoring and Coaching |
| Unit 8: Leadership Coaching: Introduction |
| Unit 9: Leadership Coaching: Frameworks and Outcomes |
| Unit 10: Leadership Coaching: Different Types of Coaching |

**Appendix - Developing and Implementing a Mentoring Program**

**References**

- Mallison, J., Mentoring to Develop Disciples and Leaders, 1998 (Openbook)
- Stanley, J. & Clinton, P., Connecting, 1992 (Navpress)

**Assessment**

| Examination | 40% |
| Continuous Assessment | 60% |

**MOL 534: CULTURE, ETHNICITY AND DIVERSITY**

**Hours per week:** 4 (3 Lectures + 1 tutorial)
**Credits:** 15

**Learning Outcomes**

1. Distinguish and describe complex issues related to culture and ethnic identity – issues of history, sociology, and more.
2. Define technical terms like ethnicity, ethnocentrism, culture, and more which are used throughout this course.
3. Review and evaluate tragedies in recent history that have been influenced by ethnicity and diversity, esp. that of intolerance of people who are different, “the Other.”
4. Prepare to enter the process of asking where diversity-training fits in training of others in Christian leadership as well as in their lifestyle and obedience to Jesus’ Great Commission

**Syllabus**

| Unit 1: Course Introduction |
| Unit 2: Creation and Fall |
| Unit 3: And God Created Diversity |
| Unit 4: Aliens and Strangers |
| Unit 5: Blessed to Bless All Nations |
| Unit 6: What Do We Do With the Past? |
| Unit 7: Reaching Out to the “Other” |
| Unit 8: The Church After Pentecost |
| Unit 9: A Church For All Peoples |
| Unit 10: Forgiveness and Reconciliation |
| Unit 11: One New Humanity |
| Unit 12: Culture, Ethnicity, and Diversity in the Future |
| Unit 13: Intentionality |

**References**

- Contained in the Module Units (Partial listing)
- U.N. Universal Declaration of Human Rights
- The Willowbank Report: Consultation on Gospel and Culture (Copyright © 1978, LCWE)
- Color-Blinded: Why 11 o'clock Sunday morning is still a mostly segregated hour. (An excerpt from Divided by Faith by Michael O. Emerson and Christian Smith)
- Case Study #1: Christian Witness and Reconciliation Initiatives in Burundi
- Case Study #2: Forgiveness in Bethlehem: A Personal Experience
- Case Study #3: Israel/Palestine, Reconciliation Between Women
- Case Study #4: The Treatment of Australian Aborigines and the Church's Role in Reconciliation
- Case Study #5: Intercession and Conflict Transformation in the Democratic Republic of Congo
Case Study #6: Nyack College, USA: Building a Multi-Ethnic Campus
Case Study #7: Kosovo, Witness, and the Orthodox Church
Reconciliation as the Mission of God

**Assessment**
Examination 40%
Continuous Assessment 60%

**MOL 535: FUNDRAISING**

**Hours per week:** 4 (3 Lectures + 1 tutorial)
**Credits:** 15

**Learning Outcomes**
1. Explore God’s perspective on fundraising by identifying scriptural models and Paul’s models of fundraising as providing biblical principles for fundraising, and describe how leadership impacts such fundraising models.
2. Understand the importance of communication in fundraising process, and identify the fundamentals of communication process that enables relationship building and communicate directly and simply in fund raising.
3. Explore how fundraising works in a local culture and knowhow to begin, and state ways to invite and involve local churches and others to participate in such ministry, and see how to write a case statement for the ministry.
4. Study the biblical basis for personal support-raising and point out its benefits, and describe how personal support raising flows out of relationships and learn how to cultivate personal supporters through communication.
5. Investigate what Western Charitable Foundations expect from those requesting funds from them and find out why they say “no” or “yes”, review the basic components of writing a proposal, and craft a proposal to fit their interests and instructions.
6. Reflect on how cultural differences impact relationships in giving and receiving, and appreciate the role business play in the Kingdom of God, and describe new trends to transform societies and nations through business

**Syllabus**
Unit 1: Kingdom Foundations
Unit 2: Leadership in Fund Raising

Unit 3: Communication in Fund Raising
Unit 4: Strategy and Planning
Unit 5: Beginning Closest to Home
Unit 6: Personal Support Raising
Unit 7: Understanding the Western Donor
Unit 8: Proposal Writing
Unit 9: Business as Mission

**References**
Nouwen, H., *The Spirituality of Fund-Raising, Fundraising as Ministry*
Haynie, R., “The Road Less Traveled in Fundraising”
Engel, J., “Your Style in Working With Others”
Downes, D. and Awuku, A., “Funding the African Missionary Movement: Fulfilling the Dream”
Ezemadu, R., Sending and Supporting African Missionaries in the 21st Century: Chs. 3, 4, 5, 6, 9, 10.
Oginga, J., “Raising Missionary / Church Worker Support in Africa”, from The Church Leader in Africa, 2nd Quarter 2005
www.parkerfoundation.org
www.firstfruit.org
Tunehag, M., *Business as Mission: Holistic Transformation of People & Societies*
“The Essentials of Good Business as Mission, 10 Guiding Principles” (an extract of Lausanne Occasional Paper on Business as Mission)

**Assessment**
Examination 40%
Continuous Assessment 60%

**MOL 536: PARTNERSHIPS**

**Hours per week:** 4(3 Lectures + 1 tutorial)
**Credits:** 15

**Learning Outcomes**
1. Critique the argument that working together is a biblical imperative, describe and outline the different stages of partnerships.
2. Evaluate and explain the differences between a simple and a complex partnership; and
horizontal and vertical partnerships, and give examples of both.

3. Evaluate and describe the impact of different types of ministry, and explain how conflict can damage a partnership and state what needs to be done to de-escalate conflict.

4. Investigate and evaluate the different methods of exploring a partnership to identify success and failure factors, and critique ways in which participants could approach ministry differently as a result of new understanding about what the Scripture says about partnership.

5. Discuss and evaluate the characteristics of effective and ineffective teams, and State the aspects and agenda for meetings to launch a partnership.

6. Evaluate ways in which cultural differences can impact a partnership and indicate how to minimize the differences and maximize multicultural understanding.

**Syllabus**

Unit 1: Partnership – a theological perspective
Unit 2: What do we mean by “partnership”?
Unit 3: The strategic importance of working together in partnership
Unit 4: Exploring a partnership
Unit 5: Launching a partnership 1
Unit 6: Launching a partnership 2: a Reflection and Review
Unit 7: The Operations Stage of a partnership
Unit 8: Developing Effective Groups and Teams in partnerships
Unit 9: Partnerships and Conflict
Unit 10: Trust, Evaluation and other key issues in Partnerships

**Assessment**

Examination 40%
Continuous Assessment 60%

**MOL 611: DISSERTATION**

**Hours per week:** 8 (1 tutorial)
**Credits:** 16

**Learning Outcomes**

1. Produce a high-quality dissertation paper based on a selected research topic.
2. Address research questions and problems considering the relevant subject-matter of the research dealt with.
3. Discuss and declare the originality of scholarly research, critical assessment, logical structure, and research findings
4. Build a clear argument on the major objectives of the dissertation in a logical and consistent manner through orderly progression of work.

**Directions**

The students will be supervised by department approved faculty and to complete within a stipulated time and submit a dissertation for the partial fulfillment of a Master of Arts in Organizational Leadership. The dissertation, which is based on the candidate’s coursework and field research, is the reflection of the student’s three-year study program.

The candidate will be provided with specific instructions on dissertation style, methods, techniques, contents, volume and other details to support him/her in writing the dissertation.

**References**


Guthrie, G. (Editor) - Basic Research Techniques, University of Papua New Guinea, Port Moresby: Education Research Unit.


**Assessment:**

Satisfactory or Unsatisfactory

**GRADUATE CERTIFICATE IN COMMUNICATION OF SCIENCE AND TECHNOLOGY (SCICOM)**

This SCICOM course developed from an ACIAR PNG Scientific Communication Project, to assist researchers, academics and others whose work involves communicating science and to nurture a national partnership for better communication in science. The SciCom course has resulted from a
collaborative effort involving five PNG universities (UOT, UOG, UPNG, UOV, DWU), PNG research institutes and the University of Queensland. Communication and Development Studies Department has taken over the facilitation of this SCIICOM course and is offering it as a short course program towards a Graduate Certificate. The module consists of two core subjects LS 501 Communicating with Adults and LS 502 Language of Science. There are five electives LS 503: Science Communication in the Community, LS504: Writing Scientific Reports, LS505: Transformation of information into Knowledge, LS506: Advance Roles for Scientists and LS507: Directed Product Development (Workplace based project). On completion of the two core subjects and two electives a graduate certificate in Communicating Science and Technology can be awarded. Offered as a short course each subject can be offered in a five-day workshop

**Program Structure**
Subjects can be taken in any order, and are taught within one-week residential mode:

**Core Subjects**
LS501 Communication with Adults  
LS502 Language of Science and Technology

**Elective Subjects**
LS503: Communication of Science and Technology on the Community  
LS504: Writing Scientific Reports  
LS505: Transformation of Information into Knowledge  
LS506: Advanced Roles for Science and Engineers  
LS507: Directed Product Development

**LS501: COMMUNICATING WITH ADULTS**

<table>
<thead>
<tr>
<th>Hours per week:</th>
<th>3 (2 Lectures + 1 tutorial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits:</td>
<td>11</td>
</tr>
</tbody>
</table>

**Learning Outcomes**
1. Demonstrate understanding of the concept of ‘andragogy’ – the principles of adult learning and be able to apply these in a communication setting.
2. Understand the scope of the communication needs in terms of target audiences and their context.
3. Understand the four basic learning styles and their implications for communication with adults.
4. Plan a mixture of communication methods to cater for the different learning styles.
5. Understand how to approach communication and learning in a gender sensitive fashion.
6. Understand ethical and power issues associated with communication between adults and be able to account for them.

**Syllabus**
This is a foundation subject that provides a theoretical and practical base for effective communication with adults. It covers adult learning principles, their application and the importance of different learning styles in developing communication strategies. Participants coming from different experiences will expand their capacity and skill in adult learning as a precursor for developing appropriate products for communicating scientific and technological topics to adults. Four themes in the subject are:

i. What’s so special about communicating with adults?
ii. What has learning got to do with communicating with adults?
iii. Reducing the noise in adult-adult communication.
iv. Dealing with gender, ethics and power.

**References**
A *Book of Readings* containing supporting materials for each theme is provided.

**Textbook**

**Assessment**
- Participation 20%
- Group Presentation 30%
- Individual Assignments 50%

**LS502: LANGUAGE OF SCIENCE AND TECHNOLOGY**

<table>
<thead>
<tr>
<th>Hours per week:</th>
<th>3 (2 Lectures + 1 tutorial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits:</td>
<td>11</td>
</tr>
</tbody>
</table>
Learning Outcomes
1. Understand some of the important terms in the language of science.
2. Appreciate some of the language constraints in communicating ‘science’ to different groups of people.
3. Appreciate the methods used in natural and social sciences, their relative merits and their impacts on communication style.
4. Consider measures to improve scientific communication across different groups.
5. Learn how to express ideas as effectively as possible.

Syllabus
This is a foundation subject for elective subjects. It assumes that participants will have varied experiences in science and technology, and the language related to them. This is a strength that enables the subject to use experiential learning techniques to provide an appreciation of science and technology, and the components of language for effective communication. Participants will produce a personal style guide for writing scientific and technological materials in their workplace. The subject has four themes:
- Language of science and technology in the workplace
- Scientific method and its impact on language
- Communicating complex ideas and relationships
- Effective writing styles.

References
A Book of Readings containing supporting materials for each theme.

Textbook

Assessment
Peer Appraisal 30%
Personal Style Guide 70%

LS 503: COMMUNICATION OF SCIENCE AND TECHNOLOGY IN THE COMMUNITY

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes
1. Demonstrate an appreciation of the importance and benefits of communicating new science knowledge to a range of audiences.
2. Determine appropriate communication media for various audiences and identify benefits and constraints of each in the varied contexts.
3. Plan a communication project.
4. Evaluate the effectiveness of a communication project.
5. Produce a communication product that meets and demonstrates the criteria for effective communication through a given medium to a given audience.

Syllabus
This subject is set within the broad context of having participants use their wide and varied experiences to appreciate the need to effectively communicate scientific information. It considers the appropriate application of different mediums for communication of scientific and technological matters through planning, selection, demonstration and evaluation. It builds on the theories and reflections of learning as adults, and the components of language for effective communication in science. During the workshop, participants are expected to produce a communication product that meets and demonstrates the criteria for effective communication through a given medium to a given audience. The four themes in the subject will be presented in an experiential learning approach:
- Scope of Communicating Science to the Community
- Planning a communication project
- Preparing a communication product
- Evaluating the effectiveness of a communication project.

References
A book of supplementary readings containing support materials from a range of sources will be given to participants.
Textbooks
Participants will use the following resources:
Snooks & Co., 2002, Style Manual for Authors, Editors and Printers, John Wiley & Sons Australia, Ltd.

Assessment
Communication medium 20%
Communication Product 60%
Peer Appraisal 20%

LS 504: WRITING SCIENTIFIC REPORTS

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes
1. Understand the process of writing a scientific paper by using: (a) The IMRaD model of scientific reporting, (b) Appropriate language for sections of a paper, (c) Appropriate arrangement of ideas in a paper

Syllabus
The ability to communicate in writing is an important role for scientists and engineers. This subject is set within the broad context of participants having a wide and varied experience in science and/or technology and their related language. This background enables the subject to use experiential learning techniques to develop capacity and skill in writing scientific reports, form a base for other reports of technical nature. It emphasizes the use of appropriate structure and language for the various sections of a research paper. It demonstrates the use of bibliographic software. Seven themes in the subject cover the main sections of a research paper:
• Introduction
• Materials & Method
• Results
• Discussion
• Abstract
• References, Acknowledgment & Appendices
• Other Scientific and Technical Reports

Participants will be required to present a draft of a research paper, or a critique or two papers to the group for peer feedback and general response, conclusions and assessment.

References
A Book of Readings containing supporting materials for each theme.

Textbooks
Participants will use the following material for reference and examples:

Assessment
Documentation of your learning 60%.
Group presentation 20%
Peer appraisal 20%.

The documentation of your learning from the course will take the form of either:
• A summary of your comparison of two papers using the tools of analysis introduced in the workshop, or
• A draft research paper or other scientific report as negotiated with the facilitator.

LS 505: TRANSFORMING INFORMATION INTO KNOWLEDGE

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes
1. Demonstrate an understanding of the steps and approaches for transforming information into knowledge.
2. Design ways to evaluate the relevance of information within a specific context.
3. Appreciate techniques for critical thinking and synthesising information.
4. Develop a framework for managing information sources

**Syllabus**
This subject presents a process for transforming information into knowledge as part of a decision making process. Gaining an understanding of the complex interactions that impact on a particular issue is the underlying principle that guides this approach to transforming information into knowledge. As an elective subject, it builds on the skills and expertise developed in the core subjects.

The subject comprises six key themes that give participants an opportunity to develop their professional capacity and practice in transforming information into knowledge. The six themes of this subject are:
- Data, information and knowledge,
- The context,
- Information access
- Evaluating and managing information
- Synthesis
- Application, review and monitoring.

**References**
Participants will have access to:
A Book of Readings with chapters and articles from recent publications relating to the six key themes described above will be provided for participants.

The bibliographic software Endnote together with a CD ROM of scientific abstracts pertaining to PNG.

**Textbooks**

**Assessment**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Assessment</td>
<td>20%</td>
</tr>
<tr>
<td>Group Presentation of case study</td>
<td>40%</td>
</tr>
<tr>
<td>Written Report of case study</td>
<td>40%</td>
</tr>
</tbody>
</table>

---

**LS506: ADVANCED ROLES FOR SCIENTISTS AND ENGINEERS**

**Hours per week:** 3 (2 Lectures + 1 tutorial)
**Credits:** 11

**Learning Outcomes**
1. Edit and referee peer written articles and research reports;
2. Organize and run a workshop or conference for peers;
3. Achieve high quality verbal presentations;
4. mentor PG students / researchers in the workplace;
5. Manage a research project.

**Syllabus**
Scientists and engineers are called upon to fulfil a number of roles for which they are often inadequately trained. These include roles such as: mentoring/supervising junior staff or post-graduate students; refereeing report from peers; organising workshops and conferences for information sharing; giving verbal presentations; and managing research projects. This elective subject consists of five 1-day workshops that combine as a week-long workshop.

**References**
A workbook including appropriate examples and readings will be provided to participants.

**Textbooks**
Expected that participants will have read:

It is also assumed that all participants have a working knowledge of:

**Assessment**
Each of the five 1-day workshops will have a separate assessment that contributes 20% of marks in LS506. The nature of assessment varies across topics, and may involve some form of peer assessment.

<table>
<thead>
<tr>
<th>Verbal presentations</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Verbal Presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Refereeing and Editing Assignment</td>
<td>20%</td>
</tr>
</tbody>
</table>
POSTGRADUATE COURSES HANDBOOK 2019

Department of Communication and Development Studies

Supervising Post Graduate Students
Assignment                                      20%
MANAGING A RESEARCH PROJECT GROUP PRESENTATION 20%
Organising A Research Conference
Group Presentation                               20%

LS 507: DIRECTED PRODUCT DEVELOPMENT

Hours per week: 3 (2 Lectures + 1 tutorial)
Credits: 11

Learning Outcomes
1. apply principles of good scientific communication to preparation of a workplace-based communication product.

This subject could well be the final subject for participants who wish to prepare:
a scientific report: LS501, LS502, LS504, LS507

Syllabus
This subject provides an opportunity for participants to apply the learning, experiences and lessons across other subjects to develop a significant communication product for their workplace. It acknowledges the fact that this may take up to one semester and allows participants to work in remote locations.

The nature of the product can be wide and varied ranging from traditional scientific or technical reports to novel ways of communicating science and technology to the community. Participants will select and develop the communication product on a case by case basis after negotiations with their employer and experienced university or industry staff.

Assessment
Proposal                                          10%
Finished project                                 60%
Documentation                                     30%

POSTGRADUATE CERTIFICATE IN STUDENT-CENTRED TEACHING AND LEARNING

While the course focuses on ICT and its teaching tools, it also intends to equip the participants with awareness and appreciation of current pedagogical trends in teaching and learning in higher education. It is expected that with the combined knowledge and skills in ICT and current trends in education, graduates of the program will be well equipped to deliver sound education to the students they serve at the PNG University of Technology, both currently and in the future.

While the course focuses on ICT and its teaching tools, it also intends to equip the participants with awareness and appreciation of current pedagogical trends in teaching and learning in higher education. It is expected that with the combined knowledge and skills in ICT and current trends in education, graduates of the program will be well equipped to deliver sound education to the students they serve at the PNG University of Technology, both currently and in the future.

Duration of study
The minimum duration of this postgraduate certificate course for a full-time candidate shall be not less than one semester.

The minimum duration of this postgraduate certificate course for a part-time candidate shall be two semesters.

Criteria for selection and admission of candidates
The selection and admission of candidates shall be coordinated by the Dean of the Postgraduate School in consultation with the HoDs in the respective academic departments.

Program Outcomes
1. Model the delivery of a subject's syllabus in a flipped classroom setting using a Learning Management System (LMS), such as Google Classroom or Moodle, demonstrating its advantages over traditional “chalk and talk” delivery methods.

2. Increase collaboration and engagement in a flipped classroom environment to foster effective student learning. Comprising online and blended learning, the program will focus on placing the learning goals of taught subjects in perspective, encompassing issues of content delivery (via
instructional strategies of using Google Classroom, Google Apps, Google Tools and other free and open source authoring tools). Furthermore, tractable and holistic assessment methods of both content and meta-cognitive skills to be gained by students will be introduced.

3. Understand the principles behind and uses of problem-based learning so that the participants can enhance their competence to deliver problem-based learning method in the courses they deliver.

4. Identify and explain the basic theories and elaborated practices of current teaching and learning trends in higher education.

5. Facilitate structured reflection on appropriate teaching pedagogies (both traditional and ICT driven), tapping from the wealth of experience of the participants.

6. Equip thereby the teaching staff members at UNITECH to be able to deliver learning-focused academic subjects in their academic discipline (via both blended and online modalities) with ICT tools effectively, both now and in the future.

Program Structure
To elaborate this course of study, there will be three subjects taught weekly for 15 weeks. Each subject will be taught for two hours per week, usually from 4 to 6 pm. The subjects will be taught by suitable specialist identified within the University. The three subjects that will form the initial basis of the course structure are:

(a) Learning Management Systems and Flipped Classrooms
(b) Problem-Based Teaching and Learning
(c) International Trends in Higher Education Landscapes and Practices

The Subject Details

<table>
<thead>
<tr>
<th>CODE</th>
<th>SUBJECT</th>
<th>WEEKLY HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDS 511</td>
<td>Learning Management Systems and Flipped Classrooms</td>
<td>2</td>
</tr>
<tr>
<td>CDS 512</td>
<td>Problem-Based Teaching and Learning</td>
<td>2</td>
</tr>
</tbody>
</table>

CDS 513: International Trends in Higher Education Landscapes and Practices

| Credits | 10 |

Learning Outcomes
1. Prepare a complete course presented in LMS (e.g., Google Classroom).
2. Plan appropriate student learning activities in a Flipped Classroom environment.
3. Design appropriate Blended learning activities in a Flipped Classroom and within LMS setting.
4. Prepare relevant videos and other interactive learning material to support a LMS.
5. Use Assessment and other Authoring Tools to support student-teacher interaction within a LMS setting.

Syllabus
This is an important subject offered as part of this program. The subject provides and develops 21st century skills to practicing academic staff in order to foster the effective delivery of varied disciplinary courses (and specific subjects) content in a flipped classroom setting using an integrative Learning Management System (LMS), such as Google Classroom or Moodle. The subject is focused on demonstrating how instructors can employ ICT tools such as to use Google Classroom, Google Apps, Google Tools and other free and open source authoring tools can enhance their teaching effectiveness.

References Used in Class
Notes Prepared for each module

Additional References
JCU Workshop Notes

Assessment
40% Continuous Assessment (10% individual class participation, 30% Deliverable)
### CDS 512: PROBLEM BASED TEACHING AND LEARNING (PBTL)

**Hours per week:** 2  
**Credits:** 10

**Learning Outcomes**
1. Understand the principles behind and uses of Problem Based teaching and learning.  
2. Be able to develop a rich and relevant problem which promotes deep learning.  
3. Be able to conduct a Goals Session in Problem Based Teaching and Learning.  
4. Be able to conduct a Teaching Session in Problem Based Teaching and Learning.  
5. Learn how to use rubrics in assessment of written and oral work.  
6. Be able to introduce Problem Based Teaching and Learning in a subject.

**Syllabus**
Problem based teaching and learning is a proven pedagogical approach. Research has shown that retention rate of information is vastly superior compared to other teaching methods. Another major advantage is that students develop communication, presentation and team working skills which make them ready for the job market. In this subject, participants will develop a problem for one of the subjects they are currently teaching, and learn how to conduct a “Goals PBL” session and a “teaching PBTL” session. They will also learn how to update and adapt their problems, how to assess student performance in PBTL enhanced course, and how to prepare and give mini-lectures when concepts are unclear to students.

### CDS 513: INTERNATIONAL TRENDS IN HIGHER EDUCATION LANDSCAPES AND PRACTICES

**Hours per week:** 2  
**Credits:** 10

**Learning Outcomes**
1. Understand the new, shifting international higher education landscape, inclusive of theoretical, comparative aspects of higher education pedagogy.  
2. Understand and apply shifting definitions of the adult student and varied teacher “selves” across vectors of time, place and valued ends.  
3. Understand and apply best professional practices in higher education, appropriately drawing from an international menu of institutional and disciplinary options when designing courses/subjects/seminars.  
4. Be able to devise a course/subject lesson plan, according to PNGUoT AQAT guidelines, as well as organize and maintain subject files.  
5. Understand and appropriately apply relevant and useful continuous and summative assessment procedures so to assist students to learn and certify their achievements.  
6. Promote appropriate student involvement in embodied teaching and learning processes, e.g., “flipped classrooms.”  
7. Appreciate approaches and trends in the appropriate use of new digital technologies in varied higher education settings and apply them to one’s taught classes.

**Syllabus**
The shifts in society (1st, 2nd, 3rd and 4th revolutions), specially the shift from analogue to digital modes of knowledge production and dissemination.

“Best practices” of general higher education pedagogical provision in a new, fast changing topography of teaching and learning, from an international, comparative perspective, in informal, non-formal and formal educative contexts, aimed at achieving quality and relevance.

The impact of specific disciplinary and knowledge domains on teaching and learning conceptions and practices at the PNGUoT. Aligning Program Objectives/Learning Outcomes with student learning and outcome assessment.

Making classes “work” for the student and professor: Developing the art of assignments as bridges to ongoing “conversations” of knowledge
transmission, use and creation. Knowledge of varied student-learning styles and approaches: Lecture, Learner-centred, (inter)active, team and group learning; pedagogical differences among large and small classes and levels of learners, online learning, project-based learning, etc.

Educating students for both expected short-term and unpredictable mid to long-term changes in the world of work across the lifespan.

References Used in Class
A wide variety of up-to-date online resources mixed with some relevant classical works.

Additional References
JCU Workshop Notes

Assessment
40% Continuous Assessment (10% individual class participation, 30% Deliverable)
60% Capstone Project (20% Mod1, 20% Mod2 and 20% Mod3)
DEPARTMENT OF ELECTRICAL & COMMUNICATION ENGINEERING

Head of Department/Associate Professor
Kumar, R., Ph.D.  
(Banasthali University, India), M. Tech. (NIT, India)

Deputy Head of Department
Kupale, G. (Mr.), M.Eng. (PNGUoT), B.Eng, (PNGUoT)

Lecturers
Aiau, S. S. (Mr), M.Phil, B.Eng, (PNGUoT), MIEPNG., Reg. Eng.(PNG).
Fisher, J., PhD, (PNGUoT), M.Eng.Sc, (UOW, Australia), B.Eng, (PNGUoT)
Chen, D. (Mr), M.IT (QUT, Australia), B.CS (VUW, New Zealand)
Kavi, M. (Mr), M.Eng. (UNSW, Australia), B.Eng. (PNGUT) Dipl. Communications Eng. (PNGUoT)
Kunsei, H (Mr)., M.Eng.Sc (UNSW, Australia), B.Eng. (PNGUoT)

Technical Instructors
Yuanko, J (Mr.), MPhil, B. Eng. (PNGUoT)
Maeoaka, R (Ms), MPhil, B. Eng. (PNGUoT)

Laboratory Manager
Sangin, D., Dipl. Comm. Eng. (PNGUT), Dip. Extra Comp. Tech. (ICS, USA); Dip. Extra TV/VCR Rep. (ICS, USA); Dipl. Extra Webpage (Penn Foster, USA); Ass. Deg. PC Maintenance Tech. (Penn Foster, USA)

Principal Technical Officer (Communication)

Principal Technical Officer (Power)
Embe, O., B.Eng. (PNGUoT)

Principal Technical Officer (Computing)
Pek, C, B.Sc. (UPNG)

Senior Technical Officer (Power)
Warra, T, PETT Cert. (Hagen Tech.), Trades Cert. (POM Tech)

Senior Technical Officer (Computing)
Kevin, L., Dipl. Comp. Technology, (DBTI)

Senior Technical Officer (Research & Computing)
Vinevel W., Dip. Telecom & Elect. Eng., (Telikom)

Technical Officer (Communication)
Karato R., B.Sc App. Phy. & Elect., (PNGUoT)

Technical Officer (Computing)
Makun, R., Dipl. Comp. Technology, (DBTI)

Technical Assistants
Pepi, F., Cert. Electrical (POM Tech.)

Senior Store Supervisor
Kondo, V., Dipl.Cert (Telrad, Israel), Cert. IT Studies (Telecom Training Col.)

Senior Secretary
Ketau, Q., Dipl. Business Stud. (PNG PolyTech), SecCert, StenoCert, (Goroka Bus. Coll.)

Sandruweh, D., Dipl. Business Stud, SecCert (Polytech), StenoCert (Rabaul Tech)
INTRODUCTION
The Department of Electrical Engineering was established to produce highly qualified professionals and technical manpower in the field of Electrical, Electronics and Communication Engineering. The Department runs degree programs, organizes and conducts short-term training programs on the topics of interest for practicing engineers, technicians as well as technical teachers of various organizations, colleges and schools. The graduating engineer of the department can work as a design engineer, technologist and maintenance engineer, as a researcher in research institutions and as a manager in firms dealing with production, service and trade in the field of Electrical, Electronics and Communication engineering at various industrial and commercial establishments.

It is imperative and indeed a demand to look ahead for the department curriculum to meet the present and future needs of the country in the field of Communication engineering and to provide educational means to meet these needs. Thus, to minimize the gap between the state-of-the-art technology and the present teaching learning process, the department has successfully brought the changes in the curriculum that supports and maintain the relevance of educational standards in the field of engineering. Thus, the department proposes a Graduate Program with specialization in Communication Engineering.

RATIONALE OF THE GRADUATE PROGRAM
The basic rationale for all of the programs is the prevailing conditions in the country as a whole with respect to the needs for professionals in the proposed areas and the future trends that are developing in the demands for the professions. The following points provide some of the major facts and observations on which the need for developing of the postgraduate programs premised.

a) Country’s Need: The needs of the country for engineers specialized in specific areas of Communication engineering can be met through graduate studies that are being currently proposed. The graduate program that is now proposed is an outgrowth of the experiences of the department in offering undergraduate courses over the years, and a series of discussions within the Department and with major employers/stakeholders and practicing professionals.

b) Rapid development: With the rapid development of ICT and communication networks in the country deeper knowledge of various branches of Communication engineering is required.

c) Future Economy: We feel, the country would take necessary steps to strengthen the Communication industrial sectors for its economy. To equip the students with the necessary knowledge and skills for assisting such vision and objectives of country, it would be necessary to launch P.G program in these fields.

d) Increasing number of Graduates: With the increasing number of graduates from the Electrical and Communication engineering department, it is becoming inevitable that many shall be seeking higher education. In addition, many practicing engineers and teaching staff in the ranks of Graduate Assistants and Assistant Lecturers at the Universities both in and outside the country are seeking for admission into Graduate Programs.

e) Limited Higher Learning Institutes: Limited or no number of higher learning institutions offering the proposed programs in country.

f) Research and Development: The higher studies in these fields are essential for engineers who can engage themselves in academic and industrial sector in fields, such as research, development and engineering administration is also being felt.

PROGRAM OUTCOMES
On completion of this program, students would have attained the adequate scientific knowledge and skills related to:

1. Competency in application of knowledge and skills from basic engineering and other disciplines to identify, formulate and present solutions to technical problems related to Communication engineering and technology.

2. Management of new technologies in the fields of tele and wireless networks along with the
concepts of that require advanced knowledge within the field.
3. Designing advanced state of the art communication systems and conduct experiments, analyze and interpret data.
4. Selection of techniques, modern engineering tools, software and equipment necessary to evaluate and analyze the systems in telecommunications.
5. Conducting systematic research studies under minimal supervision and on significant research topic within the field at global standards.
6. Effective communication of information, ideas, problems and solutions to the professionals, peers and clients.
7. Being open to acquiring knowledge and skills (both formally/informally) to keep up-to-date on advances in field of expertise so to remain valuable in the workplace and a worthy member in the professional group/society

DURATION OF THE PROGRAM
This will be a full time Post Graduate program of four semesters spread over two academic years.

DEGREE NOMENCLATURE
The degree awarded would be Master of Engineering in Communication Engineering.

ADMISSION REQUIREMENTS
Entry is open to students with a four (4) year Bachelor of Engineering degree in Electrical/Electronic/Instrumentation/Communication/Power/Electrical and Communication Engineering or equivalent as recognized by the University. The rules for admission, registration, supervision and administration of postgraduate programs shall be those of the PNG University of Technology applicable to Master of Engineering programs.

GRADUATION DEGREE REQUIREMENTS
In order to complete the degree requirements, each student is expected to earn credits as required by PNG University of Technology Master in Engineering programs (Subjects plus a Dissertation).

COURSE CREDIT REQUIREMENTS
The program courses including thesis work contains minimum of 130 credit points. In the second year, the student is required to undertake a suitable research work (dissertation) work which can be carried out in two phases in the department or industry in consultation with supervisors. During this stage, students must present their work to their respective supervisors to show the progress of their thesis work and the final completion presentation to be made to the panel constituted by Head of Department in consultation with the Principal Supervisor.

COURSE STRUCTURE
The program consists of four semesters. In second semester, students are eligible to choose elective courses. Every student will carry out dissertation under the supervision of a Supervisor(s). The topic shall be approved by a Committee constituted by Head of Department. Every student will be required to present two seminars, first at the beginning of Dissertation (Phase-I) to present the scope of the work and to finalize the topic and second towards the end of the semester presenting the work carried out by him/her during the semester. The Dissertation Phase-I will be continued as dissertation in 4th Semester. At the end of fourth semester, the students have to submit the dissertation as stipulated in postgraduate rules and regulations and the dissertation will be assessed by two external examiners.
SUBJECTS AND SCHEDULES

Credit Structure (Summary)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Semester I</th>
<th>Semester II</th>
<th>Semester III</th>
<th>Semester IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Courses</td>
<td>43</td>
<td>31</td>
<td></td>
<td></td>
<td>74</td>
</tr>
<tr>
<td>Elective Courses</td>
<td></td>
<td>11</td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Thesis</td>
<td></td>
<td></td>
<td>22</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>43</td>
<td>22</td>
<td>22</td>
<td>130</td>
</tr>
</tbody>
</table>

COURSE MATRIX

<table>
<thead>
<tr>
<th>Year I</th>
<th>Semester I</th>
<th>Course</th>
<th>Course Title</th>
<th>CCC</th>
<th>L</th>
<th>T</th>
<th>Lab</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>EE-511</td>
<td>Information Theory and Coding</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE-512</td>
<td>Linear algebra and Special functions</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE-513</td>
<td>Research Methodology</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE-514</td>
<td>Advanced Digital Communication</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td>43</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year I</th>
<th>Semester II</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit</th>
<th>L</th>
<th>T</th>
<th>Lab</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>EE-521</td>
<td>Statistical Signal Processing</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>EE-512</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE-522</td>
<td>Optical Communication Networks</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>EE-514</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE-523</td>
<td>Elective I</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE-524</td>
<td>Entrepreneurship for Engineers</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EE-524</td>
<td>Technical Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td>43</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>
## Elective I

<table>
<thead>
<tr>
<th>Code</th>
<th>Name of the subject</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE-525</td>
<td>Nonlinear Dynamics</td>
<td>EE512, EE521</td>
</tr>
<tr>
<td>EE-526</td>
<td>Electromagnetic Interference and Compatibility in System Design</td>
<td>-</td>
</tr>
<tr>
<td>EE-527</td>
<td>Mobile Communication Networks</td>
<td>-</td>
</tr>
<tr>
<td>EE-528</td>
<td>Wireless Sensor Networks</td>
<td>-</td>
</tr>
<tr>
<td>EE-529</td>
<td>Base band algorithms on FPGA</td>
<td>-</td>
</tr>
<tr>
<td>EE-530</td>
<td>Mobile Adhoc Networks</td>
<td>-</td>
</tr>
<tr>
<td>EE531</td>
<td>Wireless Security</td>
<td>-</td>
</tr>
</tbody>
</table>

## Year II

### Semester I

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Title</th>
<th>CCC</th>
<th>L</th>
<th>T</th>
<th>Lab</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE-611</td>
<td>Thesis phase I</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

### Semester II

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Title</th>
<th>Credit</th>
<th>L</th>
<th>T</th>
<th>Lab</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE-611</td>
<td>Thesis phase II</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>EE-611</td>
</tr>
</tbody>
</table>
## EE-511: INFORMATION THEORY AND CODING

**Hours per week:** 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

**Credits:** 11  

**Prerequisite:** NIL  

### Learning Outcomes

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

1. Design Analog communication systems to meet desired needs.
2. Examine the practical implementation issues, such as Error control coding, convolutional code.
3. Design and develop digital and analog systems.
4. Test various error correction techniques
5. Formulate convolution codes for information exchange.

### Syllabus

#### Information theory

Concept of amount of information -units, Entropy - marginal, conditional and joint entropies -relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.

#### Discrete channels

Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, and Shannon theorem. Continuous channels – Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Tradeoff between band width and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system.

#### Source coding


### Error detection and correction

Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and un systematic codes. Cyclic codes – Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

### Convolutional codes

Encoding- State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes - Viterbi algorithm, Sequential decoding -Stack algorithm. Interleaving techniques – Block and convolutional interleaving, Error Control and Signal Space Coding.

### Text Books


### References


### Assessment

Continuous Assessment - 50%
Final Examination - 50% (1 x 3 hours)
2. Test the idea of optimization and its applications.
3. Create Eigen values and Eigen vectors from differentiable equations.
4. Combination of theoretical knowledge and independent mathematical thinking using special functions.
5. Formulate the complex mathematical model of engineering problems.

### Syllabus

#### Calculus of Variations

Introduction to variation problems - Euler’s equation - Functional dependent on first and higher order derivatives - Functional dependent on functions of several independent variables - Some applications - Direct methods: Ritz methods.

#### Vector space

Definition and examples of linear space - Linear dependence and independence - Basis and Dimension - Inner product space - Orthogonalization process - Gram - Schmidt process - Least - square problems - Applications of inner product spaces.

#### Eigen values and Eigen vectors

Generalized Eigen values and Eigen vectors - Characteristic equation - Diagonalization - Eigen vectors and linear transformations - Complex Eigen values - Applications to differential equations - Iterative estimates for Eigen values.

#### Advance matrix theory


#### Special Functions

Bessel's equation – Bessel functions – Legendre’s equation – Legendre’s polynomials – Rodrigue’s formula – Recurrence relations – Generating functions and orthogonal property for Bessel’s functions – Strum-Liouville problem – Error functions.

#### Text Books


### References


### Assessment

Continuous Assessment - 50%
Final Examination - 50% (1 x 3 hours)

### EE 513: RESEARCH METHODOLOGY

**Hours per week:** 2 [Lecture: 2, Tutorial: 0, Laboratory: 0]

**Credits:** 09

**Prerequisite:** NIL

**Learning Outcomes**

On completion of this subject, the students will be able to:
1. Demonstrate the concepts of engineering research and its methodologies.
2. Understand the various methods used to collect the data to research.
3. Categorize the research design into different steps.
4. Formulate the research design into different steps.
5. Select appropriate software and hardware tools for the research.

### Syllabus

#### Foundations of Research:

Meaning, Objectives, Motivation, Utility, Characteristics of scientific method

#### Research Design:

Concept and Importance in Research, Features of a good research design, Background research for experimental planning

#### Experiments Design:

Statistical data analysis, executing engineering experiments and analyzing experimental findings,
**Communication and Ethics:** Oral communication of research, Written communication of research, Engineering ethics, plagiarism and information sources, Intellectual property, social impact, and financial considerations of engineering research, Laboratory safety, a laboratory notebook maintenance.

**Software and hardware tools:** Matlab, LabView, Arduino, etc.

**Text Books**

**References**
1. Alan Bryman and Emma Bell, Business Research Methods, Oxford University Press.
2. Donald Cooper and Pamela Schindler, Business Research Methods, TMGH, 9th edition

**Assessment**
Continuous: 100% (Individual reporting-20%, Weekly Assignment- 30%, Case study 50%)

---

### Syllabus

#### Baseband Data Transmission

- **Baseband PAM** –One Shot Minimum Distance Receiver –Minimum Distance Sequence Detection-M-ary signaling scheme-shaping of the transmitted signal spectrum-Noise in Baseband System - Coherent and Non coherent Technique, Orthogonal Modulation-OFDM modulation and Demodulation– Multidimensional Modulation-Modulation with Memory.

- **Band-limited channels**
  - Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel Models: Fading Dispersion channel, Time and Frequency Selective, Rayleigh channel, karhunen-loeve Expansion; Diversity Technique: Space, polarization, path, angle, Time and frequency, Diversity Combining Technique

- **Equalization**

- **Detection**

- **Fundamentals of Estimation Theory**

**Text Books**

References

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1 x 3 hours)

EE 521: STATISTICAL SIGNAL PROCESSING

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11
Prerequisite: EE512

Learning Outcomes
On completion of this subject, students will be able to:
1. Design and implement decimator and interpolator.
2. Construct multi rate filter bank and acquires knowledge of how a multi rate system work.
3. Understand different spectral estimation techniques and linear prediction.
4. Design LMS and RLS adaptive filters for signal enhancement, channel equalization.
5. Estimate of spectra from finite duration observations of a signal.

Syllabus
Multirate signal Processing

Multirate FIR Filter Design
Design of FIR filters for sampling rate conversion – Applications of Interpolation and decimation in signal processing –Filter bank implementation –Two channel filter banks-QMF filter banks –Perfect Reconstruction Filter banks – tree structured filter banks - DFT filter Banks – M-channel filter banks- octave filter banks

Linear Estimation and Prediction
Linear prediction- Forward and backward predictions, Solutions of the Normal equations-Levinson- Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.

Adaptive Filters

Power Spectral Estimation

Text Books

References

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)
**EE 522: OPTICAL COMMUNICATION NETWORKS**

**Hours per week:** 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

**Credits:** 11

**Prerequisite:** EE514

On completion of this subject, students will be able to:
1. Understand various loss mechanisms and Non-Linear effects in optical communication.
2. Apply knowledge of optical components and WDM network elements.
3. Discuss about Optical access network architectures
4. Compare layered architecture of, IP and MPLS over SONET network.
5. Measure Photonic packet switching, impediments involved and available techniques like switching, buffering, multiplexing and synchronization.

**Syllabus**

**Optical Signal propagation and System Components**
- Propagation in optical fibers – Loss & bandwidth windows, Intermodal dispersion, Optical fiber as waveguide, Chromatic dispersion, Non-Linear effects; Solitons;

**Client layers of Optical Layer**

**WDM Network Elements and Design**
- WDM Network elements - Optical line terminals, Optical line amplifiers, Optical Add/drop multiplexers-Architectures, Reconfigurable OADMs, Optical cross connects, All optical OXC configurations. WDM Network Design – Cost Trade-Offs: A detailed ring network example, LTD and RWA problems, dimensioning Wavelength routing networks, Stastical dimensioning Models, Maximum load dimensioning models

**Packet switching and Access networks**

**Network Design and Management**
- Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization; Overall design considerations; Control and Management – Network management functions, Optical layer services and interfacing, Layers within optical layer, Multivendor interoperability, Performance and fault management, Configuration Management.

**Text Books**

**References**

**Assessment**
- Continuous Assessment 50%
- Final Examination 50% (1x3 hours)

---

**EE 523: ENTREPRENEURSHIP FOR ENGINEERS**

**Hours per week:** 2, [Lecture: 2, Tutorial: 0, Laboratory: 0]

**Credits:** 9

**Prerequisite:** NIL
Learning Outcomes
On completion of this subject, students will be able to:
1. Create a full business plan, a virtual company website.
2. Compare and organize several product presentations.
3. Compete in both the end-of-semester competitions in campus and off campus.
4. Present and discuss critical importance of entrepreneurship to world’s economy (employment, technology advancement, societal development, etc.).
5. Enable students to hear from, and interact with, entrepreneurs from various sectors of economy like software, telephony, energy, light, water, social networks and enterprises, entrepreneurship and finance.

Syllabus
The course focuses on business sectors that derive from disciplines and areas of study. Engineering Entrepreneurship is a full-immersion, multidisciplinary, engineering experience holistically designed to integrate the skills and knowledge of the students in a more in-depth exposure to new product and business development to the engineering profession. The subject covers: Entrepreneurial engineer’s readiness in 21st century, innovation, money, work, time, human behavior, ethics, organization and leadership, and assessment of technology opportunities.

Text Book

Assessment
Continuous: 100% (Individual reporting-20%, Weekly Assignment- 30%, Case study 50%)

EE 524: TECHNICAL SEMINER

Hours per week: 1, [Lecture: 0, Tutorial: 0, Presentation: 1]

Credits: 1
Prerequisite: NIL

Every student will be required to present a seminar on a topic approved by the Department except on his/her dissertation. The committee constituted by the Head of Department will evaluate the presentation and will award the grades accordingly.

EE 525: NONLINEAR DYNAMICS

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

Credits: 11
Prerequisite: EE512, EE514

Learning Outcomes
On completion of this subject, students will be able to:
1. Demonstrate the ability to design and analyze nonlinear systems.
2. Develop algorithms for controlling nonlinear systems.
3. Test Chaos in the nonlinear systems.
4. Design various applications of nonlinear systems.
5. Formulate control algorithms for nonlinear systems.

Syllabus
The implications of nonlinearity, dynamics and chaos
The role of dimensionality, One-dimensional systems, one dimensional ows: visualizing the solution space; stability and xed points; linear stability analysis; existence and uniqueness. Applications and numerical methods, Bifurcations: saddle-node, trans-critical and pitchfork. Flows on the circle: uniform and nonuniform oscillators. The case of the over-damped pendulum. Applications.

Two dimensional systems
### Chaos

### Control algorithms
Adaptive control, back stepping and sliding mode controls and its applications in synchronization.

### Text Books

### Assessment
- Continuous Assessment - 50%
- Final Examination - 50% (1 x 3 hours)

### EE 526: ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

<table>
<thead>
<tr>
<th>Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits: 11</td>
</tr>
<tr>
<td>Prerequisite: NIL</td>
</tr>
</tbody>
</table>

### Learning Outcomes
On completion of this subject, students will be able to:
1. Demonstrate electromagnetic concepts and its measuring parameters.
2. Compare EMI coupling of various types.
3. Design and architecture of micro machined antennas.
5. Design PCBs for various applications.

### Syllabus
- **EMI Environment**
  - EMI/EMC concepts and definitions, sources of EMI, conducted and radiated EMI, transient EMI, time domain vs frequency domain EMI, units of measurement parameters, emission and immunity concepts, ESD.
  - **EMI Coupling Principles**
    - Conducted, radiated and transient coupling, common impedance ground coupling, radiated common mode and ground loop coupling, radiated differential mode coupling, near field cable to cable coupling, power mains and power supply coupling.
  - **EMI/EMC Standards and Measurements**
    - Civilian standards - FCC, CISPR, IEC, EN, Military standards - MIL STD 461D/462, EMI Test Instruments/Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, sensors/injectors/couplers, test beds for ESD and EFT, military test method and procedures.
  - **EMI Control Techniques**
    - Shielding, filtering, grounding, bonding, isolation transformer, transient suppressors, cable routing, signal control, component selection and mounting.
  - **EMC Design of PCBs**
    - PCB traces cross talk, impedance control, power distribution decoupling, zoning, motherboard designs and propagation delay performance models.

### Text Books

### References

### Assessment
- Continuous Assessment - 50%
- Final Examination - 50% (1x3 hours)
### EE 527: MOBILE COMMUNICATION NETWORKS

**Hours per week:** 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

**Credits:** 11

**Prerequisite:** NIL

**Learning Outcomes**
On completion of this subject, students will be able to:
1. Inspect the concepts of Cellular and Mobile Radio propagation.
2. Manage modulation and demodulation used in communication.
3. Rate multiple access techniques to solve communication problems.

**Syllabus**

**Cellular Concepts and System Design Fundamentals**

**Mobile Radio Propagation**
Free space propagation model, reflection, diffraction, scattering, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Small scale Multipath measurements, parameters of Mobile multipath channels, fading and its types.

**Modulation and Multiple Access Techniques**
Minimum Shift Keying (MSK), Gaussian MSK, Orthogonal Frequency Division Multiplexing, Multiple Access Techniques: TDMA, FDMA, CDMA, SDMA.

**2G and 2.5G Networks**

**3G Networks and Beyond**

**Text Books**

**References**

**Assessment**
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

### EE 528: WIRELESS SENSOR NETWORKS

**Hours per week:** [Lecture: 2, Tutorial: 1, Laboratory: 0]

**Credits:** 11

**Prerequisite:** NIL

**Learning Outcomes**
On completion of this subject, students will be able to:
1. Apply basics of wireless sensor networks to solve network problems.
2. Create applications in enabling technologies.
3. Examine the architecture and elements of wireless sensor networks.
5. Select tools and platforms needed to establish sensor networks.

**Syllabus**

**Overview of wireless sensor networks**

**Architectures**

**Networking of sensors**

**Infrastructure establishment**

**Sensor network platforms and tools**

**Text Books**

**References**

**Assessment**
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

**EE 529: BASEBAND ALGORITHMS ON FPGA**

**Hours per week:** 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]

**Credits:** 11

**Prerequisite:** NIL

**Learning Outcomes**
On completion of this subject, students will be able to:
1. Identify various construction blocks and operation of FPGA.
2. Implement arithmetic units and digital filters on FPGA.
3. Create FIR and IIR filter structures.
4. Design and implementation of Fourier transform and various baseband communication blocks.
5. Develop new algorithms based on FPGA.

**Syllabus**

**FPGA Technology**
Basics of FPGA, Gate array, Comparison of ASIC and FPGA, Introduction to FPGA Design flow, Programming languages, programming technology

**Basic Building Blocks**
Number representation, Binary adders, Binary dividers, Floating point arithmetic, MAC &SOP unit
Digital filter implementation
FIR filter, Theory and Structure, Filter design, Constant coefficient, FIR Design IIR filter, IIR theory, Coefficient computation and implementation details, Fast IIR filter

Fourier Transform
DFT algorithms, Goertzel algorithm, Hartley transform, Winograd DFT, bluestein chirp-z transform, Rader algorithm, FFT algorithms, Cooley-tukey, Good Thomas, Winograd FFT

Communication Blocks
Computation of Special Functions Using CORDIC, Error codes, Linear block code, Convolution codes, Modulation and Demodulation, Adaptive filters, LMS, RLS, Decimator and Interpolator, High Decimation Rate Filters.

Text Books

References

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 530: MOBILE ADHOC NETWORKS

Hours per week: 3, [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11
Prerequisite: NIL

Learning Outcomes
On completion of this subject, students will be able to:
1. Identify various challenges and vulnerabilities in MANET.
2. Revise cyber-attacks and threads in mobile networks.
4. Analyze the solutions for covering the security principles of adhoc networks.
5. Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems.

Syllabus
Wireless LAN, PAN, WAN and MAN

MAC and Routing Protocols

Transport Layer and Security Protocols

Energy Management
Need - Classification of battery management schemes - Transmission power management schemes - System power management schemes. Wireless Sensor Networks: Architecture - Data dissemination - Date gathering - MAC protocols - Location discovery - Quality of a sensor network.

Performance Analysis

Text Books

References

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)

EE 531: WIRELESS SECURITY

Hours per week: [Lecture: 2, Tutorial: 1, Laboratory: 0]
Credits: 11
Prerequisite: NIL

Learning Outcomes
On completion of this subject, students will be able to:
1. Identify the various attacks and threads of wireless Networks.
2. Setup and recognize the architectures, vulnerabilities and challenges of mobile protocols.
3. Analyze the solutions for covering the security principles of wireless networks.
4. Analyze and design security systems for wireless networks.
5. Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems.

Syllabus

Attacks on Routing Protocols

Intrusion Detection in Wireless Ad Hoc Networks
Problem in current IDS techniques - requirements of IDS - classification of IDS – Network and host based - anomaly detection, misuse detection, specification based - intrusion detection in MANETs using distributed IDS and mobile agents - AODV protocol based IDS - Intrusion resistant routing algorithms - Comparison of IDS.

Mitigating Techniques for Routing Misbehavior
Watchdog, Parthrater, Packet leashes and RAP.

Secure Routing Protocols:
Self-organized network layer security in MANETs - mechanism to improve authentication and integrity in AODV using hash chain and digital signatures - on demand secure routing protocol resilient to Byzantine failures - ARIADNE, SEAD, SAR, and ARAN.

Challenges in Routing Security
Security - Challenges and solutions - Providing Robust and Ubiquitous security support - Adaptive security for multilevel Ad Hoc Network - Denial of service Attack at the MAC layer - Detection and handling of MAC layer Misbehavior.

Text Books

Reference

Assessment
Continuous Assessment - 50%
Final Examination - 50% (1x3 hours)
DEPARTMENT OF FORESTRY

TARAKA CAMPUS

Head of Department
Peki, M.M., PhD (Tokyo), MSc (TUAT), BScFor (PNGUT), DipFor (FORCOL).

Deputy Head of Department
Jeremiah, H., MSc. (Beijing Forestry University, China). PGDAg (PNGUT), BScFor (PNGUT)

Professor
O sia G. Gideon, PhD (James Cook), MPhil, B.Sc.For (PNGUT), DipFor (FORCOL), Fellow of the Linnean Society.

Jashimuddin, M., PhD (Wales, UK), B.Sc. (Hons.) Forestry (Chittagong, Bangladesh)

Senior Lecturer
Peki, M.M., PhD (Tokyo), MSc (TUAT), BScFor (PNGUT), DipFor (FORCOL).

Yosi, C.K., PhD (UniMelb), MSc (Wales), BScFor (PNGUT), DipFor (FORCOL)

Lecturer
Edwin, P., MSc (UniMelb), BScFor(PNGUT) (On PhD study Melbourne Uni)

Pokon, R., MPhil. (PNGUT), BScFor(PNGUT).

Zure, D., MSc (PNGUT), BScFor (PNGUT) (On PhD study, Taiwan)

Jeremiah, H., MSc. (Beijing Forestry University, China).PGDAg (PNGUT), BScFor(PNGUT), Wana L., MSc GIS (PNGUOT), BScFor(PNGUT)

Senior Technical Officer
Tito, W., Dipl Lab Tech &Cert in Lab. Skill, TAFE, Inter. Western Aust., BScFor (PNGUT)

Feriwok, C., BSc For PNGUT), DipFor (PNGUT)

Technical Officer
Vinas, A. Herbarium Curator Cert (FORCOL)
Moripi, L, BScFor (PNGUT)

Ono. P., BScFor (PNGUOT)

Aisi, C. Grade 10

Computer Operator
Nona, J., CISCO Cert.

Storeman
Isom, Y., Cert.PETT(TFTC)

Secretarial
Bomoteng, E., DipITheol (CFNI) Cert Sec Studies (LaeTech)

Steven, B., BasicSecCert (LTC)

BULOLO CAMPUS

Principal
Maiguo, E., MFor (ANU), Grad.Dip(ANU) BScFor (PNGUT), DipFor (FORCOL), Grad. Cert. Scicom (PNGUT)

Lecturer
Baput, Bazakie, MSc Environ. (Univ Melbourne), BScFor (PNGUT).

Gusamo, B., MSc (Wales), DipFor (FORCOL) Gebia, O., MPhil (PNGUT), DipFor (FORCOL)

Warra, T MSc (James Cook), PGDFor (PNGUT), BScFor (PNGUT)

Senior Technical Instructor
Veisami, L., BScFor (PNGUT), DipFor (FORCOL)

Technical Instructor
Beko, J MPhil (PNGUT), PNGFor (PNGUT), BScFor (PNGUT)

Hansutan, L, BSc (UPNG)

Menin, P.BSc (UPNG)

Technical Officer
Aguadi, S., BScFor (PNGUT)

Alis, K., BScFor (PNGUT)

Secretarial
Menin, M., SecCert (LTC), Advance Cert. Computing (CTC)

Administrative
Yasepsa, K., BAcc (PNGUT)

Nohuan, T., Cert. Police (PolTrain)

Lenza, D,Cert. Accounting (LaeBus)

Gonopan, A. SecCert (ComTrain, Lae)

Library
Asari, D.Cert. Information Technology (ITI)

Gwason, Y.Grade 10 Cert. (CODE)
POSTGRADUATE PROGRAMS IN FORESTRY

Scope and Coverage

Postgraduate studies in Forestry provide advanced training in tropical forestry systems, inventory and products. Specializations include wood science & technology; biodiversity and ecology; forest assessment/inventory and management; biometrics and mensuration; carbon and biomass measurement for climate change mitigation; agroforestry and community forestry, forest engineering and operations; environmental rehabilitation. The study program is designed to meet employment and career needs, starting with recently graduating B.S. Forestry graduates seeking to improve job-seeking prospects, and extending to career foresters who wish to upgrade their formal education credentials.

Program Educational Objectives (PEO):

PEO1: Graduate will have developed a foundation in tropical forestry systems, forest inventory & management and products to improve lives and livelihoods through a successful career in forestry

PEO2: Graduates will have become effective collaborators and innovators, leading or participating in efforts to address scientific, social, technical and forest products industrial challenges

PEO3: Graduates will have engaged in life-long learning and professional development through self-study, formal and informal education and professional studies in Forestry sciences and closely related disciplines

Program Outcomes (POs):

PO1: Apply scientific knowledge, skills and technology to sustainably management and improve forest resources

PO2: Demonstrate knowledge and understanding of a range of basic concepts and fundamental principles that underpin wood science and technology

PO3: Demonstrate an understanding of the socio-economic benefits and values of extractive and no extractive values of forest resources

PO4: Understand policies of other stakeholders that support forestry products at national and international levels

PO5: Demonstrate and apply entrepreneurial skills and knowledge in forestry projects

PO6: Communicate forestry ideas and information using appropriate forestry extension methods

PO7: Identify and analyze issues affecting forest resources and management for

PO8: Demonstrate understanding to diagnose the roles of forest in counteracting climate change and communicate them to communities effectively

Applying for Study

Competitive applications require that intending applicants make advance personal contact with potential faculty supervisors and collaboratively develop an approved initial proposal that can be attached to the application.

Study Options (all full-time study)

(1) Postgraduate Diploma in Forestry (PGD) (1 year, coursework + research, resulting in Project report);

(2) Master of Forest Science (MSc) (2 years, coursework + research, resulting in Thesis);

(3) Forestry Master of Philosophy (MPhil) (2 years, research, resulting in Thesis).

The PGD is recommended as starting point for postgraduate studies unless the applicant has demonstrated exceptional science writing skill, earned high marks in a final year project, and/or earned a bachelor's degree with distinction.
Upon high recommendation by their supervisor and head of the department, students who complete their PGD on time can be invited to upgrade to the M.S. Forestry (requiring an additional year of full-time research and successful thesis submission).

A research-only PhD program is available in specialized fields of forestry where faculty supervisory capacity and time exists; opportunities announced in the current year’s Unitech postgraduate study advertisement (usually June).

**Study Requirements**

Both the PGD and M.S. degree study programs involve a mixture of required and elective courses. Not all elective courses are taught every year. For further details on general structure, consult "Procedures for Higher Degree Candidates" and the most recent University Calendar.

**Assessments**

All courses are assessed in varying combinations of reports, literature assessments and other assignments, tests, fieldwork, analytical discussions (via ‘journal club’ formats) and/or final examinations. Assessment tools are flexibly applied according to the number of students in class.

Projects/Theses are graded as Satisfactory or Unsatisfactory, with satisfactory grades required in all courses to earn the postgraduate diploma/degree.

**List of Forestry Postgraduate Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Weekly Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRP501</td>
<td>Research Project (Semester 1)</td>
<td>10 (15-18)</td>
</tr>
<tr>
<td>FRP502</td>
<td>Research Project (Semester 2)</td>
<td>6 (17)</td>
</tr>
<tr>
<td>FRP511/611</td>
<td>Research Methodology</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP513/613</td>
<td>Problem Solving and Presentation of Research Findings</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP516/616</td>
<td>Community Management of Land and Natural Resources</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP520/620</td>
<td>Mechanical and Physical Properties of Wood</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP522/622</td>
<td>Timber Utilization and Technology</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP528/628</td>
<td>Biodiversity Characterisations for Multi-Purpose Forest Inventory</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP531/631</td>
<td>Ecological Principles and Applications in PNG Forests</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP532/632</td>
<td>Forest Health and Protection</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP534/634</td>
<td>Tree Physiology and Ecophysiology</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP536/636</td>
<td>Forest Genetics</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP538/638</td>
<td>Plantation Management</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP540/640</td>
<td>Forest Biometrics</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP542/642</td>
<td>Forest Mensuration and Assessment</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP551/651</td>
<td>Forest Project Planning, Analysis and Management</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP552/652</td>
<td>Agroforestry Management</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP561/661</td>
<td>Forest Operations</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP562/662</td>
<td>Hydrology and Watershed Management</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP575/675</td>
<td>Social Environmental Soundness (SES) and Climate Change</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP578/678</td>
<td>Land Use Planning and Climate Change</td>
<td>4 (6-18)</td>
</tr>
<tr>
<td>FRP601</td>
<td>Research Project</td>
<td>4 (6-18)</td>
</tr>
</tbody>
</table>

**Generalized Course Structure**

(1) POST GRADUATE DIPLOMA (PGD) IN FORESTRY

**First Semester**

**Core Subjects:**

- **Research Project**: FRP501 (10 credits)
- **Research Methodology**: FRP511 (6 credits)
- **Problem Solving and Presentation of Research Findings**: FRP513 (4 credits)
- **Community Management of Land and Natural Resources**: FRP516 (4 credits)
- **Mechanical and Physical Properties of Wood**: FRP520 (4 credits)
- **Timber Utilization and Technology**: FRP522 (4 credits)

**Elective Subjects:** Choice of one course designed by “*” in Schedule 2 list (2x4) = 4 credits

**Total Credits:** 24 (45-48)
## Second Semester

**Core Subjects:**
- FRP502 Project (continues from Semester 1) 12 (15-18)
- FRP516 Community Management of Land and Natural Resources 4 (12)

**Elective Subjects:** Choice of two courses NOT designed by '*' in Schedule 2 list (2 x 4) 8 (12-36)

**Total** 24 (39-66)

### (2) MASTER OF SCIENCE (M.Sc.) IN FORESTRY

#### YEAR 1, First Semester

**Core Subjects:**
- Code Subject Weekly Hours (credits)
  - FRP611 Research Methodology 6 (17)
  - FRP613 Problem Solving in Forestry and Presentation of Research Findings 4 (13)

**Elective Subjects:** Choice of two courses designed by '*' in Schedule 2 list (2x4) 8 (12-36)

**Total** 18 (42-66)

#### YEAR 1, Second Semester

**Core Subjects:**
- FRP601 Research Project 10 (15-18)
- FRP616 Community Management of Land and Natural Resources 4 (12)

**Elective Subjects:** Choice of two courses NOT designed by '*' in Schedule 2 list (2 x 4) 8 (12-36)

**Total** 18 (39-66)

#### YEAR 2, First Semester, Second Semester
- FRP601 Research Project 10 (15-18)

## COURSES SCHEDULES

### SCHEDULE 1: CORE (required) Courses

**Note:** '500' series = PGD; '600' series = MSc

- FRP511/611 Research Methodology 6 (17)
- FRP513/613 Problem Solving in Forestry and Presentation of Research Findings 4 (13)
- FRP516/616 Community Management of Land and Natural Resources 4 (12)
- FRP501/FRP502 Research Project 10 (15-18)
- FRP601 Thesis 10 (15-18)

### SCHEDULE 2: ELECTIVE Courses (ALL)

#### Wood Science and Technology
- FRP520/620 Mechanical and Physical Properties of Wood 4 (13)
- FRP522/622 Timber Utilization and Technology 4 (13)

#### Forest Biodiversity, Ecology, Breeding and Protection
- FRP528/628 Biodiversity Characterisations for Multi-Purpose Forest Inventory 4 (13)
- FRP531/631 Ecological Principles & Applications in PNG Forests 4 (6)*
- FRP532/632 Forest Health and Protection 4 (6)
- FRP534/634 Tree Physiology and Ecophysiology 4 (9)
- FRP536/636 Forest Genetics 4(15)
- FRP538/638 Plantation Management 4(12)

#### Forest Biometrics and Mensuration
- FRP540/640 Forest Biometrics 4(13)
- FRP542/642 Forest Mensuration and Assessment 4(13)

#### Forest Planning and Development
- FRP551/651 Forest Project Planning,
Analysis and Management 4 (9)*  

**Agroforestry and Community Forestry**  
FRP552/652 Agroforestry Management 4(18)

**Forest Engineering and Operations**  
FRP561/661 Forest Operations 4(13)*  
FRP562/662 Hydrology and Watershed Management 4(18)

**Carbon, Biomass Measurement and Climate Change**  
FRP575/675 Social, Environmental Soundness and Climate Change 4(13)*  
FRP578/678 Land Use Planning and Climate Change 4(13)

**ALLOWABLE ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS**

**Semester 1:**  
AG531 Soil and Water Conservation Engineering 4 (6)*

**Semester 2:**  
MAP54 Probability and Statistics 4(13)

* - Offered in Semester 1 only; the remainder of Schedule 2 subjects are offered only in Semester 2.

---

**COURSE DESCRIPTIONS**

**FRP 501/FRP502: RESEARCH PROJECT**

**FRP 601: THESIS**

Common Credit: 15-18 [Core]  
Hours per week: 10-12

---

**Learning Outcomes**

On completion of the subject, the students would be able to:

LO1. Identify the main activities of a typical forestry project involving investigation, research and/or field or laboratory execution.

LO2. Plan a detailed schedule of activities (from beginning to end) in order to meet project deadlines.

LO3. Apply skills and knowledge from a broad array of forestry-related subjects, including social science, cultural anthropology or engineering.

LO4. Create and produce a comprehensible written thesis in an accepted, convention format that reports on the results of a piece of research related to forestry.

LO5. Present the discussions/results using effective communication skills.

LO6. Demonstrate greatly improved capacity in the specialized area of forestry of the student's choice.

---

**Syllabus**

Topics of the research project will be chosen in consultation with the supervisor in the area of interest or specialization. Students are expected to prepare objectives, carry out a literature review on the topic, use appropriate reference and citation protocols (for example: APA or Chicago Style), and propose the methodology of research during the first semester. These will form the basis of a seminar presentation by the student during the semester. The project work itself will be executed by the student following a standard procedure. The student is expected to present the results of his/her work in at least one month before the Semester 2 examinations. The dissertation will be examined by two or three examiners recommended by the Head of Department and approved by the Higher Degree Committee.

---

**Assessment**

Continuous assessment seminar, dissertation 100%
### FRP 511/611: RESEARCH METHODOLOGY

**Common Credit:** 17 [Core]
**Hours per week:** 6 (2 Lecture/3 Tutorial/1 Field)

**Learning Outcomes**
On completion of the subject, the students would be able to:

- **LO1.** Determine the best experimental design for various types of forestry and other related experiments,
- **LO2.** Analyze and critically interpret different results from different experimental designs,
- **LO3.** Analyze various types of qualitative and quantitative data,
- **LO4.** Apply appropriate computer software to facilitate forestry planning, management and experimentation,
- **LO5.** Demonstrate an understanding of social-cultural considerations related to indigenous vs. western-style scientific investigations;
- **LO6.** Present proper research results effectively.

**Syllabus**
General approach to research, analysis and evaluation procedures used in forestry experimentation. Planning and design of controlled field experimentation with emphasis on commercial trees and trees for agroforestry and other socio-cultural aspects of biodiversity or community-based forest management within the PNG context. This may include (but not be exclusively limited to), selection of treatments, demonstration and layout of designs in the field, on-field collection of qualitative and quantitative data, interpretation of experimental results, interpretation of ethnographic data (from participant observation) or other qualitative methodology. This will include the planning and implementation of semi-structured questionnaires (surveys), use of qualitative and quantitative methods for data collection from communities, villages or individuals, and subsequent analysis of results using appropriate computer software. Students will become familiar with the use of computers, analysis of results, and scientific publication submissions and presentation of good research results.

### References


**Assessment:**
- Continuous Assessment 50%
- Written Examination 50%

### FRP 513/613: PROBLEM SOLVING AND PRESENTATION OF RESEARCH FINDINGS

**Common Credit:** 13 [Core]
**Hours per week:** 4 (2 Lecture/2 Tutorial)

**Learning Outcomes**
On completion of the subject, the students would be able to:

- **LO1.** Apply different reasoning strategies that can be powerfully used to solve problems
- **LO2.** Apply elements of creative thinking, including application of basic steps in the scientific method.
- **LO3.** Develop and propose research questions, formulate hypotheses, and propose research questions in forestry and about forests through initial observation and analysis, leading to formulation of a hypothesis.
- **LO4.** Assess a problem and informal collection of preliminary data.
- **LO5.** Apply different approaches involved in answering research questions, including basic data analysis.
- **LO6.** Create and present data tables and charts, using appropriate spreadsheet and presentation software.
**Department of Forestry**

### Syllabus

Evolution of problem-solving approaches in science, including the scientific method.

**Problem solving approaches:** Critical analysis and reasoning (deductive, inductive); progressive steps in problem solving; elements of creative thinking.

**Formulation of research questions:** Inferences and observations to develop research questions, refined into testable hypotheses; data analysis techniques, including picking out trends and patterns.

**Answering research questions:** Identifying trends and patterns in the data; avoidance of cherry-picking and data fishing.

**Data presentation:** Techniques for effective communication via charts and tables; presentation software and oral communication techniques.

### References


### Assessment:

- Continuous Assessment: 50%
- Written Examination: 50%

### FRP 516/616: COMMUNITY MANAGEMENT OF LAND AND NATURAL RESOURCES

**Common Credit:** 12

**Hours per week:** 4 (2 Lecture/2 Project)

### Learning Outcomes

On completion of the subject, the students would be able to:

- **LO1.** Describe how PNG communities function and how they can fully participate in sustainable land use systems, for their own livelihood and that of the economy of the country;
- **LO2.** Demonstrate a sound understanding of the principles and theories underpinning community participation in management;
- **LO3.** Describe important processes and techniques of group facilitation, participatory appraisal, planning and collaborative management of resources.

### Syllabus

- Land tenure in PNG, customary ownership of land, use rights in land (and trees), land conveyance, incorporated land group, integrated cropping systems, sustainability and productivity, philosophy and evolution of participation and community management, models of community management of forests and other natural resources, policy and institutional issues in community management, process and techniques in participatory enquiry, planning and management, forms of evaluation in community management programs and conflict management.

### References

FRP 520/620: MECHANICAL AND PHYSICAL PROPERTIES OF WOOD

Common Credit: 13
Hours per week: 4 (2 Lecture/2 Tutorial)

Learning Outcomes
On completion of the subject, students would be able to:
LO1. Identify common species of commercial PNG wood,
LO2. Interpret wood samples and report its qualities and properties proficiently,
LO3. Compare wood physical and mechanical properties for industrial standards,
LO4. Recommend appropriate wood (or timber) for structural and non-structural purposes,

Syllabus
Gross wood structure, anatomical features and properties including identification and measurement, wood macro-structure, mechanical and physical properties including industrial standards, testing methods, grading and evaluation of wood based materials for structural and non-structural purposes.

References

Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 522/622: TIMBER UTILIZATION AND TECHNOLOGY

Common Credit: 13
Hours per week: 4 (2 Lecture/2 Tutorial)

Learning Outcomes
On completion of the subject, the students would be able to:
LO1. Identify and produce different types of timber products;
LO2. Demonstrate the treatment of the product for durability and its marketability;
LO3. Illustrate the visual grading and machine stress grading and acquire knowledge of wood utilization as a whole;
LO4. Interpret the specifications and strength required for timber design;
LO5. Use the basic principles of timber engineering in wood structure design and construction.

Syllabus
Commercial timber species of PNG, wood quality and utilization, design and interpretation of wood quality surveys, principles of timber engineering, the design and specification of timber, timber preservation, timber drying and standards, wood chemical properties, especially for wood pulping, species selection and use of wood products in construction, clear wood
sampling and strength properties, visual grading, machine stress grading, serviceability and design philosophy, types of timber products, cost of production and market structures.

References

Assessment
Continuous Assessment 50%
Written Examination 50%

FRP528/628: BIODIVERSITY CHARACTERISATION FOR MULTI-PURPOSE FOREST INVENTORY

Common Credit: 9
Hours per week: 4 (1 Lecture/1 Practical/1 Project)

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Describe the most commonly used survey methods and technology for assessing site biodiversity of major taxonomic groups used today in forest inventory.
LO2. Interpret issues that different habitats place on assessment of biodiversity.

LO3. Illustrate and Plan out the best possible sampling scheme for different floral growth forms, and different faunal groups.
LO4. Apply survey methods and technology, as well as how to analyse the data, from a selected taxonomic group of interest to the student.
LO5. Identify types of statistical methods are used most commonly in analysing biodiversity assessment data.

Syllabus
Biodiversity survey planning for PNG

Biodiversity characterisation: Qualitative (incl. species lists) versus quantitative; rapid assessment
Biodiversity sampling: total counts, timed searches, quadrats, distance sampling, line and strip transects, point counts, trapping webs, removal method, mark-recapture techniques; survey methodology for trees, forest vascular plants (general), amphibians, reptile, bats, Mammals (general), birds, Butterflies, moths, ants.
Biodiversity data analysis: Parametric and nonparametric statistics applied; use of spreadsheets in biodiversity assessments.

References:
[various] RAP Bulletin of Biological Assessments publ by Conservation Intl, Center for Applied Biodiversity Science (CABS). [selected numbers]
McDiarmid, R. W., M. S. Foster, C. Guyer, J. W.
**FRP 531/631: ECOLOGICAL PRINCIPLES AND APPLICATIONS IN PNG FORESTS**

**Common Credit: 6**

**Hours per week: 4 (3 Practical/1 Project)**

**Learning Outcomes**

On completion of the subject, the students would be able to:

- LO1. Identify concepts and principles of ecology in the context of characterising and understanding tropical and subtropical ecosystems of PNG.

- LO2. Apply ecological principles to design and implement an inventory of a forest area, including its biodiversity.

- LO3. Identify ecological problem and propose a methodology that would allow the problem to be solved conclusively.

- LO4. Conduct rapid assessment of an ecological problem that yields enough preliminary data to determine whether the problem should be investigated further.

**Syllabus**

Concepts and principles of ecology in the tropical and subtropical ecosystems, the processes occurring within these ecosystems and importance of ecology in the sustainable management of forests, assessment and management of biodiversity values of forests.

**References**


**Assessment:**

Continuous Assessment 100%

[includes a biodiversity assessment major project]

**FRP 532/632: FOREST HEALTH AND PROTECTION**

**Common Credit: 6**

**Hours per week: 4 (3 Practical/1 Project)**

**Learning Outcomes**

On completion of the subject, the students would be able to:

- LO1. Identify a range of common insect pests and plant diseases affecting PNG trees OM plantations and natural situations;

- LO2. Develop strategies and plans that minimize the negative effect of significant pest and disease species on both natural and plantation forests.

- LO3. Demonstrate an understanding forest fire and its behaviours to be able to institute appropriate measures to minimize its effect on the forest ecosystem.

**Syllabus**

Common insect pests and plant diseases, plant pathogens and abiotic agents, population dynamics of insects and plants and integrated pest management, which may involve biological control agents. Climatic factors that affect weather patterns and fire ecology and management, as well as the use of fire as a prescribed management tool.

**References**

Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 534/634: TREE PHYSIOLOGY AND ECOPHYSIOLOGY

Common Credit: 9
Hours per week: 4 (4 Tutorial)

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Investigate how environmental factors affect life functions of trees and develop workable strategies on how to respond to negative factors.

LO2. Identify the effects of varied soil characteristics on the capacity and capability of growth in commercial trees and other flora.

Syllabus
Photosynthesis, respiration, nutrient relations and water use, trees responses to stress due to environmental factors, including responses to global climate changes and carbon sequestration. Root growth of commercial timber species, fertilizer requirements of such species (natural and plantation), comparison of performance of seedlings, forest soils and nutritional recycling in natural forests and plantations.

References


Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 536/636: FOREST GENETICS

Common Credit: 15
Hours per week: 4 (3 Lecture/1 Tutorial)

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Demonstrate the basic principles of genetics
and provide illustrative examples.

LO2. Identify examples of the application of genetics to both natural forest and plantation and wider ecosystem management.

Syllabus
Principles of genetics, principles and methods of forest tree breeding, quantitative genetic approaches to tree improvement, methods, concepts and case studies in breeding for increased yield and quality of plant products, breeding for disease and insect resistance or tolerance in plants, and other genetic and breeding techniques.

References

Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 538/638: PLANTATION MANAGEMENT
Common Credit: 12
Hours per week: 4 (2 Lecture/2 Practical)

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Describe in some depth the principles and practices of the development and management of plantations.
LO2. Interpret the various ways in which plantation management contributes to sustainable forest management in the more holistic sense.

Syllabus
Designs of plantation; plant propagation, covering seedling production; vegetative and tissue culture; growth and development of stands; role of disturbance (natural and man-made); ecosystem stability and evolution of silvicultural methods in tropical rainforests.

References

Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 540/640: FOREST BIOMETRICS
Common Credit: 13
Hours per week: 4 (2 Lecture/2 Tutorial)

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Adopt appropriate techniques of data gathering in biological science,
LO2. Demonstrate appropriate statistical methods, using appropriate statistical software, to accurately and successfully analyze a variety of forestry-related data sets.

Syllabus
Elementary descriptive statistics, basic probability theory, random variables and their basic properties, standard probability distributions: Binomial, Poisson, uniform, normal, the Central Limit Theorem, point and interval estimation of parameters of probability distributions, hypothesis testing: critical region, size and power, applications of the normal, t and X² distributions, linear regression and an introduction to multiple regressions, analysis of variance and the Kruskal-Wallis test, design of
experiments: one- and two-way classification, factorial designs, and analysis of residuals, and use of the computer in statistical analysis, with special reference to the statistical package (e.g. Microsoft Excel, MINITAB etc.).

References

Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 542/642: FOREST MENSURATION AND ASSESSMENT

Common Credit: 13
Hours per week: 4(2 Lecture/2Tutorial)

Learning Outcomes:
On completion of the subject, the students would be able to:

LO1. Correctly selects and utilizes all standard forest measurement equipment effectively;
LO2. Evaluate and minimize various sources of error;
LO3. Accurately measure tree and stand values for diameter, height, volume, defects;
LO4. Construct and evaluate volume based upon accurate measurements of appropriate parameters
LO5. Construct comprehensive yield tables;
LO6. Apply standard statistical techniques to sampling processes, to the evaluation of tree and stand variables, and to the development of basic growth and yield models.

Syllabus
Tree measurement techniques (dbh, height, bark and crown), defects, geometry of stem volume, stem analysis, volume increment, stand basal area and volume, density, volume tables, yield tables, explanatory and predictive models for tree and stand growth, parameter estimation, site quality, sampling techniques (random, stratified and systematic samples).

References

Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 551/651: FOREST PROJECT PLANNING, ANALYSIS AND MANAGEMENT

Common Credit: 9
Hours per week: 4 (1 Lecture/3 Project)

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Identify various processes and procedures of operating large-scale logging companies whose operations are directly inclined to PNG Logging Code of Practice standards and policy matters required under the forest policy and Forestry Act 1991 amended (1996 & 2000).
LO2. Illustrate balanced view between interrelated forestry projects and ascertain of promising job market available in the future.
LO3. Compare the project operations and management options between the forestry related (non-extractive) and extractive
industries in regard to environment issues.

**Syllabus**
Project identification, formulation, analysis, documentation, appraisal, implementation and review; the need for undertaking environmental impact statements (EIS) and social impact assessment (SIA) in forestry development projects, financial analysis of forestry projects; values of other environmental goods and services; and the impact of government regulation.

**References**

**Assessment**
Continuous Assessment 50%
Written Examination 50%

**FRP 552/652: AGROFORESTRY MANAGEMENT**

**Common Credit**: 18
**Hours per week**: 4 (3 Lecture/1 Practical)

**Learning Outcomes**
On completion of the subject, the students would be able to:

LO1. Provide useful information and assistance to community groups who wish to engage in agroforestry activities.
LO2. Differentiate different socio-economic and environmental situations, develop realistic plans and strategies for specific agroforestry activities that can contribute to sustainable forest management.

**Syllabus**
Agroforestry management principles, crop and livestock production systems, fuel wood plantations, shade, shelter, nutrient, soil stability, organic matter, timber sales, processing and sales of small woodlot produce, problems with managing community forests, community consultation and participation, land protection, tree and crop combinations, community forestry, costs and benefits of community forests and support systems for community forest owners.

**References**

**Assessment**
Continuous Assessment 50%
Written Examination 50%

**FRP 554/654: GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING FOR NATURAL RESOURCE MANAGEMENT**

**Common Credit**: 15
**Hours per week**: 4 (3 Lecture/1 Project)
**Learning Outcomes**

On completion of the subject, the students would be able to:

LO1. Demonstrate data input, design, output, analysis and management in Geographic Information Systems,

LO2. Interpret remote sensing principles and application including air photo interpretation,

LO3. Illustrate the use of PC vector and raster GIS, able to use PNG geographic datasets and digital mapping sources in forest resource management

LO4. Develop the ability to design and complete a spatial analysis.

**Syllabus**

Geographic information systems, as in data input, design, output, analysis and management, remote sensing principles and application – including air photo interpretation, use of PC vector and raster GIS, and PNG geographic datasets and digital mapping sources and their applications.

**References**

Amando, A., (1999). *GIS Applications in Tropical Forestry*. Toowomba Distance Education Centre, Qld.


**Assessment**

Continuous Assessment 50%

Written Examination 50%

---

**FRP 561/661: FOREST OPERATIONS**

**Common Credit:** 13

**Hours per week:** 4 (2 Lecture/2Tutorial)

**Learning Outcomes**

On completion of the subject, the students would be able to:

LO1. Plan various operational activities in forestry design and construct logistics of roads, bridges, culverts, drainage structures and other operational infrastructures.

LO2. Conduct resource survey and mapping. Perform complete short term and long-term logging plan.

LO3. Understand reduced impact logging and demonstrate impact of logging and road construction and subsequent environmental conservation.

LO4. Understand safety and ergonomics, and can apply in the operational workplace. Apply the knowledge of impact of operational activities on wood products quality, certification and marketing.

**Syllabus**

Basic map reading and interpretation for design of resource surveys and preparation of annual, five yearly logging and set up plans, road alignment and construction, use of equipment for harvesting and roading, including some understanding of the operational cost of these equipment, procedures for the monitoring and controlling of timber harvesting in PNG, the PNG Logging Code of Practice, Log Export Procedures, and other guidelines as is current and applicable in PNG and internationally that relates to timber product development and marketing.

**References**


Assessment
Continuous Assessment 50%
Written Examination 50%

FRP562/662: HYDROLOGY AND WATERSHED MANAGEMENT

Common Credit: 13
Hours per week: 4 (2 Lecture/2 Tutorial)

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Interpret hydrology, hydrological cycles and its influence on land and water resources,
LO2. Illustrate soil water relation, infiltration, percolation, ground water flow and storage, and ground water recharge,
LO3. Interpret overland flow, stream flow behavior and stream channel design,
LO4. Illustrate behavior of catchment, drainage basin and watershed in relation to land, water and plant life,
LO5. Illustrate and interpret soil erosion and sedimentation process and their impacts on forested watershed,
LO6. Demonstrate soil conservation and watershed development planning

Syllabus
Hydrology: Hydrology and forestry, hydrologic cycle, meteorological data, precipitation, infiltration, percolation, soil water relation, ground water table, aquifers, groundwater flow, hydraulics of wells, evaporation, overland flow, stream flow and stream flow hydrograph, flow measurement in streams, stream channel and drainage design.

Watershed: Concepts of watershed and its management, surface and underground features, watershed depth, soil erosion and sedimentation process and their impacts on forested watershed, forest operations vs. soil erosion, principles of soil conservation, mechanical, vegetative, agronomic and management based measures of soil conservation in upland watershed; soil conservation structures, planning for watershed development.

References

Assessment
Continuous Assessment 50%
Written Examination 50%
Prerequisites
FR 390 Introduction to Climate Change

Learning Outcomes
On completion of the subject, the students would be able to:

LO1. Interpret and analyse social and environmental "soundness" and underlying conceptual frameworks, in order to explain how they fit into larger contexts of climate change, climate change mitigation, and climate justice debates.

LO2. Describe, explain the purpose, and apply a variety of relevant tools for addressing soundness.

LO3. Appraise how gender issues relate to REDD+ and cut across various other concepts.

LO4. Explain how safeguard mechanisms and approaches are being used in practice.

LO5. Evaluate social, environmental, and economic costs and benefits, risks and opportunities associated with REDD+ and with other PES or conservation programs and projects.

LO6. Synthesize a range of social, economic, and environmental considerations for application in REDD+ projects and safeguard mechanisms and assess real-world REDD+ and safeguard design and implementation.

Syllabus
Elements of social and environmental soundness and its larger climate change context, introduction and background, relevant, contemporary social and environmental issues related to climate change; techniques to strengthen design and implementation of REDD+ projects; state of the art examples; component synthesis and integration into REDD+ programmes.

References:

Development. 5, September: 173-176.


Assessment
Continuous Assessment 50%
Written Examination 50%

FRP 578/678: LAND USE PLANNING AND CLIMATE CHANGE (LUPCC)

Common Credit: 13
Hours per week: 4 (2 Lecture/2 Tutorial)

Prerequisites
FR 390: Introduction to Climate Change

Learning Outcomes
On completion of the subject, the students would
be able to:

LO1. Develop an adaptive management framework for land use planning under uncertain climate patterns and policy regimes
LO2. Develop approaches for quantifying drivers of historic land use patterns in a changing climate
LO3. Develop scenario planning and cost-benefit analysis that takes climate adaptation and mitigation strategies (environmental, social and economic) into consideration.
LO4. Describe a process that leads to a negotiated agreement.
LO5. Construct a Monitoring and Evaluation framework for land use planning that is tailored to a changing climate
LO6. Integrate information from multiple disciplines

Syllabus
Institutional framework: Low Emission Land Use Planning Framework (National level scale down to community initiatives); assessment of current conditions (defining drivers); analysis of options; negotiation and prioritization of implementation plan; monitoring and evaluation following implementation.

References
GTZ and IUCN (2000) Co-management of Natural Resources
UNDP Handbook on Monitoring and Evaluating for Results.

Assessment
Continuous Assessment 50%
Written Examination 50%
Department of Mathematics and Computer Science

A/Head of Department:
Benny, S., MSc (S Korea), BSc (PNGUoT)

Deputy Head of Department:
Angopa, B., BSc (UPNG)

Professors:
Ursul, M., PhD (Moldova), Dr. Sc (Russia)

Senior Lecturers:
Wilkins, C.W., PhD, BSc, DipEd (Adel)
Mirou, B., MSc (Aberystwith), BSc (UPNG)

Lecturer 2:

Lecturer 1:
Lanta, J., MSc. (Aust), B.Sc. (UPNG),
Pg.Dip.Ed. (UPNG)
Nerit, L., MSc (NZ), B.Sc (PNGUoT)
Benny, S., MSc (South Korea), BSc (PNGUoT)

Senior Technical Instructors:
Puy, N., BSc. (PNGUOT)
Tahie, J.M., MEd. (DWU) BEd. (UOG), Pg.Dip.Mx (PNGUot)

Technical Instructors:
Chris, Priscilla, BSc. (UPNG)
Angopa, B., BSc (UPNG)
Angra, I., BSc (UPNG)
Abuzo, S., BSc (PNGUOT)
Tom, S., BSc (UPNGUOT)
Tapo, Y., BSc (PNGUOT)

Technical Officer:
Abel, S., Dip IT(IBM-Pom)

Executive Secretary:
Agum, B.

Secretary:
Gaiwari, P

Administrative Officer:
Banit, S., Dip HRM (IT-Lae)

Maths Print Shop:
Maths Print Shop

Senior Technical Officer – Printer Litho
Naya, G.

Assistant Printer Litho
Arapi, S.
**POSTGRADUATE COURSES**

The Department offers three Postgraduate Diploma programs:
1. Postgraduate Diploma in Engineering Mathematics
2. Postgraduate Diploma in Mathematics
3. Postgraduate Diploma in Computer Science

The Department provides a range of postgraduate subjects in Mathematics, Statistics, and Computer Science for graduates who are preparing for higher degree studies and for those who require additional courses beyond the scope of their present training and skills.

The Diploma are practical in nature so those students who graduate will have skills, which can be readily used in Papua New Guinea. Candidates for these programs are normally expected to be graduates in mathematics, engineering, or computer science. Candidates without the prerequisite knowledge will be asked to take undergraduate subjects or formative modules before they start the Diploma.

In order to complete the Postgraduate Diploma candidates must take SIX subjects, and normally take a project equivalent to TWO subjects. In special cases two subjects may replace the project. These six (or eight) subjects can be chosen from the following lists of postgraduate subjects, but subject to the core subjects normally being studied first. Diploma advisers will help students to select a set of appropriate subjects. Approved postgraduate subjects may be taken with other Departments of the University. The balance of the six courses (particularly the core subjects) and the project area will determine which Diploma is awarded.

**POSTGRADUATE SUBJECTS**

- MAP161  Mathematics CE (A)
- MAP162  Mathematics CE (B)
- MAP51  Real Analysis
- MAP52  Linear Algebra
- MAP53  Operations Research
- MAP54  Probability and Statistics
- MAP55  Significant Aspects of Computer Science
- MAP56  Graph Theory and Applications
- MAP57  Special Functions and Methods of Mathematical Physics
- MAP58  Numerical Methods
- MAP59  Mechanics and Fluid Dynamics
- MAP60  Object Oriented Programming
- MAP61  Data Communications and Networking
- MAP62  Computer Programming
- MAP63  Operating Systems
- MAP64  Database Development
- MAP65  Software Engineering
- MAP66  Artificial Intelligence and Expert Systems
- MAP67  Analysis of Algorithms
- MAP68  Systems Programming with C++
- MAP69  User Interface Design
- MAP70  Real Time Programming
- MAP71  Complex Analysis
- MAP72  Algebraic Structures
- MAP73  Number Theory
- MAP74  Transportation and Network Flow Problems

**POSTGRADUATE DIPLOMA IN COMPUTER SCIENCE**

**Program Outcomes (POs)**

On completion of the program, the graduates should be able to:
1. Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.
2. Do research, and critically analyse, through review and analysis of current research literature, and solve complex problems using various tools.
3. Demonstrate critical awareness of current legal, social, ethical and professional issues within the discipline.
4. Make informed judgements with incomplete or inconsistent data, or where there are no professional or ethical codes or practices for guidance.
5. Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain.

**Entry Requirements**

Before starting the Post Graduate Diploma in Computer Science students should have a basic knowledge and experience with a modern microcomputer operating system, computer architecture, logic, algorithms and their coding in a higher-level language, and standard computer packages. Subjects for the Diploma include:

- MAP60 Object Oriented Programming
- MAP61 Data Communications and Networking
- MAP62 Computer Programming
- MAP63 Operating Systems
- MAP64 Database Development
- MAP65 Software Engineering
- MAP66 Artificial Intelligence and Expert Systems
- MAP67 Analysis of Algorithms
- MAP68 Systems Programming with C++
- MAP69 User Interface Design
- MAP70 Real Time Programming

**POST GRADUATE DIPLOMA IN ENGINEERING MATHEMATICS**

**Program Outcomes (POs)**

On completion of the program, the graduates should be able to:

1. Solve some problems using the methods taught
2. Assimilate complex mathematical ideas and arguments
3. Develop abstract mathematical thinking
4. Develop mathematical intuition.
5. Assimilate and communicate detailed technical arguments.
6. Apply skills learnt to problems in engineering and mathematics.
7. Develop problem-solving skills and apply them independently to problems in pure and applied mathematics.
8. Communicate effectively in writing about the subject.

**Entry Requirements**

Candidates are normally expected to be graduates in Mathematics, Engineering or Science with good performance in mathematics. Subjects for the Diploma include:

- MAP161: MATHEMATICS CE (A)
- MAP162: MATHEMATICS CE (B)
- MAP51 Real Analysis (Core Subject)
- MAP52 Linear Algebra (Core Subject)
- MAP53 Operations Research
- MAP54 Probability and Statistics (Core subject)
- MAP55 Significant Aspects of Computer Science
- MAP56 Graph Theory and Applications
- MAP57 Special Functions and Methods of Mathematical Physics
- MAP58 Numerical Methods
- MAP59 Mechanics and Fluid Dynamics.

**SUBJECT DETAILS**

**MAP 161: MATHEMATICS CE (A)**

**Hours per week:** 2 (2 Lectures)

**Prerequisite:** MA 335

**Learning Outcomes**

1. Derive equations of planes, tangents and normal in 3D,
2. Define functions as one-to-one mappings,
3. Give an epsilon-delta definition of continuity,
4. Perform advanced differentiation and integration,
5. Find Taylor series of functions,
6. Test series for convergence,
7. Perform partial differentiation,
8. Differentiate and integrate numerically,

**Syllabus**

Co-ordinate Geometry: simple co-ordinate systems,
planes, tangents, normalize, curve sketching.

Calculus: functions, limits, continuity, advanced differentiation and applications, implicit functions, mean value theorem, l'Hospital's rule, series, convergence tests, Taylor series.

Partial differentiation and applications, integration by parts, substitution, partial fractions and applications.

Simple numerical differentiation and integration, Trapezoidal Rule, Simpson Rule, Euler Rule. Ordinary differential equations, formulation from physical problems, first-order and second-order constant coefficient equations, numerical methods.

**Textbook**

**Assessment**
Continuous Assessment - 50%,
Written examination - 50% (1x3 hrs).

**MAP 162: MATHEMATICS CE (B)**

**Hours per week:** 2 (2 Lectures)

**Prerequisite:** MAP 161

**Learning Outcomes**
1. Solve sets of linear equations using Gauss methods with error and conditioning
2. Manipulate matrices and determine eigen-values and eigen-vectors,
3. Understand complex numbers and their applications to engineering; use of de Moivre's theorem,
4. Find roots of algebraic equations,
5. Use numerical methods to solve problems in one and two variables,
6. Perform descriptive statistics for the centre and spread of data, t- and other statistical tests, correlation and regression.
7. Solve probability problems using Binomial, Poisson and Normal distributions.

**Syllabus**

Statistics: Classification of data, continuous, and discrete variates, histograms, etc. Mode, median, mean, variance/standard deviation. Statistical tests, correlation, regression.

Probability: Introduction to Binomial, Poisson and Normal distributions and their applications in engineering situations.

**Textbook**

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

**MAP 51: REAL ANALYSIS**

**Hours per week:** 4 (4 Lectures)

**Learning Outcomes**
1. Apply the knowledge of limits to continuity, differential calculus and integral calculus
2. Determine convergence of infinite series and infinite integrals.
3. Evaluate line, surface and volume integrals,
4. Evaluate scalar and vector products; gradient, divergence and curl of vectors. Physical applications.
5. Apply the theorems of Gauss, Green, and Stokes to differential geometry, vector calculus and problems in mathematical physics,
6. Use Taylor's theorem with remainder term to solve problems in functions several variables including analytic solutions of partial differential equations.

**Syllabus**
Countability of rational and real numbers, quadratic surds, The continuum, the subsets of real numbers. Definition of a limit, applications, tests for convergence of infinite series. Applications to series solutions of differential equations.

Limits of functions of a continuous variable, continuous and discontinuous functions, Heine-Borel theorem. Continuous functions of several variables. Differential calculus, general theorems concerning derivatives, Rolle's theorem, the mean value theorem.

Integral Calculus, general theorems concerning integration, Areas and lengths of plane curves,
definite integrals. Differentiation of functions of several variable, small increment problems, the mean value theorem for two variables. Taylor's theorem for several variables including remainder, application to maxima and minima.
Infinite integrals, absolutely and conditionally convergent infinite integrals. Infinite products: applications and convergence.
Definition, evaluation and transformations of multiple integrals, curves and arc length, surfaces and surface area; Use of Cartesian, spherical and cylindrical co-ordinates, multiple integration of vector functions. Integrals over curves and surfaces, differential forms, vector analysis, theorems of Green, Gauss and Stokes.

**Textbook**

**Assessment**
Continuous Assessment - 40%
Written Examination - 60% (1x3hrs).

**MAP 52: LINEAR ALGEBRA**

**Hours per week:** 4 (4 Lectures)

**Learning Outcomes**
1. Perform standard vector algebra and find inner products,
2. Determine whether a given set of vectors is linearly independent,
3. Find eigen-values and eigen-vectors and apply them to the solution of problems involving differential equations and matrices,
4. Find the matrix associated with a linear transformation,
5. Find a transition matrix with a change of basis,
6. Construct an orthonormal basis for an n-dimensional inner product space.

**Syllabus**
Review of Matrix Algebra and determinants.
Vector Spaces: Fields, vector spaces, linear dependence, linear independence, basis, dimension, vector norms and inner products.
Linear Transformations: definition, the matrix of a linear transformation, transition matrix and change of basis.
The eigen-value Problem: eigen-values and eigen-vectors, Gram-Schmidt Orthogonalization process, Jordan's canonical form.
Applications chosen from the following plane geometry, equilibrium of rigid bodies, graph theory, theory of games, Markov chains, Leontiff economic models, forestry management, and computer graphics.

**Textbook**

**Reference**

**Assessment**
Continuous Assessment - 40%
Written Examination - 60% (1x3 hrs)

**MAP 53: OPERATIONS RESEARCH**

**Hours per week:** 4 (4 Lectures)

**Learning Outcomes**
1. Solve single non-linear equations and linear and non-linear systems of equations,
2. Formulate and solve linear and integer programming problems,
3. Determine the minimiser of non-linear multivariate functions both with and without constraints,
4. Simulate both simple and multiple server queues and apply performance measures,
5. Model practical problems using computer applications.

**Syllabus**
Department of Mathematics and Computer Science

Optimisation: minimising a function of several variables, search methods (grid, golden section, quadratic) alternating variables, steepest descent. Sensitivity analysis, Newton-Raphson, Davidon-Fletcher-Powell and other quasi-Newton methods. Minimisation with one or more constraints either inequality of equality constraints. Applications to pipe laying and marine populations.

Simulation: pseudo-random numbers, use of inverse cumulative distribution to sample from a probability distribution. Simple and multiple queues and their simulation using the language SIMIAN; simulation experiments - planning and performing these in relation to specific situations and producing recommendations based on the simulation's results. Performance measures.

The subject will be supported by computer packages in each area. No direct knowledge of programming is needed. The packages run under the GEM environment.

Reference
M371: Computational Mathematics (Open University, 1988).

Assessment
Continuous Assessment - 50%
Written Examination - 50% (1x3hrs).

MAP 54: PROBABILITY AND STATISTICS

Hours per week: 4 (4 Lectures)

Learning Outcomes
1. Use the terms: experiment, outcome, event, relative frequency, probability, independent experiments, conditional probability, and random variable,
2. Calculate probabilities associated with experiments with discrete and continuous outcomes,
3. Construct discrete and continuous probability distributions, and cumulative probability distributions,
4. Derive and use the Binomial, Poisson and Normal distributions, and be able to calculate the moments of these distributions,
5. Use descriptive statistics, and graphical and tabular presentation of data, effectively apply tests of significance for single populations,
6. Apply tests of significance for the difference between means of two or more populations using t-tests and analysis of variance,
7. Construct contingency tables, and perform tests of independence and goodness of fit,
8. Calculate correlation coefficients and linear regression line formulas, and perform tests of hypothesis on them.

Syllabus
Probability: Experiments, outcomes, events, relative frequencies, independent experiments, conditional probability, random variables, discrete and continuous probability distributions, cumulative probability distributions, Binomial, Poisson and Normal distributions, moments of distributions.

Statistics: Revision of descriptive statistics and graphical presentation of data. Point estimates for mean and standard deviation of Normal populations, tests of significance, the Student's t and Chi-squared distributions, interval estimates of mean and standard deviation, the F-distribution and test, comparison of variances, contingency tables and tests of goodness of fit, analysis of variance, correlation and linear regression. Some relevant applications: Analysis of experiments; Latin squares, comparison of treatments. Survey design, sampling and analysis.

Reference
Miller I. and Freund J.E., Probability and Statistics for Engineers and Scientists (Prentice-Hall, 1994).

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

MAP 55: SIGNIFICANT ASPECTS OF COMPUTER SCIENCE

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

Prerequisite
Working knowledge of a high-level programming language.

Learning Outcomes
1. Use the terminology and basic operating principles of a central processor,
2. Describe how the central processor communicates with peripheral equipment,
3. Demonstrate an understanding of the role of the Operating System,
4. Create algorithms and write programs using a
modern programming style,
5. Develop data structures and use them in programs,
6. Write macros to operate inside an applications program,
7. Demonstrate an understanding of the basics of data base design and development.

**Syllabus**
Processor architecture: Bits, bytes, words, computer logic, control, memory. Machine code, assembly code, high level languages, 4th generation languages.
Peripheral Equipment: Input and output devices, addresses, interrupts. Fetch-execute cycle.
Operating system: File organisation, single/multi user systems, single/multi tasking.
Program design: Top down design, structure, modularity, scope of variables.
Data structures: Pointers, arrays, strings, lists and operations on them.
Data bases: Flat files and relational databases. Theory of data base design.
Additional topics: Macro programming. Expert systems. Computability.

**Reference**
Stubbs D.F. and Webre, N.W., Data Structures with Abstract Data Types and Pascal (Brooks-Cole, 1985).

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

**MAP 56: GRAPH THEORY AND APPLICATIONS**

**Hours per week:** 4 (4 Lectures)

**Prerequisite:** MAP 52

**Learning Outcomes**
1. Recognize and model real-life problems using Graph Theory,
2. Select, design and use appropriate graph algorithms to solve the problems so modeled.

**Syllabus**
Graphs and sub graphs, the graph isomorphism problem, graph representation, trees, bipartite graphs.
Independent sets, cliques, chromatic number, Brook's Theorem.
Planar graphs, Euler's Formula, Kuratowski's Theorem, The Four Colour Theorem.

**Textbook**
Bondy, J. A. and Murty U.R.S., Graph Theory With Applications (North Holland, 1976).

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

**MAP 57: SPECIAL FUNCTIONS AND METHODS OF MATHEMATICAL PHYSICS**

**Hours per week:** 4 (4 Lectures)

**Prerequisite:** MAP 74

**Learning Outcomes**
1. Use methods of mathematical physics to solve ordinary and partial differential equations,
2. Use and manipulate special functions of mathematical physics,
3. Use orthogonal expansions to solve differential equations.

**Syllabus**
Fourier Series and convergence.
Laplace and Fourier transforms, inversion theorem.
Dirac delta function. Convolution theorem. Applications to problems in Mathematical Physics.
Hyper geometric functions: relations between
different types. Solution of differential equations in terms of singularities, regular and irregular singularities. P-scheme.

Partial Differential Equations: Laplace and Wave equation; solutions in terms of cylindrical and polar coordinates.

Applications to problems in heat transfer, waves (on cylinders), potential theory.

Idea of an orthogonal set of functions, expansion in terms of orthonormal functions. Use to solve differential equations.

**Textbook**
Carrier F. et. al, Functions of a Complex Variable (Mcgraw Hill 1966)

**Assessment**
Continuous Assessment - 50%
Written examination - 50% (1x3 hrs).

---

### MAP 58: NUMERICAL METHODS

**Hours per week:** 4 (4 Lectures)

**Prerequisite:** MAP 51

**Learning Outcomes**
1. Solve non-linear equations and systems of equations,
2. Use numerical methods for approximation and integration,
3. Solve ordinary and partial differential equations by numerical methods,
4. Estimate errors and assess well- and ill-conditioning.

**Syllabus**
Roots of transcendental and nonlinear equations. Systems of non-linear equations.

**Textbook**

**Reference**

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

---

### MAP 59: MECHANICS AND FLUID DYNAMICS

**Hours per week:** 4 (4 Lectures)

**Learning Outcomes**
1. Apply the laws of motion to particles and rigid bodies,
2. Calculate the fluid pressure on bodies inside a liquid,
3. Represent simple flows in terms of sources, doublets, vortices and uniform flows,
4. Apply Bernoulli's and Navier-Stokes equations in practical situations,
5. Use dimensional analysis.

**Syllabus**
Mechanics: Statics: Definitions, units, equilibrium conditions, friction, virtual work.
Dynamics: Newton's laws of motion, Applications, principle, momentum, impulse, moment of inertia, work and energy. Rotation, general plane motion.
Hydrostatics: hydrostatic forces on plane surfaces, curved surfaces and floating bodies, manometry, pressure distribution in a liquid, centre of pressure.
Fluid properties: viscosity, compressibility, surface tension. Velocity field, continuity, pressure, density, 2-dimensional flow of incompressible, inviscid fluids, Bernoulli's equation of motion, boundary conditions, stream function, stream lines, velocity potential, Flow past solid bodies, use of uniform flow, source and doublet elements to model flows.
Flow through pipes, open channels, weirs and apertures. Vortex flows and effects of viscosity; vorticity theorem and circulation, applications. Navier-Stokes equations, introduction to viscous flow, special solutions of viscous flow problems. Use of
dimensional analysis, Reynolds number. Compressible fluid flows, idea of lift and drag of aerofoils. Waves: introduction to waves on strings, standing waves, D'Alembert's solution, gravity waves, waves on beaches, tsunami's.

**Textbook**
Patterson A., A First Course in Fluid Dynamics (C.U.P., 1982)

**Reference**

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

### MAP 60: OBJECT ORIENTED PROGRAMMING

**Hours per week:** 4 (3 Lectures + 1 Lab)

**Prerequisite:** MAP 62

**Learning Outcomes**
1. Demonstrate an understanding of the ideas of object oriented programming,
2. Develop data structures using objects and classes,
3. Design and write programs using the idea of object oriented programming,
4. Understand the object oriented software technology.

**Syllabus**
Object-Oriented Programming Basics: basic concepts, classes and objects, messages, methods. Advanced issues: dynamic objects and methods, constructors and destructors, dynamic versus static objects, dynamic binding and polymorphism, exporting classes, assigning objects, arrays of objects, compound classes and objects, accessing subclasses.

Illustration of object oriented programming using classes that model objects familiar to the computer user, such as the screen, windows, the cursor. Data structures with objects: file objects, array objects, list objects, stack objects, applications of inheritance, vector and matrix objects, polynomial objects.

One of the following three examples as an illustration of advanced object oriented programming issues and data structures with objects.

Linear regression objects: linearized regression, regression classes, enhanced-precision class, linear regression class.

Electrical circuit objects: the simplest circuit, series of resistors, mixing series and parallel resistors, circuit objects.

Calculator objects: the basic calculator, the scientific calculator and financial calculator objects.

**Textbook**
Bar-David T., Object Oriented Design for C++ (Prentice-Hall 1993)

**Reference**
Collins W.J., Data Structures: An Object-Oriented Approach (Addison-Wesley, 1992)
Ezzell B., Object-Oriented Programming in Turbo Pascal 5.5 (Addison-Wesley, 1989).

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

### MAP 61: DATA COMMUNICATIONS AND NETWORKING

**Hours per week:** 4 (4 Lectures)

**Learning Outcomes**
1. Specify the advantages of networking,
2. Understand the ISO Open Systems Interconnection 7 layer model,
3. Choose, set up, evaluate, and manage a local area network,
4. Use local area and Internet network services.

**Syllabus**
The Telephone Network principles and topologies, Exchanges, PABX. Synchronous and asynchronous communication modes.
Packet Switching, Packet assemble and disassemble.


Network Security principles, Network Topologies, Local Area Networks, Wide Area Networks.
Novell network and its services. System configuration, file transfer, users, accounts, applications,
integrity, e-mail. The Internet and its services: History, gopher, TCP-IP, World Wide Web, Wide Area Information Service.

**Textbook**  

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

**MAP 62: COMPUTER PROGRAMMING**

**Hours per week:** 4 (2 Lectures + 2 Labs)

**Learning Outcomes**
1. Use all of the features of standard Pascal in the solution of programming problems,
2. Understand and use recursion, abstract data structures, and access external libraries - including O.S. routines,
3. Program and run simple programs using functional (lisp), declarative (Prolog), and object oriented programming (Turbo Pascal) models.

**Syllabus**
Revision of basic Pascal features. Introduction to further Pascal constructs: functions, sets, and pointers.
Use of mini project to consolidate programming ideas, and provide basis for discussing the needs of "programming in the large".
Concepts of modularity: data hiding, data abstraction, libraries, modular programming, and finally simple object oriented programming - implementation using Turbo Pascal units.
Implementation of abstract data structures using different implementation methods (including stacks, queues, lists and trees).
Implementation of pure functional programs using Pascal, followed by implementation of the same programs in Lisp. Implementation of simple declarative programs using Prolog.

**Textbook**  

**Reference**  

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

**MAP 63: OPERATING SYSTEMS**

**Hours per week:** 4 (3 Lectures + 1 Lab)

**Learning Outcomes**
1. Demonstrate an understanding of operating system kernel structure,
2. Write batch files,
3. Exploit memory management,
4. Appreciate job and process scheduling,
5. Distinguish between single-user and multi-user operating system services and requirements.

**Syllabus**
Single and Multi-user kernel Structures, hardware software interface, instruction interpreter, job scheduling, I/O, virtual memory, memory management, paging.
Search paths and environment variables, virus protection, disk caching, memory management, high and extended memory. Script programs.
LAN operating systems: Security considerations, directory conventions, resource sharing.
Operating system shells; The Windows graphical interface, multi-tasking.
WAN: UNIX file structure, directories, processes and scheduling, shells, e-mail, writing shell scripts.

**Textbook**  

**Reference**  

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

**MAP 64: DATABASE DEVELOPMENT**

**Hours per week:** 4 (3 Lectures + 1 Lab)

**Learning Outcomes**
1. Identify information necessary for the application,
2. Construct Entity-Attribute Relation (EAR) models and on-line Database files,
3. Normalise an EAR model,
4. Create queries and reports on the data,
5. Design and write database programs using a
database programming language, SQL.

Syllabus
What is a database? Motivation for using a database.
Entities, attributes and relations between them.
Converting user requirements to an EAR model.
External, conceptual and internal levels of
architecture. Normalising the EAR model. Data
manipulation by means of SQL instructions.
Queries and reports, use of FoxPro to create and
manipulate relations within a database. Other
packages: Oracle, Paradox, CASE tools.
Database administration, data integrity and security,
data dictionary, distributed database.

Textbook

Reference

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

MAP 65: SOFTWARE ENGINEERING

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

Prerequisite: MAP 62 or equivalent

Learning Outcomes
1. Describe the concept of software engineering, the
phases of the software life cycle, and the different
tasks that are carried out during a software project,
2. Use software engineering techniques to develop
requirements documents, write specifications,
analyse and design medium-scale pieces of
software,
3. Demonstrate skill in the use of software tools to
support the different stages of the software life
cycle,
4. Describe different ways of achieving, verifying and
testing the quality of a piece of courseware.

Syllabus
Life cycle: The stages of the software life cycle,
different techniques used at each stage, and outline
problems typical of each stage.
Requirements analysis: purpose, levels and
approaches to analysis, prototyping, specification,
practical exercises.
Types of analysis and design: The purpose of
analysis and design, tree and graph notations,
structured analysis and design (e.g. SSADM,
Yourdon), object oriented analysis and design (Coad
and Yourdon), data driven analysis and design
(Jackson). Use of case studies to support
understanding and application of these techniques.
Discussion of software tools to support analysis and
design.
Implementation, testing and maintenance: Modularity, coupling, cohesion, data abstraction,
procedural abstraction. Testing techniques and
strategies. Practical exercises to test a large system.
Management of maintenance projects.
Project management: purpose of project
management, estimating techniques, monitoring
techniques, human resource issues, quality
assurance, and quality control. Use of project
management software.

Textbook
Pressman R., Software Engineering: A practitioner’s

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

MAP 66: ARTIFICIAL INTELLIGENCE
AND EXPERT SYSTEMS

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

Prerequisite: MAP 62

Learning Outcomes
1. Decide on the suitability of a KBS solution for a
given problem,
2. Design knowledge representations and an
inference engine for a given task,
3. Implement a knowledge-based solution in a shell,
4. Discuss AI techniques and their implementation
using Prolog,
5. Describe typical AI applications and the potential
of AI in the future.

Syllabus
Overview: What is knowledge? What is AI? Scope
and limitations of knowledge-based techniques. Life cycle of KBS.
Knowledge Acquisition: Observation, interviews, use of protocols, selection of problems, expert program solutions, verification. Problems in knowledge acquisition.
Knowledge Representation: Decision trees, rules, semantic nets, frames, uncertainty, fuzzy logic, constraints, meta rules.
Search and Inferencing Techniques: Forward and backward chaining, tree and graph searching (simple searches, hill climbing, means end), constraints, case-based reasoning, machine learning.
Implementation: Use of a rule-based shell. Examination of the pros and cons of Prolog and Lisp, KRLs. Use of Prolog.
Applications: Examples will be taken from games, education, design support, customer support, medicine, geology, equipment configuration will be used to demonstrate search, classification, intelligent checklists, decision making/advice and problem solving. The future of KBS.

Textbook

Reference
Ginsberg M., Essentials of AI (Morgan Kaufmann, 1993).

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

MAP 67: ANALYSIS OF ALGORITHMS

Hours per week: 4 (4 Lectures)

Prerequisite: MA 463 or equivalent

Learning Outcomes
1. Distinguish polynomial time from exponential time algorithms,
2. Bound the complexities of their own algorithms,
3. Appreciate the complexity classes P, NP, co-NP, NP-complete and the significance of the P = NP question.

Syllabus
Decision problems, Languages and Turing machines.

Time and space complexity of algorithms, the classes P and NP, polynomial transformations, NP-completeness.
Proving NP-completeness, standard NP-complete problems.
Complements of NP-complete problems, the class co-NP, the NP = co-NP question.
Coping with NP-completeness, performance guarantees for approximation algorithms.

Textbook

Reference

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

MAP 68: SYSTEMS PROGRAMMING WITH C++

Hours per week: 4 (2 Lectures + 2 Labs)

Prerequisite: MAP 62

Learning Outcomes
1. Write C++ programs incorporating functions and pointers,
2. Define and incorporate objects, private and public data and functions into an object oriented program,
3. Write shell scripts

Syllabus

Textbook
Nagler E., Programming in C++ (West, 1993).

Reference
McDonald C., Introduction to C Programming (Unitech, 1994).
### MAP 69: USER INTERFACE DESIGN

**Hours per week:** 4 (2 Lectures + 2 Labs)

**Prerequisite:** MAP 62

**Learning Outcomes**
1. Explain the problems of developing an effective user interface,
2. Analyse a problem for user interface requirements,
3. Describe the different development methodologies used in human computer interface design,
4. Apply user interface design techniques to a range of sample problems,
5. Test and assess a user interface for usability,
6. Use a prototyping tool.

**Syllabus**
- Psychological characteristics of users, types of user-computer interaction, interface models (analogies and metaphors), types of usability problem.
- User population analysis, data flow analysis, data modelling, task analysis, context analysis.
- User participatory design. Iterative development methods, evolutionary developments, prototyping, brainstorming. User support mechanisms (on-line help, documentation, etc).
- Usability testing: timing, participants, metrics, checklists. Objective testing versus comparative testing.
- Guidelines and standards for screen design, menus, dialogue box design etc.
- Implementation: Use of a suitable prototyping tool such as Visual Basic, Toolbook, Macromind Director, or Authorware Professional.

**Textbook**

**Reference**

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

### MAP 70: REAL TIME PROGRAMMING

**Hours per week:** 4 (3 Lectures + 1 Lab)

**Prerequisite:** MAP 68

**Learning Outcomes**
1. Explain the characteristics of real time systems,
2. Specify the requirement of a real time system,
3. Design a real time system,
4. Use concurrency classical solutions to solve data and resource sharing problems,
5. Write device driver software.

**Syllabus**
- Real Time System attributes and issues, embedded systems, process control, reliability, verification, timing constraints, areas of application.
- Design activities, Yourdon Systems Design Method for Real Time Systems: Concurrency and resourcing, Mutual exclusion, semaphores, monitors.
- Device drivers, interrupts and polling.

**Textbook**

**Reference**

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

### MAP 71: COMPLEX ANALYSIS

**Hours per week:** 4 (4 Lectures)

**Prerequisite:** MAP 51

**Learning Outcomes**
1. Apply the concepts of limits and convergence to complex sequences. Perform tests, to determine convergence of infinite series,
2. Determine whether a complex function is differentiable and make use of analytic functions and their properties,
3. Use the theory of Riemann Integration to evaluate integrals of functions of a complex variable,
4. Represent integral and meromorphic functions as power series using Taylor's theorem and Laurent's theorem,
5. Apply the theory of residues to evaluate various...
complex integrals,
6. Construct integral functions with given zeroes,
7. Manipulate some important complex functions; 
   Gamma and Elliptic functions.

**Syllabus**
Complex Numbers, Basic operations, Fundamental 
ideas of complex analysis, limits and convergence of 
complex sequences, Cauchy's principle of 
convergence, double sequences, double series and 
absolute convergence of double series.
Continuity and uniform continuity, differentiability 
of functions of a complex variable, analytic functions, 
Cauchy-Riemann equations, necessary and sufficient 
conditions for regular analytic functions.
Conformal mapping and homographic transfor-
mations, elementary functions and their Riemann 
surfaces.
Integral representations of a regular function, 
Fundamental integral theorem of Cauchy, regularity 
of continuous functions in a simply connected 
domain, Formula of Newton and Leibnitz for regular 
functions, Cauchy's Integral formula, Properties of 
regular functions. Applications to harmonic functions.
Dirichlet's first boundary value problem.
Representations of regular functions by series, Taylor 
and Laurent series, isolated and removable 
singularities, essential singularities, behaviour at 
infinity.
Integral functions, theory of residues and its 
applications.
Gamma functions, Inverse Laplace transforms and 
applications, Jacob's Elliptic functions

**Textbook**
Wunsch A.D., Complex Variables With Applications, 
2nd ed. (Addison-Wesley, 1994).

**Reference**
Copson E.T., Theory of Functions of a Complex 
Fuchs B.A. and Shabat B.V., Functions of a Complex 

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

**MAP 72: ALGEBRAIC STRUCTURES**

**Hours per week:** 4 (4 Lectures)

**Prerequisite:** MAP 52

**Learning Outcomes**
1. Define all the algebraic structures covered in the 
   subject, e.g. group, ring, field and module,
2. Find all substructures of a given structure, i.e., find 
   all subgroups of a given group, find all subrings of 
   a given ring, etc,
3. Construct all quotient structures, e.g. quotient 
   groups and quotient rings,
4. Identify the structure, from a given set of sufficient 
   conditions,
5. Perform factorisation in commutative rings.

**Syllabus**
Preliminaries: set operations and functions, partitions 
and equivalence relations, binary operations, the 
integers.
Groups: groups and subgroups, homomorphisms, 
Lagrange's Theorem and the Quotient set, Normal 
subgroups and the Quotient group, Group actions and 
solvable groups. Sylow theorems.
Rings: rings and subrings, homomorphisms, ideals, 
Quotient rings, Maximal Ideals and the Chinese 
Remainder Theorem, Prime Ideals, Integral Domains, 
and the Fraction Field.
Factorisation in Commutative Rings: Euclidean Rings 
and Principal Ideals, Rings, Primes and Unique 
Factorisation, Noetherian Domains. 
Introduction to Modules. Idea of Galois theory.

**Textbook**
Crown G.D. et al, Abstract Algebra (Marcel Dekker, 
1986).

**Reference**
Allenby R.B., Rings, Fields and Groups (Arnold, 
1983).

**Assessment**
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs).
MAP 73: NUMBER THEORY

Hours per week: 4 (4 Lectures)

Prerequisite: MAP 51

Learning Outcomes
1. Use the fundamental theorem of divisibility of numbers as products of prime factors, infinitude of primes, congruent numbers. Apply this to the theory of residues,
2. Apply the theory of congruences to Chinese remainder theorem, Number of roots, residual polynomials and congruences,
3. Prove the quadratic reciprocity law and apply it to integral solutions of diophantine equation-s, tions,
4. Define binary quadratic forms and their equivalence, Definite and reduced forms; to represent numbers as a sum of two squares,
5. Solve problems related to integral solutions of diophantine equations using the methods of Euler and Lagrange,
6. Define Jacobi, Legendre, and Kronecker symbols and apply them to the theory of indefinite quadratic forms.
7. Define arithmetical functions and apply them to generate Dirichlet series,
8. Represent numbers as sums of cubes and higher powers and apply this to Waring's problem and existence of G (3) and g (3),
9. Use geometry of numbers and theory of lattices for applications to Kronecker's theory,
10. Define algebraic number fields and extend the fundamental theorem of arithmetic to the ring of algebraic integers.

Syllabus
Prime numbers, Greatest common divisors, relatively prime integers, infinitude of primes, fundamental theorem of divisibility, congruent numbers, least residues, Fermat's theorem and Euler's generalisation, Euler's function, Gauss' lemma, Quadratic reciprocity law, Legendre's and Jacobi's symbols. Introduction to Diophantine equations, equations having rational and integral solution. Binary quadratic forms, equivalent forms, definite and reduced forms, determination of all integral and reduced forms, automorphic transformations, numbers as sums of two squares, Kronecker's symbol, positive forms, number of representation by positive forms. Discriminant and Genus of quadratic forms.

Special diophantine equations, methods of Euler and Lagrange, Arithmetic functions f(n), m(n), s(n), d(n), t(n) Definition of Dirichlet's series, order of magnitudes of arithmetic functions. Representation of numbers by cubes and higher powers, definition of G(3) and g(3), lower bounds for G(k) and g(k), Further problems of Diophantine analysis.

Geometry of numbers, theorem of Minkowski, simple applications to lattice theory in n-dimensions, arithmetic proof of Kronecker's theorem. Theory of algebraic number fields, algebraic numbers, algebraic integers, irreducible equations, degree of an algebraic number field, ring of algebraic integers, prime ideals. Generalisation of fundamental theorem of divisibility to algebraic number fields and applications to Quadratic fields.

Textbook

Reference

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

MAP 74: TRANSPORTATION AND NETWORK FLOW PROBLEMS

Hours per week: 4 (4 Lectures)

Prerequisite: Degree with mathematics as a major component.

Learning Outcomes
1. Use the Network Simplex Algorithm to solve transhipment problems,
2. Use network flow theory to solve unweighted bipartite matching problems,
3. Use bipartite matching theory to solve aircraft scheduling problems,
4. Apply the Critical Path Method to solve project management problems,
5. Use the Primal Dual Algorithm to solve minimum cost flow problems,
6. Apply network flow theory to optimal project selection problems.

Syllabus
Proof of the Max-flow Min-cut Theorem, Dinic's Algorithm. Applications to project selection and to job scheduling.

The Transportation and Transhipment Problems: An economic motivation and an algebraic description of the Network simplex Method, Decomposition into sub problems, cycling in the Network Simplex method and its prevention by Cunningham's Method, Applications to the scheduling of production and inventory.


Activity Digraphs, the Critical Path Method (CPM and PERT) in project management.

**Textbook**

**Reference**

**Assessment**
Continuous Assessment - 50%
Written Examination - 50% (1x3 hrs)
Department of Mechanical Engineering

DEPARTMENT OF MECHANICAL ENGINEERING

Head of Department and Professor
Pumwa, J., Ph.D. (Texas A&M), MEng. (Hons), (Wollongong), BEng. (Mech.) PNGUOT, Postdoctoral Fellow, KAIST, South Korea, Fellow ASME, Fellow IEPNG, CEng MIMechE

Deputy Head of Department
N’drelan. B. J., MEng. (ITB, Indonesia), BEng (QUT, Aust.), BEng (Mech) PNGUOT.

Professors
Lambrache, N. Ph.D. (Bucharest), Fellow American Institute of Physics, Fellow Optical Society of America, Fellow International Society of Optical Engineers.

Associate Professors
Muduli, K., Ph.D. (Industrial Engineering) Indian Institute of Technology Bhubaneswar, India, M.Tech (Industrial Engineering) Biju Patnaik University of Technology, India, BEng (Mech) Utkal University, India

Senior Lecturers
Arshad, G. M., Ph.D. (Wichita State), M.Sc. (KFUPM)

Wahid S Ph D (Univ NSW), CEng MIMechE (UK)

A. Mohmaed, Ph.D., MSc., BSc. (Mech), University of Minotoba, Canada. Postdoctoral (Faculty of Medicine Health Science Center, Winnipeg, Canada), Associate Research and Instructor (Memorial University, St. John’s, Canada).

Lecturers
Mr. Karo Komuna, MEng (Mech) Gadjah Mada University Indonesia, BEng (Mech) PNGUOT.

Principal Technical Instructors
N’drelan. B. J., MEng. (ITB, Indonesia), BEng (QUT, Aust.), BEng (Mech) PNGUOT.

Staff on Study Leave
Khallahle, J.B., MSc.(UNSW), BEng (Mech.) PNGUT, MIEAust.

Ales, S. K., MSc (Shenyang Aerospace University - China), MTech (Mech.) PNGUOT, BEng (Mech.) PNGUOT.

Dunstan, S. MTech (Mech) PNGUOT, BEng (Mech.) PNGUOT.

Laboratory Manager
George Warup, BSc. (Applied Science) PNGUOT.

Engineer
Peter, T., B.Eng (Mech), PNGUOT, ASNT Level II (Radiography).

Principal Technical Officer
Kami, P. Diploma in Mech. Eng, (Lae Polytech)

Eric Eng., Air Conditioning and Refrigeration (PETT)

Senior Technical Officer
Kamit, J., BEng (Mech) PNGUOT, MIEPNG, USFAA ADX.

Technical Officer
Kasir, M. E., Tradesman Mechanic (PETT)


Pebuar, R., B.Sc (Applied Physics) PNGUOT

Peruka Jnr, M., Certificate in Fitting and Machining (Lae Polytech)

Technical Assistant
Sahumalal, P., National Certificate II in Fitting and Machining (Lae Polytech)

Kami, B., (Temporary) Certificate in IT

Artisan
Senior Storeman
Mendode, H. Grade10 with experience

Senior Secretary
Kapipi, G. Certificate in Stenography

Secretary I
Ilo, D. Basic Secretarial Training
INTRODUCTION
The Department of Mechanical Engineering offers courses leading to Bachelor of Engineering, Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) in Mechanical Engineering. The department shares the view with others that there is a need to develop postgraduate training facilities in Mechanical Engineering to meet the manpower requirements of industries, government departments and academic institutions. This postgraduate course, that combines both formal lectures and self-motivated research, aims to meet the present need. The Department has a highly qualified and enthusiastic team of academics with proven track record of research performance. This would be an asset to efficiently offer the proposed course in a very professional way. The research programs of the Department are aligned with the PNGUoT Corporate Plan 2019-2023 and the PNG Vision 2050 in achieving their objectives towards nation building. The Department is committed to produce highly skilled and qualified manpower for the various sectors of PNG as well as of the Pacific Island countries. The Department is also in touch and collaboration with the industries through the “Departmental Industrial Advisory Committee” to enrich the curricula.

The Syllabus of the MEng (Mech) is revised and updated to meet the needs of the industry as well as to bring the standard to at par to the overseas universities. In order to facilitate greater participation of practising engineers in industries and government departments, the course has been structured to have built-in flexibility.

RATIONALE
Department of Mechanical Engineering, PNG University of Technology, currently, offers Master of Technology (MTech) in Mechanical Engineering. Master of Technology is a broader term that may include disciplines, such as sciences and information technology, etc. However, Mechanical Engineering wants to focus only on engineering disciplines. Moreover, the proposed MEng (Mech) is in uniformity with most of the overseas institutions’ degree awarding systems. The proposed MEng (Mech) shall be in line with the Bachelor degree that recently been renamed by the PNG University of Technology authority as BEng (Mech) from Bachelor of Engineering Mechanical Engineering. Additionally, the increased number of subjects and more closely monitored research in MEng (Mech) will also enable students to develop problem solving skills and will help them in communicating the research findings to the stakeholders. Once this proposed program is approved, it would replace the current MTech in Mechanical Engineering.

PROGRAM OUTCOME
On completion of the MEng (Mech) program, the students will be able to:

| PO1 | Use knowledge of mathematical and scientific modelling to critically analyse, develop, design, build and maintain mechanical engineering systems. |
| PO2 | Develop the experimental methodologies. |
| PO3 | Draw well informed conclusions through the application of research-based knowledge and methods such as design of experiments, results, analysis and data interpretation. |
| PO4 | Effectively communicate scientific and engineering concepts in a multi-disciplinary and multi team environment. |
| PO5 | Perform professionally and ethically, with an appreciation of the values of lifelong learning, appreciate the value of social well-being and environmental issues of all engineering activities. |
| PO6 | Develop and apply leadership, entrepreneurial and negotiation skills to all engineering activities. |
ENTRY REQUIREMENTS
i. Candidates with a bachelor degree in any engineering or equivalent from a recognised institution.
ii. Minimum weighted average of 65% marks in a Bachelor program or a GPA of 2.6 out of 4.
iii. No ‘Fail’ in any subject of the completed Bachelor program

SUMMARY OF THE PROPOSED COURSE
The proposed MEng (Mech) degree program is a two-year full-time normal mode program of study. It offers four (4) compulsory core subjects and four (4) elective subjects, each with four (4) hours of teaching per week. The student shall satisfactorily complete four (4) core subjects and four (4) elective subjects during the first year of the studies. The whole of second year shall be reserved for research work. At the end of semester 1 and semester 2 of second year, the student shall satisfactorily present the work in the form of seminar and a panel of academics shall evaluate the student's work. MEng (Mech) Thesis shall be evaluated by two external examiners.

PROGRAM SCHEDULE

<table>
<thead>
<tr>
<th>YEAR 1</th>
<th>Contact Hours/week</th>
<th>Common Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMESTER 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three (3) Core subjects each 4 hrs per week</td>
<td>*12 (12/0/0)</td>
<td>54</td>
</tr>
<tr>
<td>One (1) Elective Subject</td>
<td>4 (4/0/0)</td>
<td>18</td>
</tr>
<tr>
<td>SEMESTER 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One (1) Core Subject at 4 hrs per week</td>
<td>4 (4/0/0)</td>
<td>18</td>
</tr>
<tr>
<td>Three (3) Elective Subjects at 4 hrs per week</td>
<td>12 (12/0/0)</td>
<td>54</td>
</tr>
<tr>
<td>DISSERTATION</td>
<td>4 (0/0/4)</td>
<td>6</td>
</tr>
<tr>
<td>YEAR 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMESTER 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISSERTATION</td>
<td>20 (0/0/20)</td>
<td>30</td>
</tr>
<tr>
<td>SEMESTER 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISSERTATION</td>
<td>20 (0/0/20)</td>
<td>30</td>
</tr>
</tbody>
</table>

*Lecture / Tutorial / Project

SCHEDULE OF SUBJECTS

<table>
<thead>
<tr>
<th>Name of Subjects</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM 501: Advanced Engineering Mathematics I (Core)</td>
<td>I</td>
</tr>
<tr>
<td>MM 502: Advance Engineering Mathematics II</td>
<td>II</td>
</tr>
<tr>
<td>MM 503: Numerical Methods (Core)</td>
<td>I</td>
</tr>
<tr>
<td>MM 504: Research Methodology &amp; Computation (Core)</td>
<td>I</td>
</tr>
<tr>
<td>MM 505: Dissertation</td>
<td>I &amp; II</td>
</tr>
</tbody>
</table>

ELECTIVE SUBJECTS [SUBJECT TO AVAILABILITY OF RESOURDESS]

GROUP- A: ELECTIVE SUBJECTS

| MM 506 | Advance Machine Design | I or II |
| MM 507 | Materials Handling System | I or II |
| MM508: Computer Aided Design | I or II |
| MM509: Finite Element Method | I or II |
| MM510: Advanced Vibration | I or II |
| MM511: Noise Control Engineering | I or II |

GROUP.B: ELECTIVE SUBJECTS

<p>| MM 512 | Computer Integrated Manufacturing | I or II |
| MM 513 | Conventional Manufacturing | I or II |
| MM 514 | Robotics in Manufacturing | I or II |
| MM 515 | Total Quality Management | I or II |
| MM 516: Just-in-Time Systems | I or II |
| MM 517: Advanced Quality Control | I or II |
| MM 518: Planned Preventive Maintenance | I or II |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM 519</td>
<td>Internal Combustion Engines</td>
<td>I or II</td>
</tr>
<tr>
<td>MM 520</td>
<td>Gas Turbines</td>
<td>I or II</td>
</tr>
<tr>
<td>MM 521</td>
<td>Hydraulic Machines</td>
<td>I or II</td>
</tr>
<tr>
<td>MM 522</td>
<td>Advanced Heat Transfer</td>
<td>I or II</td>
</tr>
<tr>
<td>MM 523</td>
<td>Renewable Energy</td>
<td>I or II</td>
</tr>
<tr>
<td>MM 524</td>
<td>Fossil Fuels &amp; Combustion Technology</td>
<td>I or II</td>
</tr>
<tr>
<td>MM 525</td>
<td>Refrigeration &amp; Air-Conditioning</td>
<td>I or II</td>
</tr>
</tbody>
</table>
## MM 501: ADVANCED ENGINEERING MATHEMATICS I

### Hours per week: 4 (4/0/0)

### Common Credit: 18

### Learning Outcomes

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

1. Master first, second and higher order differential equations and systems of ODE
2. Acquire advanced knowledge regarding series solutions of ODE: Legendre’s equation and Legendre’s polynomials, power series method, extended power series method, Bessel functions.
3. Acquire advanced knowledge in Laplace transform and its applications in control engineering
4. Acquire advanced knowledge in linear algebra and vector calculus
5. Acquire advanced knowledge in matrix eigenvalues problems, including the determination of eigenvalues and eigenvectors

### Syllabus


### Textbooks


### References

- Mauch, Sean – Advanced Mathematical Methods for Scientists and Engineers, California Institute of Technology, 2002

### Assessment

- Continuous Assessment: 60%
- Final Examination: 40%

## MM 502: ADVANCED ENGINEERING MATHEMATICS II

### Hours per week: 4 (4/0/0)

### Common Credit: 18

### Learning Outcomes

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

3. Acquire knowledge in Fourier analysis and partial differential equations
6. Acquire knowledge in advanced probabilities and statistics

### Syllabus

### Binomial, Poisson, hyper geometric and normal distributions

**Textbook**  

**References**  
Mauch, Sean – Advanced Mathematical Methods for Scientists and Engineers, California Institute of Technology, 2002  
Anton, Howard – Calculus, Sixth Edition, John Willey and Sons, New York, 1999

**Assessment**  
Continuous Assessment: 60%  
Final Examination: 40%

---

### MM 503: NUMERICAL METHODS (4/0/0)

**Hours per week:** 4 (4/0/0)  
**Common Credit:** 18

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

1. Find roots of equations and polynomial equations and polynomial equations of higher order  
2. Solve linear and nonlinear differential equations  
3. Find eigen values, approximations of functions and their integration  
4. Solve common partial differential equations  
5. Interpolate polynomials

**Syllabus**  
Roots of a function: Bisection, fixed point, Newton methods, Secant and Regula Falsi. Roots of polynomial equations.  
Polynomial Interpolation: Lagrange polynomial, Neville’s method, divided differences, Hermite polynomial and splines.  
Numerical differentiation and Numerical Integration: Richardson’s extrapolation, Trapezoidal rule and Simpson’s rule, Newton-Cotes Integration Formulas, Gaussian quadrature.

---

### Solution of linear systems of equations

- Gauss elimination method, computation of matrix inverse, LU decomposition.  
- Approximation of Functions: Taylor polynomial, Chebyshev polynomial, least square approximation, rational approximations.  

**Textbook**  

**Reference**  

**Assessment**  
Continuous assessment 60%  
Written Examination 40%

---

### MM 504: RESEARCH METHODOLOGY AND COMPUTATION

**Hours per week:** 4 (4/0/0)  
**Common Credit:** 18

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

1. Apply research methodology  
2. Use the computer applications for use in independent study and research  
3. Acquire knowledge and skills in designing experiments, simple comparative experiments, sampling and confidence Intervals  
4. Acquire skills in factorial design of experiments, including fitting regression models  
5. Develop knowledge and skills regarding numerical approaches in research methodology

**Syllabus**  
Elements of an experimental test set-up. Basic instrumentation. Data acquisition system. Data
### Course: Experimental Methods for Engineers (MM505)

**Learning Outcomes**
On completion of the Research Project, the student should be able to:

1. Identify the main activities of a typical engineering product, process or system
2. Plan a detailed schedule of activities to complete and meet the project deadline
3. Apply the engineering principles learnt in other subjects in the development of the project work
4. Develop effective communication skills including listening, oral and written presentations and the ability to handle Q/A sessions
5. Write a dissertation on the project work

**Syllabus**

This course involves a project given to each student as an independent study for which lecturers will provide guidance. Topics of research project will be chosen in consultation with supervisors in areas relevant to PNG conditions. Candidates are expected to prepare objectives of the project, review the literature, propose the methodology of research, and initiate and conduct the research work required. The candidate is expected to present results of the research in the form of a dissertation.

**Assessment**

Continuous assessment and submission of a dissertation - 100%

### Course: Advanced Machine Design (MM506)

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

1. Develop analytical skills in machine element design
2. Design simple machines and components
3. Apply the fundamentals of product planning development
4. Acquire knowledge on material selection and Static Stresses on elements of machinery, finite element modelling and experimental approaches on fracture mechanics
5. Familiarize with failure theories, safety factors and reliability in machine design

**Syllabus**

The scope of design: fundamentals of engineering systems and systematic approach; the design process; product planning; product specification; conceptual design; search for solutions; methods of analysis; choosing the best design; product design; reliability; design project (preferably from industry).

**Textbook**


**Assessment**

Continuous assessment 60%
Written Examination 40%
### MM507: MATERIALS HANDLING SYSTEMS

- **Hours per week:** 4 (4/0/0)
- **Common Credit:** 18

**Learning Outcomes**

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

1. Analyse and design integrated material handling systems for automatic storage and retrieval of unit loads
2. Specify key parameters for such systems
3. Analysis on manufacturing cycle time
4. Knowledge on delays and damage
5. Promote safety and improve working conditions
6. Promote productivity

**Syllabus**

Analysis and design of integrated material handling systems; automatic storage and retrieval of unit loads, and identifying and establishing boundary conditions on key parameters required to specify the desired system required for equipment vendors to design appropriate hardware.

**Textbooks**


**Assessment**

- Continuous assessment 60%
- Written Examination 40%

### MM508: COMPUTER-AIDED DESIGN

- **Hours per week:** 4 (4/0/0)
- **Common Credit:** 18

**Learning Outcomes**

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

1. Describe the key characteristics of a feature-based, parametric solid modeler. Identify the principal components of a modern 3D CAD software user interface. Explain how different dimensioning methodologies serve different design intents. Creation of fully defined sketches.

2. Create a new part. Insert a new sketch and add sketch geometry. Establish sketch relations between pieces of geometry. Understand the state of the sketch. Creation of fully defined sketches. Use sketch tools to add fillets. Extrude the sketch into a solid.


4. Perform solid modeling for casting and forging. Feature parameter editing.

5. Create linear, circular and mirror patterns.

6. Create revolved and sweep features. Select materials for solid models and calculate physical properties of solid models: mass, center of gravity, inertial moments.

7. Create shellings and ribs. Edit for repairs and design changes. Edit part configurations.

8. Create design tables and equations. Use existing design tables to create families of parts.


**Syllabus**

The subject introduces students to the modern approach of 3D CAD for generating and analysing solid models and assemblies on computers. The included topics address theoretical and practical aspects encountered in the creation, modification, analysis, and optimization of mechanical engineering design. Also included are topics dealing with the creation of technical drawings, generation of bills of materials.

**Textbook**


**Assessment**

- Continuous assessment 60%
- Final Examination 40%
### MM 509: FINITE ELEMENT METHOD

**Hours per week:** 4 (4/0/0)  
**Common Credit:** 18  

**Learning Outcomes**  
On completion of the subject, the student should be able to understand and apply:

1. Partial differential equations governing the behavior of deformable bodies.  
2. Fundamental relations for linearly elastic solids and the importance of stress matrix in finite element method.  
4. Numerical and reduced integration. Solutions for simultaneous linear equations and stress calculations  
7. Physical capabilities of flow simulation   
9. Flows in porous media and Boundary conditions

**Syllabus**  

**Textbooks**  

**Reference**  

**Assessment**  
- Continuous assessment: 60%  
- Final Examination: 40%

### MM510: ADVANCED VIBRATION

**Hours per week:** 4 (4/0/0)  
**Common Credit:** 18  

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

1. Explain principles of mechanical vibrations.  
2. Define and describe the concepts of vibration modes and natural frequencies and their measurement and estimation for multi-degree-of-freedom systems.  
3. Analyse mechanical vibration in random vibration, non-linear vibrations and vibration of continuous systems.  
4. Model free vibrations of single degree of freedom systems.  
5. Acquire proficiency in analysing harmonically excited vibrations.  
6. Recognise difficulties in modelling multiple degrees of freedom vibrations.  
7. Determine natural frequencies, mode shapes, vibration, measurement and analysis.

**Syllabus**  
This course may be offered in any of the following topics depending on the requirements of attending students:

- Mechanical Vibrations and Experimental Methods in Vibrations: Linear theory of
Vibrations of finite number of degrees of freedom systems via languages equations
Sensors, instruments, measurements techniques data acquisition methods; data reduction
methods for vibration measurement and modal analysis; applications including turbo machinery
blades, vanes, gears, bearings and rotors; structures such as beams, frames and machine
foundations.

Continuous systems: Introduction to continuous systems; vibration of strains, longitudinal
vibration of rods, torsional vibration of rods; beam vibration, effect of rotary inertia and shear de-
function; vibration of the plates.

Random vibrations: Random phenomena, defining expected value, frequency responses
function, probability distribution, correlation of signals, power spectrum, power spectral density,
Fourier Transform, response of single and multi-
degree systems to stationary random excitations.

Nonlinear vibrations: Introduction to nonlinear vibration, exact methods of solution, approximates
analytical methods, graphical methods, stability of equilibrium, numerical methods.
Vibration measurement and control common to all topics.

Textbook

References

Assessment
Continuous assessment  60%
Written Examination  40%

MM511: NOISE CONTROL ENGINEERING

Hours per week:  4 (4/0/0)

Common Credit:  18

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

1. Apply basic concepts of the nature of sound and noise to engineering students
2. Conduct measurements and analyses required to diagnose noise and vibration problems and develop meaningful solutions;
3. Develop and apply methods for the control of noise and vibration in most situations;
4. Know when outside consultation is required for solving complex noise and vibration control problems and how to utilize consultants effectively

Syllabus
The nature of sound; units; sound measurements; instruments; effects of noise on people; hearing loss; noise and law; near and far field noise; acoustics of rooms and enclosures, noise analysis; noise criteria; damping of panels; principles of noise control: vibration isolation, noise source identification and their relative importance, noise control procedures applicable to source, path and receiver; case studies: cooling fan, mine ventilation fan noise, duct noise, material handling impact noise, engine noise, turbine noise, jet noise; factory noise, industrial noise control programme.

Textbook

Reference

Assessment
Continuous assessment  60%
Written Examination  40%
| **MM5012: COMPUTER-INTEGRATED MANUFACTURING** | 1. Understand relevant fundamentals and real-world practices of advanced manufacturing process  
2. Understand interrelationships among technical and economic factors involved  
3. To acquire knowledge gain on forming processes for engineering materials  
4. Develop strategies for the safe and effective utilizations of human resources materials, and manufacturing methods.  |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **Hours per week:** 4 (4/0/0) | **Learning Outcomes**  
On completion of the subject, the student should be able to:  
1. Understand the concepts of computer integrated manufacturing  
2. Recognise constituent parts of CIM systems and integration of the parts to form a system  
3. Achieve Advanced Understanding Regarding CNC Systems in Advanced Precision Manufacturing  
4. Master Software Platforms for CNC Manufacturing, Including Tool Path Optimization of 3D CAD Models of Parts  
5. Acquire Advanced Understanding Regarding Maintenance Issues in Computer Integrated Manufacturing  
6. Develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.  |
| **Common Credit:** 18 | **Textbook**  
| **Learning Outcomes** | **Assessment**  
Continuous assessment 60%  
Written Examination 40%  |
| **On completion of the subject, the student should be able to:** | **MM513: CONVENTIONAL MANUFACTURING TECHNOLOGY**  
**Hours per week:** 4 (4/0/0)  
**Common Credit:** 18  
**Learning Outcomes**  
On completion of the subject, the student should be able to:  
1. Understand industrial robots  
2. Understand their mechanical elements, sensory systems, and control systems and their use in manufacturing  |
| **Textbook**  
Continuous assessment 60%  
Written Examination 40%  |
| **Assessment**  
Continuous assessment 60%  
Written Examination 40% | **MM514: ROBOTICS**  
**Hours per week:** 4 (4/0/0)  
**Common Credit:** 18  
**Learning Outcomes**  
On completion of the subject, the student should be able to:  
1. Understand industrial robots  
2. Understand their mechanical elements, sensory systems, and control systems and their use in manufacturing  |
Learning Outcomes
On completion of the subject, the student should be able to:

1. Understand the basic philosophies of JIT system
2. Gain sufficient understanding for implementation of JIT in a manufacturing industry.
3. Apply JIT principles to reduce lead time in any organization.
4. Propose methods to eliminate obstacles of JIT for any organization

Syllabus
Brief history of Just-In-Time system; definition, objectives and benefits of JIT; basic philosophies; key elements of JIT; Push and Pull Systems; Kanban; Kanban rules; inventory control under JIT; reduction of lead time, reduction of set-up time, standard operations; machine layout in JIT, multifunctional workforce, job rotation, training requirements; improvement activities; Autonomous defects control; functional management and its organization; adapting to JIT system, obstacles; future development of JIT system. Applications of Lean Approaches and Methodologies.

Textbook

Reference

Assessment
Continuous assessment 60%
Written Examination 40%

MM517 ADVANCED QUALITY CONTROL

Hours per week: 4 (4/0/0)
Common Credit: 18
Prerequisite: Knowledge of statistics.
**Learning Outcomes**
On completion of the subject, the student should be able to:

1. Understand both classical and advanced acceptance sampling methods
2. Gain in depth understanding of statistical process control methods
3. Understand, conduct and analyze comparative experiments
4. Understand and apply control charts for analysis of observational data
5. Design and conduct screening experiments, including graphical analysis.
6. Design, conduct and analyse complete factorial

**Syllabus**
Advanced methods applied to quality control. Acceptance sampling plans from the classical lot attribute plan to sophisticated multi-lot dependent plans. Classical treatments and recent developments in process control. Evaluation, design and maintenance of quality control programs.

**Textbook**

**Reference**

**Assessment**
Continuous assessment 60%
Written Examination 40%

---

**MM 518: PLANNED PREVENTIVE MAINTENANCE**

**Hours per week:** 4 (4/0/0)

**Common Credit:** 18

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

1. Understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. Explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
3. Design a maintenance schedule for some maintenance activities.
4. Analyse and develop cost effective maintenance alternatives
5. Understand the use of simple instruments used for condition monitoring in industry

**Syllabus**
Maintenance fundamentals; systematic approach to maintenance; maintenance economics; maintenance organization; origin of maintenance problems; inspection and maintenance tools; inspection and lubrication schedules; condition monitoring; repair methods for basic machine elements; repair methods for material handling equipment; maintenance records; maintenance inventory examples of maintenance of elements and machines; maintenance planning; scheduling; manual vs computer assisted maintenance; motivation of workforce; implementation of maintenance programme.

**Textbooks**
Davies A., Handbook of Condition Monitoring: Techniques and Methodology, Springer, 2018

**References**

**Assessment**
Continuous Assessment 60%
Final Examination 40%

---

**MM519: INTERNAL COMBUSTION ENGINES**

**Hours per week:** 4 (4/0/0)

**Common Credit:** 18

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

1. Apply principles of relevant fields of study in basic design considerations of the system
2. Demonstrate ability to modifications to the design of some systems
### MM 520: GAS TURBINES

#### Hours per week: 4 (4/0/0)

#### Common Credit: 18

#### Learning Outcomes

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

1. Demonstrate thorough knowledge on different types of compressors
2. Estimate performance parameters for different types of gas turbines and gas turbine arrangements
3. Demonstrate a thorough knowledge of gas turbines on power plants, air and marine transportations.
4. Demonstrate a thorough knowledge on combustion chamber
5. Demonstrate a thorough knowledge on gas turbine limitations. Selection of materials, parts and components

#### Syllabus


#### Textbook


#### Assessment

Continuous assessment 60%
Final Examination 40%

---

### MM521: HYDRAULIC MACHINES

#### Hours per week: 4 (4/0/0)

#### Common Credit: 18

#### Learning Outcomes

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

1. Analyse the fluid flow in hydraulic machines
2. Design rotodynamic machinery and their components
3. Select pumps and turbines for industrial applications
4. Demonstrate thorough knowledge on vibration and noise and causes in hydraulic machines
5. Acquire knowledge on controls of power, pressure and flow in hydraulic machines

#### Syllabus

System analysis for pump selection, specific speed and modelling laws, specific speed charts; design considerations for various applications; impeller design - impeller layout, development of impeller vane; volute design, double and triple volute casing design, circular volute; design of multi-stage casing; double-suction pumps and side-suction design; pump applications - vertical pumps, wet-pit pumps, barrel-mounted pumps, slurry
pumps, pumps for chemical processes; hydraulic turbines - selection process, turbine performance prediction, fixed guide vane turbines, variable guide vane turbines; pump and turbine components - mechanical seals, bearings and lubrication; gear pumps and vane pumps; compressors - types and design considerations; vibration and noise - causes of vibration, cavitation, diagnosis of pump vibration problems; controls - constant power control, constant pressure control, constant flow control.

**Textbook**

**Reference**

**Assessment**
Continuous assessment 60%
Final Examination 40%

---

**MM522: ADVANCED HEAT TRANSFER**

**Hours per week:** 4 (4/0/0)

**Common Credit:** 18

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

1. Demonstrate the ability to solve heat exchanger problems
2. Solve multi-dimensional conduction problems
3. Demonstrate the ability to solve problems involving one or more modes of heat transfer
4. Make right assumptions and approximations for tackling practical situations
5. Analyse complex heat transfer problems

**Syllabus**
Steady-state heat conduction in one, two, and three dimensions - graphical and numerical methods; unsteady-state heat conduction - chart and numerical methods; convection - review, dimensional analysis, boundary layer analysis, Reynolds’ analogy, free convection, forced convection inside tubes and over exterior surfaces; heat exchangers - types and arrangements, LMTD and effectiveness methods of analysis, fouling factors, selection; radiation - review, gas-filled enclosures, combined modes with conduction and convection; boiling heat transfer, condensing heat transfer.

**Textbook**

**Assessment**
Continuous assessment 60%
Final Examination 40%

---

**MM523: RENEWABLE ENERGY**

**Hours per week:** 4 (4/0/0)

**Common Credit:** 18

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

1. Discuss different types of renewable energy sources
2. Discuss the technologies for renewable energy utilisation and conversion
3. Explain the economics of renewable energy conversion devices
4. Conduct feasibility and design studies for selected renewable energy technologies
5. Discuss national and international trends and protocols

**Syllabus**
Range of renewable energy resources and its potential; selected technologies generally recognized as being the most feasible technically and economically, e.g., solar (both thermal and photo-voltaic), wind, hydro, tidal, waste and biomass; methods of harnessing and using energy from these sources, including hybrid systems; limitations of renewable energy harnessing; principles of energy conversion; storage and transfer for renewable energy systems; feasibility and design studies for selected renewable energy technologies; national and international trends.

**Textbook**
Jefferson W Tester, Elizabeth M Drake, Michail J Discoll, Michael W Golay, William A Peters,
**Department of Mechanical Engineering**

**MM524: FOSSIL FUELS & COMBUSTION TECHNOLOGY**

<table>
<thead>
<tr>
<th>Hours per week:</th>
<th>4 (4/0/0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Credit:</td>
<td>18</td>
</tr>
</tbody>
</table>

**Learning Outcomes**

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

1. Discuss different types of fossil fuels and methods for their exploration and production
2. Acquire knowledge of combustion equipment
3. Apply combustion technology to combustion equipment to improve efficiency
4. Discuss limitations of solid fuels to be used on gas turbine applications and the importance of updating on latest technological developments
5. Discuss impacts of products of combustion to the environment and its mitigation

**Syllabus**

Different types of fossil fuels, geographic spread of reserves, life-span, processes involved from exploration to production; grades of fuels; impurities; processes involved in refining the fuels; thermochemical reactions and combustion of fossil fuels on theoretical and practical bases; theory of combustion and brief introduction to combustion kinetics; air supply in combustion; by-products of fuel production and combustion; control of combustion processes; pulverized fuel combustion; fluidized-bed combustion; environmental control systems; particulate emissions; particulate and sulphur dioxide removal; scrubbers.

---

**MM525: REFRIGERATION & AIR-CONDITIONING**

<table>
<thead>
<tr>
<th>Hours per week:</th>
<th>4 (4/0/0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Credit:</td>
<td>18</td>
</tr>
</tbody>
</table>

**Learning Outcomes**

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

1. Acquire knowledge on energy conservation and its incorporation in refrigeration and air conditioning industries
2. Demonstrate the ability to make right assumptions and approximations for tackling practical problems
3. Describe air conditioning and refrigeration materials and equipment
4. Demonstrate the ability to perform heat load calculations and select appropriate A/C devices
5. Demonstrate the ability to perform ducting requirements and designing a complete air conditioning and distribution systems

**Syllabus**

Air cycle; body comfort; psychometric chart and processes; principles of heat load estimation for air-conditioning systems; types of air-conditioning equipment; air distribution; ducts; residential and commercial air-conditioning; air-conditioning equipment; refrigerants; types of refrigeration systems; food, and growth of micro-organisms; basic principles of heat transfer; latent heat; calculation of heat load; insulation; evaporator; condenser design; compressors; charging and testing of refrigeration systems; basic refrigeration controls; electrical components.

**Textbook**

Australian Refrigeration and Air Conditioning Vol 1 and 2, AIAH 2016.
References
DA09 Air Conditioning Load Estimation, AIRAH, 1998 [AIRAH Document]

Assessment
Continuous assessment 60%
Final Examination 40%
DEPARTMENT OF SURVEYING AND LAND STUDIES

Head of Department & Professor
Babarinde J A., PhD Urban & Reg. Planning (Ibadan); MURP Urban & Reg. Planning (Ibadan); BSc Estate Management/Valuation (UEL, London, UK); Ontario Licensed Realtor (Toronto); Cert. Ed. (London Metropolitan, UK); FRICS; MCIP; Chartered Valuation Surveyor; Registered Planner.

Deputy Head of Department
Kari L., MSST (USQ), B.Tech.Cart. (PNGUT)

Professors
Pal D K., PhD RS/GIS in Land Use Planning and micro-watershed prioritization (IIT), M. Sc (CU); B. Sc (Hons.) (CU), ISRSILM, INCALM, GSILM

Associate Professors
Samanta S., PhD Climatological Modeling (VU), M.Sc. Remote Sensing and GIS (VU), B.Sc Geography (VU)
Jana S K., PhD. (VU); M.Sc. (VU); B.Ed. (VU)

Senior Lecturers
Suat J., MGIS, PGDipMapSurv.(UQ), PGDLS, B.Tech.Surv.(PNGUT), MASPNG, MIMSSIPNG

Lecturer-II
Antonio W., (on study leave) MSIS. (UTAS), PGD Surv. Science (UTAS), PDGLS (PNGUT), B.Tech.Cart. (PNGUT), MIMSSIPNG
Pai A., (on study leave) M.Sc. (UQ), B.Tech.LandMgmt. (PNGUT), Reg. Val. (PNG), MPNGIVLA
Holis S S, M.Sc. (UTS), B.Tech.Land Studies (PNGUT), Reg. Val. (PNG) MPNGIVLA
McVie R A, MUD (QUT), B. Land Studies (PNGUT), MPNGIVLA
Rosa R., M.Phil. Geomatics (PNGUT); B.Tech.Surv. (PNGUT); MASPNG.

Lecturer-I
Gupta S., M.Sc. Remote Sensing and GIS (VU), B. Sc Physics (Hons) (CU)
Kari L., MSST (USQ), B.Tech.Cart. (PNGUT)
Kapi N V., M.Phil Geomatics (PNGUT), B.Tech.Surv. (PNGUT)

Tumare J., M.Phil Geomatics (PNGUT); B.Surv. (PNGUT)
Karigawa L., M.Phil. Property Studies, (PNGUT), B.Tech.LandMgmt. (PNGUT), MPNGIVLA
Mille J., M.Phil. Property Studies, (PNGUT), B.Tech.LandMgmt. (PNGUT), PGD in Education (UOG); MPNGIVLA
Sekak T, M.Phil Geomatics (PNGUT); B.TechGISci. (PNGUT)

Principal Technical Instructor
Tagicakibau M., PGDip Surv.Sc. (Otago, NZ); B.Surv. (QUT, Aust); Dip.Eng.Surv. (FIT, Fiji); MIS (Fiji); Reg. Surveyor (Fiji)

Senior Technical Instructors
Popeu, M., B.Tech.Surv. (PNGUT); MASPNG.

Technical Instructors
Honeaki H., B.Surv. (PNGUT)

Laboratory Manager
Napitalai A. Diploma in Electronics Engg. (PNGUT)

Principal Technical Officer
Tine S., B.Tech. Surv., (PNGUT)

Senior Technical Officer
Yanabis C. B.Tech.Cart. (PNGUT)

Technical Officers
Karipal R., B.Tech. Surv., (PNGUT)

Support Staff
Yaum A., Senior Secretary 1
Kababa G., Executive Secretary 1
Bonga M., Survey Stores-Person (on study leave)
Matilda Naiai, Survey Stores-Person (Temporary)
OBJECTIVES

This beautiful country – often referred to as ‘the paradise on earth’ by the philanthropists – deserves a befitting management of her enormous natural resources. The sustainable development of her natural resources and eco-friendly exploitation of the resources can only be achieved by the enlightened citizens. The program aims to create the human resources that will be adept in optimal management and development of natural resources by the state-of-the-art space technology. In nutshell, this program is slated to churn out qualified professionals who, using space technology, will be instrumental in developing, managing, exploiting all sorts of natural and man-made resources in a sustainable manner in order to realize the country’s mid-term and long-term development aspirations.

The discipline aims at integrating the emerging state-of-art technologies of space-borne and air-borne data acquisition - remote sensing and digital photogrammetry, digital cartography and mapping, geographic information systems, Global Positioning System (GPS) and information technology, thereby creating specialists in optimal resources management.

Moreover, the department foresees - this course could draw a substantial interest from a large section of PNGian who earnestly yearn for attaining a post graduate degree from the ace institution of PNG. Commenced in 2013, the course has been very popular amongst the PNGians. Barring economic recession, the country is facing in recent years, the program continues to be self-sustained.

The program is being exclusively offered from this department, departmental faculties duly completed all the modules preparation and this is a full-fledged ongoing program of the department with the first batch admitted in 2013.

ENTRY REQUIREMENTS

GRADUATE DEGREE in any SCIENCE and ENGINEERING discipline from a recognized university.

RESOURCE REQUIREMENTS

The department is in possession of all the material resources, space, and human resources etc. to undertake the proposed program.

COURSE DETAILS AND SCHEDULING

The program ‘Master of Science in Remote Sensing and Geographic Information System (M.Sc. in RS & GIS)’ offered in DISTANCE MODE has four semesters with the session starting from November and end in December after 2 years (eg. start: Nov’13, end: Dec’15 nominally). The direct contact is proposed to be in the month of November-December compulsorily, while depending upon the situation another session of contact can be given in the month of June. The entire study modules, lectures, examinations, etc. are being conducted exclusively from the Department of Surveying and Land Studies.
<table>
<thead>
<tr>
<th>Year 1: First Semester</th>
<th>Year 2: First Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td>RGS501</td>
<td>Introduction to Map Projection &amp; Field Survey</td>
</tr>
<tr>
<td>RGS503</td>
<td>Geodesy</td>
</tr>
<tr>
<td>RGS505</td>
<td>Aerial Photography</td>
</tr>
<tr>
<td>RGS507</td>
<td>Photogrammetry</td>
</tr>
<tr>
<td>RGS509</td>
<td>Concept and Foundation of Remote Sensing</td>
</tr>
<tr>
<td>RGS511</td>
<td>Orbital Characteristics of Remote Sensing Satellites</td>
</tr>
<tr>
<td>RGS513</td>
<td>Ground Based Observation Equipment &amp; Study of Topographical Map</td>
</tr>
<tr>
<td>RGS515</td>
<td>Image Interpretation &amp; Map Scales</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>20 (20-0-0) 88</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2: Second Semester</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td>RGS502</td>
<td>Image Interpretation for Earth Science and Terrain Evaluation</td>
</tr>
<tr>
<td>RGS 504</td>
<td>Interpretation of Remote Sensing Data for Thematic Mapping</td>
</tr>
<tr>
<td>RGS506</td>
<td>Thermal Infrared and Hyperspectral Remote Sensing</td>
</tr>
<tr>
<td>RGS508</td>
<td>Microwave Remote Sensing</td>
</tr>
<tr>
<td>RGS510</td>
<td>Digital Image Processing System – Basics &amp; Characteristics</td>
</tr>
<tr>
<td>RGS512</td>
<td>Image Restoration &amp; Manipulations</td>
</tr>
<tr>
<td>RGS514</td>
<td>Multi-Image Manipulation – Information Extraction</td>
</tr>
<tr>
<td>RGS516</td>
<td>Geo-Statistics</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>20 (20-0-0) 89</strong></td>
</tr>
</tbody>
</table>

Total subjects: 29; Total CCC: 318
PROGRAM OUTCOMES (POs)

PO1: Have a sound knowledge and understanding of the use and application of geospatial technologies in solving geographic problems of various domains, e.g., environmental, natural resources, land management and administration, government, health, utilities, transport, etc.

PO2: Be competent in the foundation of Remote Sensing and GIS operations and demonstrate sound knowledge on the nature and properties of geospatial data.

PO3: Be able to choose and perform data collection for RS and GIS analyses, including GPS, satellite imagery, and handling collateral data like topographic maps, scanned photographs, etc.

PO4: Demonstrate advanced knowledge of physics of remote sensing and techniques of GIS including sensor systems, basic radiative transfer, cartographic projections and display, and spatial databases, and of fundamental concepts in geospatial analysis and modeling techniques.

PO5: Know how to design, develop and manage GIS and remote sensing application projects from the numerous possible applications including, land and natural resource developments, environmental monitoring and management, disaster risk reduction and disaster risk management.

PO6: Be knowledgeable of the various methods of Geospatial Analysis, GIS and Cartographic Modelling using spatial and aspatial data in solving geographic problems.

PO7: Be able to differentiate between various forms of remote sensing data – optical IR, thermal, microwave, hyperspectral; sensors, resolution; apply appropriate data processing and design expedient strategies for storing, managing and accessing these large volumes of data.

PO8: Quantitatively analyze data to evaluate scientific hypotheses and arguments in remote sensing and geographic information science.

PO9: Communicate effectively, both verbally and in writing, advanced concepts in remote sensing and geographic information systems.

PO10: Demonstrate understanding of the broader impacts and applications of remote sensing and GIS for natural sciences, social sciences, limitations of the technology, ethical use of the technology for the society at large.

PO11: Apply a range of geospatial analysis techniques using remote sensing and GIS tools toward solving quantitative problems in one or more core disciplinary areas such as geography, ecology, environmental sciences, biogeosciences, urban planning or natural resources management.

DETAILED SYLLABUS

RGS501: INTRODUCTION TO MAP PROJECTION & FIELD SURVEY

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

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

LO1-Describe the concept of Map Projection
LO2-Recognize the various systems of Projections – the Polyconic Projection, the Mercator’s Projection, and the Universal Transverse Mercator Projection and use it.
LO3-Demonstrate the use of instruments used for measuring angle, direction, area, height and distance of objects on ground
LO4-Operate Theodolite to measure vertical angle, horizontal angle, height and distance

Syllabus
Introduction to Map Projection System and their Classification, Map Scale, Map Detail, Map Accuracy, Map Resolution, Map Projections – properties, Construction of Zenithal, Cylindrical,
Conic group: Polyconic and Universal Transverse Mercator projections.

Conventional Field Survey, Survey Instruments to Measure Angle, Direction, Area, Height and Distance of Objects on Ground, Prismatic Compass, Theodolite, Measurement of Vertical Angle, Measurement of Horizontal Angle, Measurement of Height and Distance, Contouring; Trigonometric Leveling, Plane Table Survey, The Plane Table and its Accessories.

**Text Books**

**Assessment**
Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

---


**Text books**

**Assessment**
Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

---

**RGS503: GEODESY**

**Hours:** 3 (3-0-0) (Lecture-Tutorial-Lab)

**Credit:** 13

**Learning Outcomes**
Upon completion of the subject student will be able to:
- LO1-Describe the various applications of geodesy
- LO2-Identify the various coordinate systems used in geodesy
- LO3-Illustrate the WGS 84 ellipsoid and PNG geodetic datum
- LO4-Illustrate satellite geodesy

---

**RGS505: AERIAL PHOTOGRAPHY**

**Hours:** 2 (2-0-0) (Lecture-Tutorial-Lab)

**Credit:** 09

**Learning Outcomes**
Upon completion of the subject student will be able to:
- LO1-Explain the evolution of Aerial Photography
- LO2-Illustrate the basic negative-to-positive photographic sequence
- LO3-Know about the spectral sensitivity of black and white films
- LO4-Judge the colour film
**Syllabus**


**Text book**


**Assessment**

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

---

<table>
<thead>
<tr>
<th>RGS507: PHOTOGRAMMETRY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours:</strong> 2 (2-0) (Lecture-Tutorial-Lab)</td>
</tr>
<tr>
<td><strong>Credit:</strong> 09</td>
</tr>
</tbody>
</table>

**Learning Outcomes**

Upon completion of the subject student will be able to:

- LO1-Identify the geometrical elements of vertical air photo
- LO2-Correct image positions of terrain points using relief displacement
- LO3-Evaluate object height and ground coordinate location from parallax measurement
- LO4-Contrast the Analogue photogrammetry and Digital photogrammetry

**Syllabus**

Geometric Elements of Vertical Air Photos, Characteristics of Relief Displacement of Vertical Features, Object Height Determination from Relief Displacement Measurement, Correcting for Relief Displacement, Image Parallax, Characteristics of Image Parallax, Object Height and Ground Coordinate Location from Parallax Measurement, Parallax Measurement, Hardcopy Measurements, Softcopy Measurements, Ground Control for Aerial Photography, Orthophotos, Analog Photogrammetry, Digital Photogrammetry

**Text book**


**Assessment**

Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

---

<table>
<thead>
<tr>
<th>RGS509: CONCEPT AND FOUNDATION OF REMOTE SENSING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours:</strong> 3 (3-0-0) (Lecture-Tutorial-Lab)</td>
</tr>
<tr>
<td><strong>Credit:</strong> 13</td>
</tr>
</tbody>
</table>

**Learning Outcomes**

Upon completion of the subject student will be able to:

- LO1-Describe various types and stages of remote sensing
- LO2-Illustrate energy source and radiation principles
- LO3-State the characteristics of real remote sensing system
- LO4-Interpret optical images

**Syllabus**

### Characteristics of Satellite Remote Sensing Data

- Data Volume
- Interpretation of Remotely Sensed Data
- Interpretation of Optical Images - Panchromatic Images & Multispectral Images
- False Colour Composite
- Natural Colour Composite
- Reference Data
- Supervised Classification
- An Ideal Remote Sensing System
- Characteristics of Real Remote Sensing System

### Text books


### Assessment

- Continuous Assessment: 50%
- Written Examination (1 x 2 hours): 50%

### RGS511: ORBITAL CHARACTERISTICS OF REMOTE SENSING SATELLITES

**Hours**: 3 (3-0-0) (Lecture-Tutorial-Lab)

**Credit**: 13

### Learning Outcomes

Upon completion of the subject student will be able to:

- LO1: Relate with the satellite orbits / space borne platforms, basics of orbiting satellites as per Kepler's model, geostationary orbits, and sun synchronous orbits
- LO2: Describe the various types of sensor resolutions.
- LO3: Identify the various types of remote sensing satellites, sensors, and their applications
- LO4: Appraise the Indian Remote Sensing System series of satellites
- LO5: Recognize the European Remote Sensing series of satellites

### Syllabus

- Satellite Orbits / Space Borne Platforms, Basics of Orbiting Heavenly Bodies / Satellites – Kepler's Model
- Characteristics of Satellite Platforms
- Satellites - Geostationary Orbits & Sun Synchronous Orbits
- Sensors, Resolution of Sensors, Types of Remote Sensing Satellites, Sensors and Applications

### Text books


### Assessment

- Continuous Assessment: 50%
- Written Examination (1 x 2 hours): 50%

### RGS513: GROUND BASED OBSERVATION EQUIPMENTS & STUDY OF TOPOGRAPHICAL MAP

**Hours**: 3 (3-0-0) (Lecture-Tutorial-Lab)

**Credit**: 13

### Learning Outcomes

Upon completion of the subject student will be able to:

- LO1: Identify different map projections and topographical maps
LO2- Identify features for ground-based recognition
LO3- Interpret the topographical sheets.

Syllabus
Map Projection, Topographical Map, Map Reading, Identification of Topographical Sheets, Study of topographical sheets for delineation of different features, Methods to be followed during Interpretation, Identification of the Features, Ground based observation equipment – Radiometer, spectrophotometer.

Text book

Assessment
Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS515: IMAGE INTERPRETATION & MAP SCALES
Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)
Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Understand the characteristics of image and its interpretation
LO2-Identify image interpretation elements
LO3-Generate thematic maps
LO4-Construct graphical scales –plain and comparative scale

Syllabus
Fundamentals of Airphoto/ Satellite image interpretation, Basic photo/ Image elements, Characteristics of image and its interpretation, image reading, measurement and analysis, Generation of thematic maps, Different weather satellites, Optical satellite data interpretation, Radar data interpretation, Interferometry, Concept of scale of maps, Representation of Map Scales, Cartographic Representation of Map Scales, Construction of Graphical Scales, Plain Scale, Comparative Scale, Diagonal Scale

Text book

Assessment
Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%

RGS502: IMAGE INTERPRETATION FOR EARTH SCIENCE AND TERRAIN EVALUATION

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)
Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Identify various types of igneous rocks, metamorphic rocks and their formation
LO2-Detect different types of rock and minerals through Remote Sensing
LO3-Apply remote sensing to assess soil textures, soil moisture regime, soil organic matters

Syllabus

Airphoto/ Satellite Image Interpretation for Terrain Evaluation for Study of soil Characteristics, Study of drainage & erosion, Study of land use & vegetation,
<table>
<thead>
<tr>
<th>RGS504: INTERPRETATION OF REMOTE SENSING DATA FOR THEMATIC MAPPING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours:</strong> 4 (4-0-0) (Lecture-Tutorial-Lab)</td>
</tr>
<tr>
<td><strong>Credit:</strong> 18</td>
</tr>
<tr>
<td><strong>Learning Outcomes</strong></td>
</tr>
<tr>
<td>Upon completion of the subject student will be able to:</td>
</tr>
<tr>
<td>LO1-Achieve urban growth using remote sensing</td>
</tr>
<tr>
<td>LO2-Identify wildlife ecology and archaeological applications; and environmental assessment</td>
</tr>
<tr>
<td>LO3-Apply principles of landform identification and evaluation, soil characteristics, topography, drainage pattern, texture and land erosion.</td>
</tr>
<tr>
<td><strong>Syllabus</strong></td>
</tr>
<tr>
<td><strong>Text book</strong></td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
</tr>
<tr>
<td>Continuous Assessment: 50%</td>
</tr>
<tr>
<td>Written Examination (1 x 2 hours): 50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RGS506: THERMAL INFRARED AND HYPERSPECTRAL REMOTE SENSING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hours:</strong> 3 (3-0-0) (Lecture-Tutorial-Lab)</td>
</tr>
<tr>
<td><strong>Credit:</strong> 13</td>
</tr>
<tr>
<td><strong>Learning Outcomes</strong></td>
</tr>
<tr>
<td>Upon completion of the subject student will be able to:</td>
</tr>
<tr>
<td>LO1-Describe the thermal radiation principles, interpret thermal scanner imagery</td>
</tr>
<tr>
<td>LO2-Recognize thermal scanners, FLIR systems</td>
</tr>
<tr>
<td>LO3-Describe the Planck's radiation (blackbody) law, diurnal heating effects</td>
</tr>
<tr>
<td>LO4-Describe the thermal properties of water; heat capacity mapping mission</td>
</tr>
<tr>
<td>LO5-Conceptualize hyperspectral remote sensing and potential application of hyperspectral remote sensing</td>
</tr>
<tr>
<td><strong>Syllabus</strong></td>
</tr>
</tbody>
</table>
RGS508: MICROWAVE REMOTE SENSING

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)

Credit: 09

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

LO1-Relate with the fundamentals of microwave sensing, radars, microwave sensors onboard satellites

LO2-Describe the concept of radar altimeter, microwave scatterometer, microwave radiometer

LO3-Describe the spatial resolution of SLAR systems and synthetic aperture radar

LO4-Underline the terrain characteristics which influence radar returns, polarisation

LO5-Underline NASA's SIR-C/X-SAR mission

Syllabus

Text books


Assessment
Continuous Assessment: 50%
Written Examination (1 x 2 hours): 50%
### Learning Outcomes
Upon completion of the subject student will be able:

- **LO1**: Envision the components of digital image processing system
- **LO2**: Describe the notations commonly used in digital remote sensing data
- **LO3**: Discuss on preprocessing of a digital image.
- **LO4**: Assemble logical units of DIP, with high level language

### Syllabus
Image Processing System Characteristics: CPU, Arithmetic Co-Processor, RAM, Operating System and Compiler, Basic operations, Hardware, Software, Humanware, Data, Procedure, History of development, Classification of digital computer, workstations, Communication device, Transmission media, Logical units of DIP, Operating system, Application software, Software categories, Data representation in DIP, Programing language, High level language, Program development tools, Concept of internet, Basic features of digital images, Image display system, BW Image Interpretation, Video Image display, transferring video displays to hard copy displays. Classification of digital images, DIP flowchart, Modes of digital image generation, Data format of digital satellite imagery, soft copy image to hardcopy image

### Text books

### Assessment
- Continuous Assessment: 50%
- Written Examination (1 x 2 hours): 50%
**RGS514: MULTI-IMAGE MANIPULATION – INFORMATION EXTRACTION**

**Hours:** 2 (2-0) (Lecture-Tutorial-Lab)

**Credit:** 09

**Learning Outcomes**

Upon completion of the subject student will be able to:

- LO1: Understand image transformations, band combinations, band ratioing, develop knowledge on Principal Component Analysis
- LO2: Analyse various vegetation indices, colour space transformation
- LO3: Analyse various image classification algorithms, various outputs of data processing, methods of accuracy assessment

**Syllabus**

Spectral Rationing, Principal and Canonical components, Vegetation Components – TVI, NDVI, Intensity – Hue – Saturation (HIS) Colour Space Transformation, Image Classification, Classification Algorithms, Minimum Distance to Means Classifier, Parallelepiped Classifier, Gaussian Maximum likelihood Classifier, Supervised Classification, Training stage, Unsupervised Classification, Output stage – Graphic Products, Tabular Data, Post Classification Smoothing, Classification Accuracy Assessment, Advanced classification techniques

**Text books**


**Assessment**

- Continuous Assessment: 50%
- Written Examination (1 x 2 hours): 50%

---

**RGS516: GEO-STATISTICS**

**Hours:** 3 (3-0-0) (Lecture-Tutorial-Lab)

**Credit:** 13

**Learning Outcomes**

Upon completion of the subject student will be able to:

- LO1: Apply statistical tests to data to assess precision and accuracy of single and groups of linear measurements;
- LO2: Use partial differentials to derive error analysis of linear and non-linear functions;
- LO3: Apply statistical methods for the definition of specifications;
- LO4: Apply basic statistical analyses for thematic mapping and spatial data aggregations, generalisations and polygon manipulations.

**Syllabus**

Sampling and summarizing Geographical data: Types of sampling methods, Estimates from sample, Types of error. Collection of data, Classification & Tabulation; Chart and Diagrams; Frequency distribution, Measures of central tendency and dispersion; Moments, skewed Concept of Probability distribution; Normal Probability distribution; Properties of Normal Curve. Mean centre of population & settlement and their temporal shift, Locational Quotient (LQ), Lorenz Curve & Gini's Coefficient of Correlation, Standard Score / Z-Score, Nearest Neighbor analysis & Population Potential, Bi-variate distribution and Correlation: Scatter diagrams and regression analysis; Measures of Correlation: Product Moment Correlation coefficient, introduction to least square & Residual Mapping, Spearman's Rank correlation coefficient. Time series analysis and spatial distributions and interaction; shortest path analysis.

**Text book**

RGS601: PRACTICAL ON DIGITAL IMAGE PROCESSING (DIP) - INTRODUCTION TO REMOTE SENSING WITH ERDAS IMAGINE

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)
Credit: 09

Syllabus
Handling satellite image, FCC preparation and Scientific Visualization: Image loading & display, Standard FCC and various band combination FCC, Studying FCC, Signature generation on graph sheets for various land covers; Pre-processing: Image registration, Single map (topographic map), Map to Image, Image to Image, Image with known points; Image Mosaicing: Registration of all adjacent images in the same coordinate system, Image mosaicing, Sub set images registration, Image cutting with given boundary.

Text books

RGS603: PRACTICAL ON DIP - INTRODUCTION TO DIGITAL IMAGE PROCESSING

Hours: 4 (1-0-3) (Lecture-Tutorial-Lab)
Credit: 09

Syllabus

Text books
### RGS605: PRACTICAL ON DIP - SATELLITE IMAGE CLASSIFICATION, 3D MODELING AND MAPPING

**Hours:** 4 (1-0-3) (Lecture-Tutorial-Lab)

**Credit:** 09

**Learning Outcomes**
- LO1: Understand Digital Elevation Modeling and 3D analysis
- LO2: Compare various unsupervised and supervised image classification
- LO3: Prepare output maps

**Syllabus**
- Satellite Image Classifications: Unsupervised classification, Pseudo-colour assignment to classified image, Signature creation after visual interpretation, Supervised classification, Statistics generation from classified image, Classification with mask, Recoding, Accuracy assessment, classification error matrix generation; Output generation: Raster to vector generation from classified image, Smoothening of classified image to reduce noise, Preparation of colour thematic maps, ready for print to a pdf or Tiff file; 3D modelling: Understanding contour layer and Z (altitude values), Create surface from the contour layer using Z coordinate, display the DEM/3d surface data into the Virtual GIG viewer, Vertical exaggerations, flood zone or water level analysis.

### RGS607: PRACTICAL ON PHOTOGRAMMETRY, VISUAL ANALYSIS OF AIRPHOTO & SATELLITE IMAGE

**Hours:** 4 (0-0-4) (Lecture-Tutorial-Lab)

**Credit:** 06

**Learning Outcomes**
- LO1: Identify interpretation techniques of analog data products
- LO2: Use stereoscopes and Parallax bar
- LO3: Determine scale of image from reference map, topographical sheets
- LO4: Apply image and photo interpretation and preparation of map

**Syllabus**
- Study of border information from Air Photo, Stereo Test with lens stereoscope and Stereo Test Card, Orientation of stereo model under mirror stereoscope, Determination of Photo scale, Use of Parallax Bar, Use of Parallax Bar and determination of height from stereo pair, Study of border information of IRS Satellite imagery, marking of...
reference system (Study of path & row), Preparation of Base map from Toposheets,
Visual interpretation of Air photo, Single band & False Colour Composite (FCC) imagery for identification of earth surface feature, Mapping of the following themes using satellite imagery - Landuse/Land Cover, Forest, Soil Geomorphology, Surface water, Geology

Text book

Reference/Module
1. Departmental Modules

Assessment
Continuous Assessment: 100%

RGS609: COMPONENTS OF GEOGRAPHIC INFORMATION SYSTEM (GIS)

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)
Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Describe the geographic information system and applications
LO2-Recognize different segments in geographic information system
LO3-Describe data structures

Syllabus
Introduction to Geographic Information System (GIS), Components of Geographic Information System (GIS); GIS software module, Organizational aspects of GIS, Data for GIS Applications, Various Segments – in GIS, Developments in GIS – Past, Present & Future – Pitfalls, GIS as a Unique concept, Data Structures, Raster Based GIS, Vector Based GIS, Databases, Global Positioning Systems (GPS) - an Excellent Tool in Aid of GIS, Remote Sensing Interface, Data Standards and Future Trend, Measurement, Representation, Operation, Transformations, GIS as a Set of Interrelated Subsystems, Scope of Environmental Applications of GIS, Future trend in GIS.

Text book

Assessment
Continuous assessment - 50%
Computer based Practical examination - 50%

RGS611: DATA ORGANISATION & DATA MODELS IN GIS

Hours: 2 (2-0) (Lecture-Tutorial-Lab)
Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Identify data structures for GIS
LO2-Understand geographical data in computer
LO3-Practice raster data structure
LO4-Recognize vector based GIS
LO5-Compare advantages and disadvantages of the data models

Syllabus
Introduction to Geographic Information System (GIS), Components of Geographic Information System (GIS); GIS software module, Organizational aspects of GIS, Data for GIS Applications, Various Segments – in GIS, Developments in GIS – Past, Present & Future – Pitfalls, GIS as a Unique concept, Data Structures, Raster Based GIS, Vector Based GIS, Databases, Global Positioning Systems (GPS) - an Excellent Tool in Aid of GIS, Remote Sensing Interface, Data Standards and Future Trend, Measurement, Representation, Operation, Transformations, GIS as a Set of Interrelated Subsystems, Scope of Environmental Applications of GIS, Future trend in GIS.
Syllabus
Data Organisation in computer; Data Structures For GIS, Geographical Data in Computer, Files and Data Access, Data structure of GIS: Points, lines and area; Geographical data in computer; Perceived structures and computer representation of geographic data, Raster Data System - Raster Data Structures, Vector Based GIS - Vector data structure for thematic maps; Choice of Vector or raster data, Mosaic, Reclassification, Slicing, Choice of Data Model – Advantages and Disadvantages

Text books

Assessment
Continuous assessment - 50%
Computer based Practical examination - 50%

RGS613: DATA ENCODING & DATA MANIPULATION

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)
Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Recognize data input
LO2-Describe manual digitising and scanning of analogue maps
LO3-Discuss on the direct data entry
LO4-Manage data structures for GIS
LO5-Perform line generalisation, simplification, and smoothing algorithms

Syllabus

Text books

Assessment
Continuous assessment - 50%
Computer based Practical examination - 50%

RGS615: GIS–APPLICATIONS & SOME CASE STUDIES

Hours: 2 (2-0-0) (Lecture-Tutorial-Lab)
Credit: 09

Learning Outcomes
Upon completion of the subject student will be able to:
LO1-Recognize capabilities of GIS and GIS applications
LO2-Describe data analysis – spatial modelling
LO3-Use functional tools for map analysis
LO3-Utilize map projection and spatial transformation
LO5-Demonstrate spatial
**Syllabus**

GIS Application, Creation of Digital Elevation Models as Input for GIS, Data Analysis - Spatial Modelling, Capabilities of a GIS, Definition of database, Basic Database Requirements Data Analysis; Simple Data Retrieval, Functional Tools for Map Analysis, Projection and Spatial Transformation

Utilities, Spatial modeling, Cartographic modeling: Map overlay, Data Quality; Spatial Retrieval, Classification, Measurement Functions, Data Retrieval Using Rules of Boolean Logic, Logical and Visual Overlaying Capabilities, Proximity and Network Functions, Map Algebra Utilities, Vector Overlay Processing, Vector Based GIS Overlay, Error

- Sources & Handling in GIS, Errors resulting from rasterizing a vector map; errors associated with digitizing a map and with geocoding; errors associated with overlaying two or more polygon network, GIS application for – Forest resource inventory; Landuse- landcover study; Drought monitoring, Soil mapping; Geological study, Geomorphological study, Environmental Management, Oceanographic Study, Natural Hazard Management.

**Text books**


**Assessment**

Continuous assessment - 50%
Computer based Practical examination - 50%

---

**RGS602: PRACTICAL ON GEOGRAPHIC INFORMATION SYSTEM (GIS) - INTRODUCTION TO ARCGIS BASICS**

**Hours:** 4 (1-0-3) (Lecture-Tutorial-Lab)

**Credit:** 09

**Learning Outcomes**

Upon completion of the subject student will be able to:

- LO1-Operate in ArcGIS platform
- LO2-Describe spatial reference to a raster data
- LO3-Demonstrate table and data base handling procedures
- LO4-Manage data in ArcGIS platform

**Syllabus**

Introduction, Raster and Vector Data Storage, Overview of The ArcGIS Software System, Hands on training related to GIS software: ARC/GIS, Introduction basics of ArcMap, Exploring Raster and Vector data with ArcMap; Display a Raster data, Performing Standard FCC of the Raster data, Performing Zoom in, moving and full Extent of map, Display a vector layer, Off-On layers and Changing display symbol of Vector layers, Identifying features from Vector layers; Dealing with data and table: Performing Attribute Query from Vector layers, Performing Spatial Query from Vector layers, joining a Table from other GIS layer, Export a GIS layer, Importing data base into GIS, Joining a Table from database file; Using Raster Images – Creating control Points and Geo-coding, Geometric transformation.

**Text book**


**Reference/Module**

2. Departmental Modules
### RGS604: PRACTICAL ON GIS - CREATION OF NEW VECTOR COVERAGE, DATA BASE AND THEMATIC MAPPING

**Hours:** 4 (1-0-3) (Lecture-Tutorial-Lab)

**Credit:** 09

**Learning Outcomes**
Upon completion of the subject student will be able to:
- LO1-Digitise new coverage and create data base
- LO2-Prepare thematic maps
- LO3-Managing animations and recording
- LO4-Develop hazard related maps and data base

**Syllabus**
- Vector layer creation and Digitization: New Vector layer creation, Point layer, Line layer and polygon layer creation, Point features, line features and area/polygon features digitization; Attribution to the vector layer: Attribution to the point (vector) layer, line layer and polygon layer; Cartographic design and map representation: Display data layers and change the symbol, Change the layer symbol and label properties, Making a choropleth map using polygon layer, Preparing Map for Presentation using Legend, scale, North arrow, grid and Title, Exporting Map to TIFF format and print.

**Text book**

**Reference/Module**
2. Departmental Modules

### RGS606: PRACTICAL ON GIS - SPATIAL DATA ANALYSIS AND 3D MODELING

**Hours:** 4 (1-0-3) (Lecture-Tutorial-Lab)

**Credit:** 09

**Learning Outcomes**
Upon completion of the subject student will be able to:
- LO1-Recognize different 3D and surface analysis procedures
- LO2-Understand proximity analysis
- LO3-Apply overlay analysis and spatial interpolation process

**Syllabus**
- Spatial Interpolation with vector layer: Display the point (vector) layer, Inverse Distance Weighted Interpolation, Spline Interpolation, Kriging Interpolation, Reclassification of Raster data; Surface Analysis using DEM data: Creating TIN using Contour data, Displaying TIN in the ARC Scene, Surface Analysis: Contour From DEM data, Slope, Aspect, Hill shade, View shade, and Cut and Fill From DEM data; Overlay and proximity analysis: Simple buffer for point layer, Multiple ring buffer for point layer, Intersection between two Polygon Layers, Union between two Polygon Layers.

**Text book**

**Reference/Module**
2. Departmental Modules

**Assessment**
- Continuous Assessment: 100%
RGS608: APPLICATION OF GEOINFORMATICS

Hours: 4 (4-0-0) (Lecture-Tutorial-Lab)

Credit: 18

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

LO1-State real world application of geo-informatics
LO2-Describe the GNSS / NAVSTAR GPS and other countries’ navigation systems
LO3-Describe differential GPS positioning
LO4-Generation of specific theme-oriented GIS systems
LO5-Analyze several case studies on specific themes

Syllabus/Case Studies

Text book
MASTER OF SCIENCE IN URBAN AND REGIONAL PLANNING

RATIONALE
This beautiful country – often referred to as ‘the paradise on earth’ by the philanthropists – deserves a befitting management of her enormous natural resources. The sustainable development of natural resources and eco-friendly exploitation of the resources can only be achieved by the enlightened citizens. The program aims to create skilled manpower/human resources that will be adept in optimal planning, management and development of Urban and Rural areas. In a nutshell, this program will churn out qualified professionals who, using state of the art technology, will be instrumental in developing, managing, exploiting all sorts of natural and man-made resources in a sustainable manner in order to create sustainable villages, towns, cities and provinces to facilitate PNG’s achievement of mid-term and long-term development aspirations.

The program aims at creating human resources capable of integrating the physical planning and development of PNG with the emerging technologies of remote sensing, geographic information systems, Global Positioning System (GPS) etc.

It is paramount to note that the country has dire shortage of qualified planners / planning professionals to man the public and private sectors. We presume that this course will be churning out qualified professionals to fill in this void. Moreover, the department foresees that this course could draw a substantial interest from a large section of PNGians who earnestly yearn for attaining a post-graduate degree from this ace institution of PNG. Once we start the course, we expect a chain reaction and the market will be self-sustained.

The program will be substantially offered from this department, with the multi-disciplinary support of a number of allied departments in the University (Architecture and Building, Civil Engineering, and Communications and Development Studies). With the additional support received from two other departments in the University (Business and Agriculture) we have designed a globally benchmarked program curriculum substantially offered from this department that will feed into the preparation of standard course modules. We can now look forward to commencing this course in November 2017.

PROGRAM OUTCOMES
The aim of the M.Sc. URP program is to train and develop highly skilled urban and regional planners to meet the increasing needs of local, municipal, provincial and national governments as well as the private sector for the overall purpose of the planning of the scientific, aesthetic, and orderly disposition of land, resources, facilities and services with a view to securing the physical, economic and social efficiency, health and well-being of urban and rural communities in PNG and South Pacific.

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

1. How urban and regional planning practice is intertwined with urban and regional planning theory, and how theory gets honed from practice.
2. Lessons that can be learned from the histories of great human settlements in resolving the multi-dimensional dilemmas of contemporary human settlements.
3. The principles and practice of urban and regional planning and development relevant to the social, cultural and economic environment in PNG and relative to regional and global opportunities and constraints within the system.
4. The interrelationships and impacts of geographical, legal, physical, economic, social, political and global factors affecting sustainability and liveability of human settlements in a holistic fashion.
5. Built environment (theoretical and applied) research, data collection, data analysis and report writing as inputs in policy making and implementation.
6. The design, analysis and evaluation of urban and rural development schemes, including physical development plans, for both private and public-sector clients and other stakeholders.
7. Working on multi-disciplinary project teams and comprehending team members’ scopes of work, deliverables and issues in which all members are able to lead the team towards the desired goal of creating sustainable villages, towns and cities.
8. Recognition of the need for, and an ability to engage in life-long learning to upgrade to higher learning and research activities for the benefit of urban and rural communities.
9. Production of a range of environmental and liveability analyses for new and existing settlements as well as environmental impact assessments for large-scale projects at an appropriate level of professional competence.

10. Application of basic concepts in mapping, cartography, reference surfaces and coordinate systems in the design and study of human settlements.

11. Application of GIS and Remote Sensing technologies in the design and management of human settlements and in addressing climate change challenges.

12. Use of public advocacy to secure effective public participation and achieve conflict resolution in the planning process.

13. Application of financial analysis, feasibility studies, graphics, risk/sensitivity analysis, data analysis and sustainable development techniques in the evaluation of urban and rural development schemes.

14. Undertaking computer assisted design and architectural design in the process of planning, development and long-term management of human settlements.

15. Application of physical (environmental) planning standards and building regulations in preparing site plans, land sub-division layouts, subject, local, provincial and master/structure plans for sustainable human settlements.

SUMMARY OF THE COURSES

The duration of the proposed MSc. URP course will be normally two years. In case a student fails to complete it within the scheduled timeline he/she will be allowed relaxation for a maximum of 2 more years on valid grounds (e.g. medical, financial etc.). After four years, the candidate’s enrollment will be treated as cancelled and the entire course fee paid by him/her will be forfeited. Then the candidate shall have to seek re-admission as a fresh candidate.

The program will be offered in DISTANCE MODE over a period of four semesters with the session starting from November and ending in November/December. The residential (direct contact) period is proposed to be in the months of November-December while, depending upon the situation, another session of contact may be given in the month of June (for about 15 days).

Notwithstanding the contributions of allied departments, the administration of entire study modules, lectures, examinations, etc., shall be the responsibility of the department of Surveying and Land Studies.

ENTRY REQUIREMENT

The entry requirement for admission of students is a Bachelor’s degree in Science, Social Science or Engineering from a recognized university as per the University norms.

Course Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Mode of Study</th>
<th>Duration</th>
<th>Contract Hours</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Residential</td>
<td>Nov-Dec</td>
<td>34</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td>Semester 1 - Distance</td>
<td>Feb-June</td>
<td>20</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Semester 2 - Distance</td>
<td>July-Oct</td>
<td>18</td>
<td>67</td>
</tr>
<tr>
<td>2</td>
<td>Residential</td>
<td>Nov-Dec</td>
<td>32</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Semester 1 - Distance</td>
<td>Feb-June</td>
<td>28</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Semester 2 - Distance</td>
<td>July-Oct</td>
<td>28</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Residential</td>
<td>Nov-Dec</td>
<td>32</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>192</td>
<td>550</td>
</tr>
</tbody>
</table>

Subject Outline

<table>
<thead>
<tr>
<th>Year</th>
<th>Code</th>
<th>Subject</th>
<th>Hours with CCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>URP 501: Planning Theory and Methods</td>
<td>20</td>
<td>(4-1-0)</td>
</tr>
<tr>
<td></td>
<td>URP 502: Mapping Concepts</td>
<td>22</td>
<td>(4-2-0)</td>
</tr>
<tr>
<td></td>
<td>URP 503: Urban Planning &amp; Design Studio</td>
<td>16</td>
<td>(3-0-2)</td>
</tr>
<tr>
<td></td>
<td>URP 504: Statistics for Planners</td>
<td>22</td>
<td>(4-2-0)</td>
</tr>
<tr>
<td></td>
<td>URP 505: GIS for Planners</td>
<td>20</td>
<td>(4-1-0)</td>
</tr>
<tr>
<td></td>
<td>URP 506: Hands-on Exercises Using Geo-spatial Data</td>
<td>9</td>
<td>(0-0-6)</td>
</tr>
<tr>
<td>2</td>
<td>URP 507: Planning for Coastal Zones</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td></td>
<td>URP 508: Satellite Remote Sensing for Planners</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td></td>
<td>URP 509: Demographic Studies</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td></td>
<td>URP 510: Regional Planning</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td></td>
<td>URP 511: Planning Policies, Law &amp; Ethics in PNG</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td>2</td>
<td>URP 512: Rural Development Planning</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td></td>
<td>URP 513: Disaster Management</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
</tbody>
</table>
# Department of Surveying and Land Studies

## POSTGRADUATE COURSES HANDBOOK 2019

### Distance Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>URP 514</td>
<td>Women in Rural Development</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td>URP 515</td>
<td>Organisational Behaviour</td>
<td>22</td>
<td>(4-2-0)</td>
</tr>
<tr>
<td>URP 516</td>
<td>Rural Sociology</td>
<td>20</td>
<td>(4-1-0)</td>
</tr>
<tr>
<td>URP 517</td>
<td>Project Evaluation, Planning and Sustainability</td>
<td>16</td>
<td>(3-0-2)</td>
</tr>
<tr>
<td>URP 518</td>
<td>Satellite Image Processing Techniques</td>
<td>10</td>
<td>(1-0-4)</td>
</tr>
<tr>
<td>URP 519</td>
<td>GNSS/GPS: Theory and Practice</td>
<td>15</td>
<td>(2-0-4)</td>
</tr>
<tr>
<td>URP 520</td>
<td>Research Methodology</td>
<td>22</td>
<td>(4-2-0)</td>
</tr>
<tr>
<td>URP 521</td>
<td>Dissertation</td>
<td>11</td>
<td>(0-5-0)</td>
</tr>
</tbody>
</table>

### Residential Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>URP 521</td>
<td>Dissertation</td>
<td>45</td>
<td>(0-20-0)</td>
</tr>
<tr>
<td>URP 522</td>
<td>Climate Change: Policy Implications for Human Settlements and Planners’ Response</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td>URP 523</td>
<td>Transportation Engineering and Planning</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
</tbody>
</table>

### Semester 1- Distance

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>URP 524</td>
<td>Urban Housing and Settlement Planning</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td>URP 525</td>
<td>Land Use Planning and Sustainability</td>
<td>15</td>
<td>(3-1-0)</td>
</tr>
<tr>
<td>URP 521</td>
<td>Dissertation</td>
<td>45</td>
<td>(0-20-0)</td>
</tr>
</tbody>
</table>

### Semester 2 - Distance

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>URP 526</td>
<td>Practical on Watershed Management Using RS Images</td>
<td>9</td>
<td>(0-0-6)</td>
</tr>
<tr>
<td>URP 527</td>
<td>Mapping of Urban Land Use with High Resolution Images</td>
<td>9</td>
<td>(0-0-6)</td>
</tr>
</tbody>
</table>

Contact hours: (X-Y-Z); X = Lecture hours; Y = Tutorial hours; Z = Lab hours

## Details of the Subjects

### URP 501: Planning Theory and Methods

**Hours per week:** 5 (4-1-0)

**Credit:** 20

**Learning Outcomes**

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

1. Explain the histories, theories and methods of planning relating to contemporary professional practice
2. Demonstrate how practice is informed by theory and how theory emerges from practice
3. Examine the multi-dimensional dilemmas that planners attempt to resolve in day-to-day practice and the contradictions that animate their work

**Syllabus**

**Definitions and Historical Perspectives**

Definition of planning; aims and objectives of physical planning; the necessity and rationale of planning; the characteristics of planning; the planning process; history and evolution of Urban and Regional Planning thought in Europe, America, Africa and Oceania

**Philosophy and Theory of Urban and Regional Planning**

Normative planning, positive planning and ameliorative planning; the synoptic or rational comprehensive planning theory; Incremental planning theory, Mixed-Scanning theory, Transactive planning theory, Advocacy planning theory, Radical planning theory, Choice theory and Action planning; their relevance

**Planning Practice**

Levels of planning in PNG and the Pacific; their broad interrelationships, components of settlements, Planning techniques and the changing role of the planner, the nature of planning, procedural and substantive process, planning traditions in both capitalist and socialist economies, citizen participation in the planning process

**Planning Methods & Modes**

Economic base and input-output methods, methods of population projections, National and Regional Income Accounting and Industrial Complex Analysis, methods of Evaluation in Planning; methods of cost-benefit and goals achievement analyses; Planning Programming and Budgeting systems; Planning modes.

**References**

Campbell (Eds.), Readings in Planning Theory (3rd Ed.) (pp. 87-104). Oxford: Wiley-Blackwell

Journal

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 502: MAPPING CONCEPTS

Hours per week: 6 (4-2-0)
Credit: 22

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Use the basic concepts in Mapping
2. Apply the concepts of Reference Surfaces, Coordinate Systems and Map Projections
3. Undertake map design and layout
4. Apply their knowledge of Topographic and Thematic Cartography.

Syllabus
Basic Concepts: Map and its Basic Characteristics, Cartography, History and nature of cartography, Scales of maps, Classification of maps, Maps and Plans.
Reference Surfaces, Coordinate Systems and Map Projection: Physical Surface of the Earth, Geoid, Reference Spheroid and Geodetic datum, Geographical Coordinate System, Map Projection (LO, UTM),
Map Design and Layout: The graphic outline (the title, legend and scale), Lettering and Toponomy, Cartographic Generalization, Map Numbering System, Map Reproduction.
Topographic and Thematic Cartography: Definition and scales of topographic maps, Topographic data Content, Representation of Relief.

Textbooks

References
1. Departmental Modules

Assessment
Continuous Assessment: 50%
Written Examination 50%

URP 503: URBAN PLANNING & DESIGN STUDIO

Hours per week: 5 (3-0-2)
Credit: 16

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Apply urban design principles and concepts in undertaking site planning and urban design analysis
2. Design the process of and appreciate the products of the design of the built environment
3. Undertake visual, graphic and spatial representations of the built environment
4. Appreciate the impact of experiential learning by doing (through cooperative studio exercises and projects) and the interdependence of procedural and substantive knowledge.

Syllabus
Theoretical Background to Design Studio
Macro theories and principles of design; the formulation of minimum and desirable space standards; ecological approaches to urban and regional design; visual elements in an urban complex; design of urban images, urban from determinants - urban scale, urban space, urban mass and open spaces.
Intermediate Design Studio
Design resources, design composition, space articulation and aesthetic qualities, practical assignments in site planning particularly the design of housing, industrial, commercial and recreational estates.
Advanced Design Studio
### URP 504: STATISTICS FOR PLANNERS

**Hours per week:** 6 (4-2-0)  
**Credit:** 22

**Learning Outcomes**  
Upon completion of this subject, students will be able to:  
1. Apply the basic concepts of Statistics  
2. Analyse geographical data  
3. Undertake basic statistical data analysis  
4. Apply statistical analysis to thematic mapping

**Syllabus**  
**Variable and Graphs:** Introduction to Statistics- The Research Process & Use of Statistics in Planning and Policy, Descriptive Statistics, Population and Sample.  
**Frequency Distribution:** Raw data, Array, Frequency distribution, Class Boundaries, Relative Frequency and Percentages, Relative frequency distribution, Relative Cumulative-Frequency distribution and percentage Ogives.  
**Measures of Central Tendency:** Mean, Median, Mode, Quartile, Decile and Percentile.  
**Measures of Dispersion:** The Range, the Inter-quartile Range, Standard deviation/Root Mean Square error, the variance, properties of Standard Deviation, Absolute and relative dispersion; Coefficient of Variation, Standard Variable; Standard Scores.  
**Elementary Sampling Theory:** Sampling theory, Random samples and Random Number, Sample with and without replacement, Sampling distribution, Sampling distribution of mean, standard error.  
**The Small Sampling Theory:** Small sample, student's t distribution, test of hypotheses and significance, the chi square distribution, degree of freedom, the chi square test for goodness of fit.  
**Correlation Theory:** Correlation and regression, linear relation, Measure of Correlation, The least squares regression lines, standard error estimation, residual mapping, Coefficient of correlation, Correlation of time series

**Textbook**  

**References**  
2. Departmental Modules

**Assessment**  
<table>
<thead>
<tr>
<th>Continuous Assessment</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Examination</td>
<td>50%</td>
</tr>
</tbody>
</table>

### URP 505: GIS FOR PLANNERS

**Hours per week:** 5 (4-1-0)  
**Credit:** 20

**Learning Outcomes**  
Upon completion of this subject, students will be able to:  
1. Understand and apply basic concepts of GIS  
2. Explain spatial data modelling techniques  
3. Use various data capture methods  
4. Perform various types of GIS data analysis

**Syllabus**  
**GIS Introduced:** An overview of the development of the GIS field, spatial and non-spatial data, GIS defined, Components and functions, Data sources, GIS applications.  
**Spatial Data Modeling** (Computer representation of cartographic features): Spatial feature types – points, lines, areas and networks and surfaces, Spatial data models (vector and raster models), spatial data structure (vector and raster)
Data Capture Methods: Map digitization: manual digitization, semi-automatic and automatic digitization, Scanning and geo-referencing, automatic vectorization, Conversion from other digital sources, Attribute data input and management, metadata.

GIS Data Analysis/Processing: Measurements in GIS, Queries, Buffering, Integration, digital terrain modeling, data visualization.

Textbook

References
1. Departmental Modules

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 506: HANDS ON EXERCISES USING GEO-SPATIAL DATA

Hours per week: 6 (0-0-6)
Credit: 9

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Understand and apply the various data handling techniques used in ArcGIS platform
2. Design and use geo-spatial tables and relevant data handling procedures
3. Perform spatial referencing with regards to raster data and digitising of new coverage
4. Design GIS Database and thematic mapping.

Syllabus
Introduction to ArcGIS: Introduction basics of ArcMap, Display a Raster data, Performing Standard FCC of the Raster data, Performing Zoom in, moving and full Extent of map, Display a vector layer, Identifying features from Vector layers.

Dealing With Data and Table: Performing Attribute Query from Vector layers, Performing Spatial Query from Vector layers, joining a Table from other GIS layer, Export a GIS layer, Importing data base into GIS, Joining a Table from database file; Using Raster Images – Creating control Points and Geo-coding, Geometric transformation.

Vector Layer Creation and Digitization: New Vector layer creation, Point layer, Line layer and polygon layer creation, Point features, line features and area/polygon features digitization; Attribution to the vector layer: Attribution to the point (vector) layer, line layer and polygon layer.

Cartographic Design and Map Representation: Display data layers and change the symbol, Change the layer symbol and label properties, Making a choropleth map using polygon layer, Preparing Map for Presentation using Legend, scale, North arrow, grid and Title, Exporting Map to TIFF format and print.

Textbook

References
1. Departmental practical modules on GIS

Assessment:
Continuous Assessment: 50%
Practical Examination: 50%

URP 507: PLANNING FOR COASTAL ZONES

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Explain the sustainable use of coastal natural resources
2. Demonstrate how to maintain high levels of biodiversity and real conservation of critical habitats
3. Explain how to maintain and support fisheries, protect the community from storm ravages, attract tourists, promote public health, maintain yields from mangrove forests and preserve coral reefs

Syllabus
Definition of coastal zone and related nomenclature; Coastal processes: Wave, tide and wind. Coastal currents and cells; Coastal morphodynamics: Micro, macro and biogenic forms; Systems of change in coasts: cyclical and progressive; Classification of...
coasts based on processes and sediment characteristics; Coastal biogeography with special reference to sea weeds, mangroves, dune vegetation and corals: Their ecological and economic significance; Natural coastal hazards and their management: Sea level rise, erosion, sedimentation and tropical cyclones; Techniques of monitoring changes in coastal processes and landforms; Coastal regulations with special reference to PNG; Human utilisation of coasts, environmental impacts and management: Navigation, mining, fishing and fish-processing, off-shore oil exploitation, reclamation and tourism; Coastal engineering and its impacts: Ports and harbours, measures for prevention of erosion and sedimentation; Coastal pollution: Sources, impacts and management; Integrated Coastal Management: Concepts, techniques and applications; Major environmental issues, problems and their management; Application of Remote Sensing with special reference to Fishery; Monitoring Surface waters in Coastal Regulatory Zone (CRZ); Study of Suspended mineral in water; Study of Chlorophyll in water; Measurement of Sea Surface Temperature (SST)

Textbooks

References
1. Departmental practical modules on GIS

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 508: SATELLITE REMOTE SENSING FOR PLANNERS

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Understand and explain the conceptual foundation of Remote Sensing
2. Explain the various RS platforms, sensors, and associated concepts
3. Understand and describe the concept of Digital image processing
4. Describe the benefits and strategies for the application of satellite images in the 21st century

Syllabus
Remote Sensing Satellites: LANDSAT, SPOT, IRS, IKONOS, QUICKBIRD, Worldview, RADARSAT, NOAA etc.
Image Interpretation: Elements of image interpretation, Visual and digital interpretation techniques, their advantages and limitations, Ground truth Collection.
Digital Image Processing: Image statistics, Radiometric and Geometric Corrections, Image Enhancement, Information Extraction, Visual and digital interpretation techniques, their advantages and Limitations, Ground truth Collection Applications: Topographic surveying, Land use/Land cover mapping

Textbooks

References
1. Departmental Modules

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 509: DEMOGRAPHIC STUDIES
### URP 510: REGIONAL PLANNING

**Hours per week:** 4 (3-1-0)  
**Credit:** 15

**Learning Outcomes**  
Upon completion of this subject, students will be able to:  
1. Describe the theories, concepts, ideas, and strategies employed in the pursuit of regional planning and economic development  
2. Develop and apply basic principles that enable critical assessment of alternative development policies and programs  
3. Reflect on the goals and objectives, implementation strategies, successes and failures of regional planning and economic development efforts

**Syllabus**  
Concept of Region and Regional Planning (Concepts, Scope, Content and Types of Regional Planning), Historical Development of Regional Planning: Regional Planning in Developed, less Developed world, PNG and current status of Regional Planning, Regional Development models/Theories (spatial, non-spatial models), Strategic Development; Theoretical and Philosophical Issues in Regional Development Planning: The various schools of thought in planning in both Capitalist and Socialist economies. The contribution of social sciences to the field of planning. The evolution of development strategies in the developing and developed world. The expanded role of planning and planning crisis in the developing world. Regional Development Planning: Regional development process: conceptual and functional issues; Regional Planning through the Development of a Central Place, Growth Pole and Growth Centres in Regional Development Strategy, Theories of Regional Growth and Location. Regional imbalance and disparity in PNG, Planning Regions of PNG, Problems and prospects of Regional Planning; Case studies of Regional Planning practice in both developed and developing countries. Socialist and

**Assessment**  
Continuous Assessment: 50%  
Written Examination: 50%

---

### POSTGRADUATE COURSES HANDBOOK 2019

**Hours per week:** 4 (3-1-0)  
**Credit:** 15

**Learning Outcomes**  
Upon completion of this subject, students will be able to:  
1. Explain the meaning of Statistical data as a source of population data  
2. Define terms and concepts relating to demography, e.g. gender/sex composition  
3. Identify the factors affecting sex ration and age-sex pyramid  
4. Explain the Malthusian theory of population growth  
5. Describe the Demographic Transition Model and its application

**Syllabus**  
Scope and contents of Demography; Sources of population data, their nature and quality; Population characteristics and composition: age, sex, education, religion, casts and tribes, rural and urban, occupation, language (with special ref. to PNG); Theory of population dynamics – fertility, mortality, migration; Factors determining population growth, distribution and density with special reference to PNG; Migration: Types, patterns and streams of migration and controlling factors; Theories of population growth – classical and modern theories; Demographic transition and the problems of developed and developing countries; Nutrition, fertility, morbidity and mortality with special reference to PNG; PNG’s population policies; Problems of displaced population; Human development index, the PNG scenario; Population Health: HIV /AIDS with special reference to PNG.

**Textbooks**  

**References**  
capitalist approaches to Regional Planning. Special problems of regional planning in developing countries. Conceptual and Theoretical Frameworks for Urban and Regional Planning Analysis: Advanced analysis of city system and the urban and regional structural compositions. Advanced techniques of evaluation, monitoring and control in planning; Multipurpose River Basin planning, Social Dimensions of Regional Development, Delineation of Planning Regions, Intra-provincial planning region, Planning for Customary and Tribal Development

Textbooks

References

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 511: PLANNING POLICIES, LAW AND ETHICS IN PNG

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Describe the planning process and the regulatory tools used to implement it
2. Explain the legal doctrines that empower local governments to regulate land use activities
3. Understand the models, frameworks, and theoretical perspectives under which professionals can assess ethical problems in planning
4. Evaluate the most important emerging ethical trends and controversies in planning, such as ethical uses of the conventional and new media to market projects and ideas
5. Identify the scope and power of professional roles within PNG’s legal and institutional frameworks
6. Apply the fundamental principles of land use law to real world planning issues; and
7. Gain skills in critical analysis and logical reasoning by resolving ethical problems both verbally and in writing.

Syllabus
The public interest dilemma; the rationale for State intervention in the allocation of resources in the built environment; critical examination of the Planning Acts and Legislations in PNG. Land Laws; the Public Health Code and the Housing Code. Laws on compensation with special reference to PNG. History and development of Local Government in the U.K. Australia and PNG and effects on Urban Planning, Urban Government systems, the enforcement of development control, zoning; politics of planning in PNG; Planning policies, practices and procedures, norms and ethics of the planning profession, professional responsibilities and discipline, PNG Institute of Town Planners’ management strategies for environmental hazards; Environmental Impact Assessment; Sustainability issues; The Town Planners Registration Board of PNG and its role. Planning as a business venture. Business skill acquisition and self-employment strategies. Introduction to business management. Personnel management (recruitment, motivation and rewarding). Prudence in financial management. Business ethics and planning ethics. Some laws governing contracting/consultancy case studies. Money laundering, corruption and international politics in business and their impacts on planning.

Textbooks

References

**Assessment**

Continuous Assessment: 50%
Written Examination: 50%

**URP 512: RURAL DEVELOPMENT PLANNING**

**Hours per week:** 4 (3-1-0)
**Credit:** 15

**Learning Outcomes**

Upon completion of this subject, students will be able to:
1. Identify and appraise the theories, policies and methods of rural development in an urbanising world
2. Understand the relationship between rural social framework and social change in rural areas and analyse approaches to rural development in selected developed and developing countries, including the Pacific countries
3. Analyse rural governance and administration in PNG, including the impact of VGGT on customary land tenure system and the ILGs
4. Analyse and synthesise the challenges, prospects and policies of rural industrialisation in PNG

**Syllabus**

**Concepts and Models of Rural Development**
Basic elements and rationale of rural development; growth versus development; rising expectations and development; development and change, dilemmas in development; approaches to rural development; rural development policies; regional and rural development policies in PNG; rapid rural appraisal and participatory rural appraisal, VGGT principles and land governance, public participation and role of voluntary organisations in rural development

**Rural Poverty**

Theories, concepts, causes, effects, nature, biases (spatial, project, person, season, diplomatic and professional); clusters of disadvantages and deprivation; trap, rural poverty alleviation measures; rural poverty scenario in PNG

**Rural Settlements**

Types of settlement; principles and elements of human settlement; approaches to spatial, social, human resources and technological problems of rural areas; policy goals and instruments for rural integration; principles and strategies in the planning of public and private rural facilities; the problems of rural threshold

**The Need for Decentralized Planning**

The need for decentralization of legal and administrative frameworks for cost minimisation and efficiency; PNG as a case study, planning at the Provincial level, advantages and disadvantages over centralized planning; strategies for decentralized planning; institutional framework for decentralized planning in PNG

**Textbooks**


**References**


**Assessment**

Continuous Assessment: 50%
Written Examination: 50%

**URP 513: DISASTER MANAGEMENT**

**Hours per week:** 4 (3-1-0)
**Credit:** 15

**Learning Outcomes**

Upon completion of this subject, students will be able to:
1. Identify and describe various disasters and their impacts on human settlements
2. Identify disaster mitigation measures and cost-effective preparedness strategies
3. Design sustainable environmental planning strategies for disaster-prone areas
4. Understand and apply relief and rehabilitation measures for the sustainability/liveability of disaster areas

**Syllabus**

**Introduction to Disasters**
Introduction to Disasters, Classification of Disasters; Natural disasters, man-made disasters

**Types of disasters:** Biological hazards: epidemics, animal and insect infestation; Geophysical hazards: Earthquakes; Mass movement dry; Mass movement wet, Tsunamis; Volcanic eruptions; Drought; Extreme temperatures; Wildfires / Urban fires, Floods, Tropical storms, hurricanes, typhoons and cyclones, Storms and tidal waves, Industrial accidents, Transport accidents. Famine/food insecurity

**Scope and Objectives of Disaster Mitigation, Preparedness and Response**
Preparedness planning; action plans and procedures, training issues and models, checklists/disaster response planning, roles and responsibilities of various agencies/emergency operations support and management, community participation, public awareness.

**Planning for disaster-prone areas**
Disaster mapping, vulnerability analysis, vulnerability atlas, predictability, forecasting and warning, relief measures, reconstruction and rehabilitation, disaster preparedness plan, land use zoning for disaster management, infrastructure management skill assessment.

**Textbooks**

**References**
1. Anonymous (1986). Bangkok under the Capacity Building in Asia using Information Technology Applications project, to the participating universities and institutions for educational purpose only. www.adpc.net.
3. Departmental Module

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Continuous Assessment: 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Written Examination: 50%</td>
</tr>
</tbody>
</table>

**URP 514: WOMEN IN RURAL DEVELOPMENT**

**Hours per week:** 4 (3-1-0)

**Credit:** 15

**Learning Outcomes**
Upon completion of this subject, students will be able to:
1. Understand and appreciate the concept of rural development
2. Recognize and appreciate the multiple roles that women play in rural development
3. Analyse the role and status of rural women within the context of overall development at the local, provincial, regional and international levels
4. Assess the current and emerging development issues facing rural women in developing countries
5. Identify and apply sustainable strategies capable of fully integrating women into national economic development and rural development processes

**Syllabus**
General theories in development in relation to role of women; Government policies supporting women’s involvement in rural development in developing countries including PNG; rural infrastructure & services; social and economic involvement of women in rural development in developing countries and in PNG; the household, women’s role in agriculture production, use of multi-disciplinary approach to integrate women into the rural development process; relationship among the multiple roles rural women play in agriculture production, household food & nutritional security, family and community life; equal opportunity in education and training for rural women in developing countries for effective participation in rural development process; opportunities for rural women both as participants and beneficiaries in rural development; obstacles to women’s participation in rural development.

**Textbook**

**References**


**Assessment**

| Continuous Assessment: | 50% |
| Written Examination:   | 50% |

**URP 515: ORGANIZATIONAL BEHAVIOUR**

**Hours per week:** 6 (4-2-0)

**Credit:** 22

**Learning Outcomes**

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

1. Understand and apply the concept of organizational behaviour
2. Identify and describe the foundations of individual behaviour
3. Understand and describe the typical organizational behaviour process
4. Apply the principles and theories of organization behaviour in resolving organizations’ problems hindering employee engagement, organizational growth and sustainability

**Syllabus**

**Introduction to Organizational Behaviours (OB)**

Foundations of OB, importance and shortcomings of, approaches to OB. Definition and meaning; Why study OB? Learning – nature of learning, how learning occurs, learning and OB.

**Foundations of Individual Behaviour**


**Group and Interpersonal Behaviour**

Group dynamics - why groups form, types, group norms, cohesiveness, decision making/ styles, strategies for improving decision making teams - special types of groups, types of teams, Power and political behaviour - sources of power, effective use of power. Organisational policies, forces creating political behaviour, forces creating political behaviour, personality and political behaviour. Conflict - Sources and strategies to resolve conflict. Leadership - styles, contemporary developments. Interpersonal communication - essentials, networks, communication technologies, non-verbal communication, barriers, strategies to overcome barriers. Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Followership, An introduction to Transactional Analysis (TA)

**Organisational Process**

Organizational design - types and their behavioral implications. Organizational change - cause for change, why change resisted - managing change. Organization culture - how is culture created and sustained.

**OB Challenges**

Managing diversity, globalisation, technology transformation, ethical behaviour. International Organizational Behaviour: trends in international business, individual and interpersonal behaviour in global perspective.

**Textbooks**

URP 516: RURAL SOCIOLOGY

Hours per week: 5 (4-1-0)
Credit: 20

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Understand and apply the concept of rural sociology as it applies to PNG
2. Describe the theoretical perspectives of rural sociology and their policy implications
3. Identify and describe the social systems in PNG and their impact on natural resource consumption, e.g. customary land
4. Analyse the challenges facing the social systems in PNG based on the theoretical framework

Introductory Concepts
Nature of sociology: definition of society, and the emergence of sociology; basic sociology concepts; social structure; social group; social institution; socialization

Theoretical Perspectives
Structural theory, conflict theory, functionalist theory and interactionist theory

Social Systems
Tribal society; feudalism, capitalism, pro-capitalistic systems, place of culture in society; social stratification and social structure (caste, class and patriarchy); mechanism of social change; rural political and administrative systems, rural economy. Rural sociology: approaches to the study of rural society, agrarian institutions, social issues and strategies for rural development, rural development, rural trends, urban edge, core-periphery dichotomy

Textbooks

References

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 517: PROJECT EVALUATION, PLANNING AND SUSTAINABILITY

Hours per week: 5 (3-0-2)
Credit: 16

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Effectively use basic land and urban economics tools to evaluate major infrastructure projects
2. Understand when to complement this basic analysis with more sophisticated tools
3. Critique the process used to evaluate typical infrastructure projects
4. Describe a broad range of project types that are relevant to Urban and Regional Planning and related fields
5. Describe the ways in which project performance can be measured and improved
6. Analyse the impact of uncertainty on project sustainability and its measurement
7. Undertake an end-to-end project evaluation

Syllabus
Nature and features of large-scale infrastructure projects; Environmental Impact Assessment; Review of case studies of adaptation of orthodox planning techniques to specific planning issues in the developing countries. Project evaluation and feasibility studies; planning and management: Identification and formulation of a project; Analysis of a project, definition of a project, Private and social profitability; Speculative and public projects; Project management services; Project budget using various techniques, e.g. Residual Valuation Approach; Project proposal writing; Sources and sourcing of funds for project execution; costing and loan disbursements; professional scale of fees. Sourcing of professionals; co-ordination and management of project; Risk factors and risk management in project
Department of Surveying and Land Studies

**URP 518: SATELLITE IMAGE PROCESSING TECHNIQUES**

**Hours per week:** 5 (1-0-4)  
**Credit:** 10

**Learning Outcomes**  
Upon completion of this subject, students will be able to:  
1. Understand and describe image processing using Erdas Imagine S/W.  
2. Apply image preprocessing techniques for problem solving  
3. Understand and describe different enhancement techniques  
4. Understand and apply different classification techniques  
5. Produce accuracy report and change detection report from classified data

**Syllabus**  
**Introduction to Digital Images Processing:** Concept of digital image, digital image processing and its advantages, image compression techniques, image statistics  
**Image Pre-processing:** Radiometric corrections, geometric corrections, geo-referencing  
**Image Enhancement:** Contrast enhancement, band combinations, band rationing, spatial filtering, edge enhancement, special transformations, image fusion; image enhancement with RADAR and LIDAR data sets

**Information Extraction:** Supervised and unsupervised classification techniques for land use / land cover mapping.  
**Accuracy Assessment and Change Detection:** Hands on training on accuracy, assessment, and change detection and future trends in land use-land cover linkages

**Textbook**  

**Assessment**  
Continuous Assessment: 50%  
Written Examination: 50%

---

**URP 519: GNSS/GPS - THEORY AND PRACTICE**

**Hours per week:** 6 (2-0-4)  
**Credit:** 15

**Learning Outcomes**  
Upon completion of this subject, students will be able to:  
1. Understand and describe the concept of GNSS  
2. Describe in full the components of GPS  
3. Explain the various GPS positioning methods  
4. Understand and discuss the limitations of GPS survey  
5. Understand and describe the operational aspects of GPS

**Syllabus**  
**Introduction to GNSS**  
Positioning techniques; History and developments: GPS, GLONASS, IRNSS, COMPASS, GALILEO, etc.  
**GPS Components**  
Space segment, the control segment and user segment, Signal structure  
**GPS positioning methods**  
Positioning concept (resection from space), Point positioning, Relative positioning, Static positioning, Kinematic positioning  
**Limitations of GPS survey**  
Sources of error, Datum, Anti-spoofing and selective availability, Geoid model

**Practical exercise using GPS**  
Familiarization with GPS instruments, implementing a GPS-based survey as a project

**Textbook**  

References
1. Departmental Modules

Assessment
Continuous Assessment (Theory & Practical): 50%
Written Examination: 50%

URP 520: RESEARCH METHODOLOGY

Hours per week: 6 (4-2-0)
Credit: 22

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Plan, undertake and manage an urban or regional planning research project
2. Collect survey data using appropriate means and undertake data analysis to generate findings
3. Relate research findings to literature and conceptual framework and draw appropriate conclusions
4. Prepare a standard research report, communicate the findings to a professional audience, and submit the research report for assessment.

Syllabus
Identifying a Research Problem
Reasons for research; the research process and research design; selection of a researchable topic; sources of research problems/topics; qualitative and quantitative research methods; types of research: applied, theoretical and action researches; literature review strategies; research culture and funding; consent of respondents and research ethics

Conceptual/Theoretical Framework and Literature Review Strategies
Purpose and functions of conceptual/theoretical framework; strategies; useful examples

Data Collection and Analysis
Secondary and primary data sources; sampling methods; statistical techniques; data collection; data coding/treatment; data analysis; report writing; open presentation/defence

Individual Research Project

Every student will undertake an independent research project that must make substantial contribution to knowledge in general and the planning profession in particular. Students are reminded that the lessons they learn from Statistics and Computer Techniques will be of immense benefit to them when writing their projects.

Textbooks

References

Assessment
• Continuous Assessment (Theory & Practical): 50%
• Written Examination: 50%

URP 521: DISSERTATION
Credit: 138

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Plan, undertake and manage a research project
2. Prepare and submit a standard research report that is both academically and professionally sound.

**Syllabus**

**Consolidation**
This subject is to be regarded by students as a unique opportunity they have to demonstrate the academic, research and professional planning skills that they have gained throughout their Master's program.

**Mastery of Academic Writing**
A mastery of proficiency in academic writing, free from plagiarism, is a must for students. Plagiarism is an academic crime that all students must avoid. Students must use a uniform and approved referencing style (e.g. APA system) and submit both soft and hard copies of their dissertation before the stipulated deadline. Students must also realise that their dissertation will be graded by both internal and appointed external assessors.

**Textbooks**

**References**

**Assessment**
Dissertation is a subject that runs through three semesters. Continuous Assessment will be done by lecturers taking the subject. Every student's progress will be judged by the department as either SATISFACTORY or NOT SATISFACTORY. The final output in form of the Dissertation itself will be assessed and based on 100% by External Examiners appointed by the University.

**URP 522: CLIMATE CHANGE: POLICY IMPLICATIONS FOR HUMAN SETTLEMENTS AND PLANNERS’ RESPONSE**

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>4 (3-1-0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit</td>
<td>15</td>
</tr>
</tbody>
</table>

**Learning Outcomes**
Upon completion of this subject, students will be able to:
1. Understand the physics of climate change
2. Describe the various contributing factors to climate change
3. Analyse the possible societal impact
4. Identify realistic mitigation and adaptation measures
5. Identify and describe international response to climate change

**Syllabus**
Introduction: Energy input / output leading to climate change, thermal equilibrium / temperature anomaly, role of greenhouse gas, role of volcanic eruption / aerosols, role of urbanization, policies and strategies: energy planning, energy generation and consumption, conservation, energy supply and demand, fossil fuel, clean energy; mitigation, adaptation, low carbon growth and economic development, REDD+, sea level rise, sinking islands, disaster induced by climate change, role of nations, international response, GHG emission in PNG, PNG’s National Climate-Compatible Development Strategy Position as victim of climate change, climate refugee

**Textbooks**

**Assessment**
Continuous Assessment: 50%
Written Examination: 50%

**URP 523: TRANSPORTATION ENGINEERING & PLANNING**

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>4 (3-1-0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit</td>
<td>15</td>
</tr>
</tbody>
</table>
### Learning Outcomes

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

1. Understand and describe the links between highway engineering and urban and regional planning
2. Identify and describe the critical elements of planning of airports
3. Identify and describe the critical elements of planning of ports and harbors
4. Identify and describe the critical elements of planning of railways and railway stations as a mode of transport
5. Reflect on the modes of transport in PNG and related transport policies and transport management strategies

### Syllabus

**Highway Engineering**

Roles of transport, modes of transport, importance of highway transportation, principles of highway planning, highway alignment requirements, engineering surveys for highway location, highway materials, elements of transport planning, Selection of bridge sites.

**Airport Planning**

Airport site selection, aircraft characteristics, various surfaces of an aircraft, wind rose diagram, geometric elements of runway and taxiways, holding apron, parking configuration, terminal building visual aids, air traffic control, airport marking and lighting

**Port and Harbor Planning**

Site selection, design, construction, and operation of ports and harbors

**Railways as Mode of Transport**

Site selection of stations, components of a railway track, track alignment, traffic surveys, rack and pinion rails, gradient norms

**Modes of Transport in PNG**

Different modes of transport in the country; the transport policies and management strategies

### Textbooks


### Assessment

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment</td>
<td>50%</td>
</tr>
<tr>
<td>Written Examination</td>
<td>50%</td>
</tr>
</tbody>
</table>

### URP 524: URBAN HOUSING AND SETTLEMENT PLANNING

#### Hours per week: 4 (3-1-0)

**Credit: 15**

#### Learning Outcomes

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

1. Understand and describe the theoretical underpinnings and relevant techniques for formulating urban housing strategies
2. Review current issues, trends and policies in the field of housing development, finance, and management, and summarize the housing needs of households.
3. Identify and analyse the salient features of the typical housing development process
4. Analyse and examine the challenges associated with squatter settlements around PNG cities and apply squatter upgrading strategies to resolve the impasse
5. Apply financial analysis techniques for housing development and management
6. Evaluate the importance of management and the many aspects of the manager’s role in the operation and strategic planning involved in the development and day-to-day management of multifamily housing
7. Practice professional skills in learning to be an effective team member and representative to community partners

### Syllabus

The formulation of housing policies and programs in various countries of the world. The determinants of standards and criteria in the design of houses: Formulation of minimum desirable standards of space and environment in building design. Ecological versus economic perspectives on environmental planning. Housing needs/demand and analysis. Housing Development Process: The institutionalised private and public development of housing estates covering land acquisition and compensation, site planning, design and cost aspects, development finance and funding, development appraisal, construction and project management. Allocation of public housing units, and merchandising of private housing estates. Non-institutional housing development process: squatters traditional self-help and petty commodity production in housing; The Informal Housing Sector; Redevelopment schemes; slum improvement
techniques, squatter upgrading strategies and urban renewal.

Textbooks

References
2. Anonymous (2002). Housing affordability in three dimensions: Price, income and interest rates / Montoya, Juan; Trimbath, Susanne -- [Santa Monica, CA]: Milken Institute.

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 525: LAND USE PLANNING AND SUSTAINABILITY

Hours per week: 4 (3-1-0)
Credit: 15

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Understand and describe the significance of land use planning and city liveability/sustainability
2. Describe the optimum utilisation of land resources
3. Analyse sustainable development using socio-economic and environmental inputs
4. Understand and use the concept of integrated development in solving urban and regional problems

Syllabus
The nature, trends and patterns of urbanization; the benefits of land use planning, including conversion process of rural land to urban use; significance of job creation in rural areas as a measure to stop migration; Techniques of land use analysis; determination of Highest and Best Use; Evaluation of current land use effects and conflicts; planning standards and subdivision control; Land use estimation and projection methods; Land tenure and land policies; Mathematical modeling of urban land use and activity systems; Contemporary issues in Planning in the developing countries: The influence of Western planning culture on planning in developing countries; concepts of liveability and sustainability; important aspects of sustainability, concept of integrated development, socio-economic input in development planning, development and implementation of action plan leading to sustainable development

Textbook

References

Assessment
Continuous Assessment: 50%
Written Examination: 50%

URP 526: PRACTICAL ON WATERSHED MANAGEMENT USING RS IMAGES

Hours per week: 6 (0-0-6)
Credit: 9

Learning Outcomes
Upon completion of this subject, students will be able to:
1. Understand and analyse watershed and watershed characteristics for watershed management
2. Practise different tasks on morphometric analysis using RS and GIS software
3. Describe how to manage watershed

Syllabus
Introduction
Introduction, philosophy and concept and role of Remote Sensing in watershed conservation, planning and management

**Watershed Characterization and Morphometric Analysis**
Watershed hydrology and physical processes in Watershed; Slope, aspect, flow direction, flow accumulation, drainage, network & morphometric analysis, applications of Digital Elevation Models in Water Resources; Watershed Prioritisation; Watershed conservation planning and management

**Watershed Management**
Runoff estimation, soil erosion/soil loss mapping using satellite data, spatio-temporal soil loss characterizing; soil and water conservation-planning using RS &GIS; erosion, erodibility and Sediment Yield Modeling.

**Textbook**

**References**
1. Departmental Practical Modules on Watershed management.

**Assessment**
- Continuous Assessment: 50%
- Practical Examination: 50%

**URP 527: MAPPING OF URBAN LAND USE WITH HIGH RESOLUTION IMAGES**

**Hours per week:** 6 (0-0-6)

**Credit:** 9

**Learning Outcomes**
Upon completion of this subject, students will be able to:
1. Understand and apply high resolution images for land use mapping
2. Undertake geometric corrections
3. Extract urban land use features from high resolution images for environmental planning purposes

**Syllabus**

**Introduction to High Resolution Images**
What are high resolution images? Relevance to urban and regional planning; display, interpretation and enhancement techniques, including pan-sharpened images.

**Geometric corrections**
Geo-referencing of high resolution images using polynomial transformation and other techniques; exercises on geometric corrections

**Extraction of urban land use features**
Identification of urban features essential in planning; creation of geo-database, extraction of urban features; urban map composition

**Textbook**

**References**
1. Departmental Module

**Assessment**
- Continuous Assessment: 50%
- Practical Examination: 50%