DEPARTMENT OF
MATHEMATICS

FACULTY OF NATURAL SCIENCES

STUDENT HANDBOOK
2019– 2024

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Deputy Vice Chancellor (Academic)
Prof. Ishaya Tanko

Deputy Vice Chancellor (Administration)
Prof. Gray G. Ejikeme

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Deputy Dean
Dr Geoffrey M. Kumleng

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Mrs Suzan P. Iliya

Faculty Finance Officer
Mr Philip Z. Dorkur

BRIEF HISTORY OF THE UNIVERSITY

The University of Jos started as a campus of the University of Ibadan in November 1971. Professor E.A. Ayandele was appointed the first Acting Principal of the Jos Campus of the University of Ibadan. Located at the present Township Campus along Murtala Mohammed Way within the city of Jos, its first set of students were admitted in January 1972 as pre-degree students. The University was still a campus of the University of Ibadan up to 1974, but became a full-fledged University in 1975, as one of the seven new universities established by the Federal Military Government at that time. Since then, the University of Jos has witnessed steady growth, both in infrastructure and academic development, covering three campuses and several academic faculties, including Agriculture, Arts, Education, Engineering, Environmental Sciences, Law, Management Sciences, Natural Sciences, Pharmaceutical Sciences, Social Sciences, Veterinary Medicine and the College of Health Sciences which is made up of the faculties of Basic Medical Sciences, Clinical Sciences, Health Sciences and Technology and Dental Sciences. The University currently runs Courses at pre-degree, undergraduate and postgraduate levels.

The Vice-Chancellors of the University from its inception are as follows: Prof. Gilbert O. Onuaguluchi, Prof. Emmanuel U. Emovon, Prof. Ochapa C. Onazi, Prof. M. Para Mallum, Prof. G. O. M. Tasie (Acting), Prof. Nenfort E. Gomwalk, Prof. Monday Y. Mangvwat, Prof. Sonni G. Tyoden, Prof. Hayward B. Mafuyai, and the current Vice-Chancellor, Professor Seddi Sebastian Maimako, whose tenure began in June 2016.

HISTORY OF THE DEPARTMENT OF MATHEMATICS

The Department of Mathematics at the University of Jos started as an offshoot of the parent Department of Mathematics at the University of Ibadan in 1974. At that time, there was a Jos Campus of the University of Ibadan. This campus eventually became the University of Jos. At commencement, Lecturers in the Department at Jos came on secondment, for short periods, from the University of Ibadan, in visiting capacities; but by October 1974, a few Mathematicians including Dr. G.M. Habibullah, were sent to Jos as permanent staff of the Jos campus of the University of Ibadan.

During the 1975/76 session, Prof. S.A. Messiha was appointed as a Coordinator of the young Department. By 1980/81 session, the Department had a respectable component of staff including the following lecturers:- Prof. E.N. Chukwu, Dr. I. Baranowicz, Mr. E.Y. Ametewee, Dr. G.M. Habibullah, Dr. K.K. Kumar, Dr. L.S.O. Liverpool, Dr. T. Stys, Dr. (Mrs.) K. Stys, Dr. S.K. Gupta, Dr. J. Wilkowski, Dr. P. Smoczinsky, Mr. J.A. Uvah, Mrs.

M.I. Sen, Dr. S. N. Enurah, Mr. C. Ukwu and Mr. R.H. Tachia. Professor Chukwu was the first Nigerian Head of Department and Mr. Frank was the Departmental Secretary.

The Mathematics undergraduate programme started in the 1976/77 session and the postgraduate programme two years later, in the 1978/79 session. Prof E.N. Chukwu left the Department at the end of 1980/81 session and was succeeded by Dr. G.M. Habibullah and later by Dr. T. Stys. Thereafter, Professor L.S.O. Liverpool, Dr. K. Kumar, Professor M.S. Audu, Professor P. Onumanyi, Professor S.U. Momoh, Professor U.W. Sirisena, Dr S.E. Adewumi and Professor J.P. Chollom served as the Heads of Department. The current Head of Department is Dr J.N. Ndam.

The Department currently has twenty-eight (28) academic staff including seven at professorial level. Only six academic staff members are females which include one-time Head of the Department – Professor U.W. Sirisena. The Department has a vibrant research agenda. Research activities are mainly in the areas of Algebra, Complex Analysis, Numerical Analysis, Biomathematics/Mathematical modelling, Control Theory and Statistics.

Currently, the Department offers undergraduate degrees in Mathematics and Statistics. Postgraduate degrees are offered at the masters and doctoral levels in Mathematics only. The Department in addition, offers Mathematical Sciences courses to students reading for the Mathematics education degree in the Faculty of Education. Ancillary courses in Mathematics are available for students in eight of the twelve Faculties of the University, namely: Agriculture, Education, Engineering, Environmental Sciences, Medical Sciences, Natural Sciences, Pharmaceutical Sciences and Veterinary Medicine.
In 2001/2002 session, two new undergraduate programmes were introduced in the Department in Computer Science and Statistics, in addition to the existing Mathematics programme. At the moment, postgraduate programmes are offered at the Master's and doctoral levels in Mathematics only. The Department in addition, has an approved Postgraduate Diploma programme in Statistics.

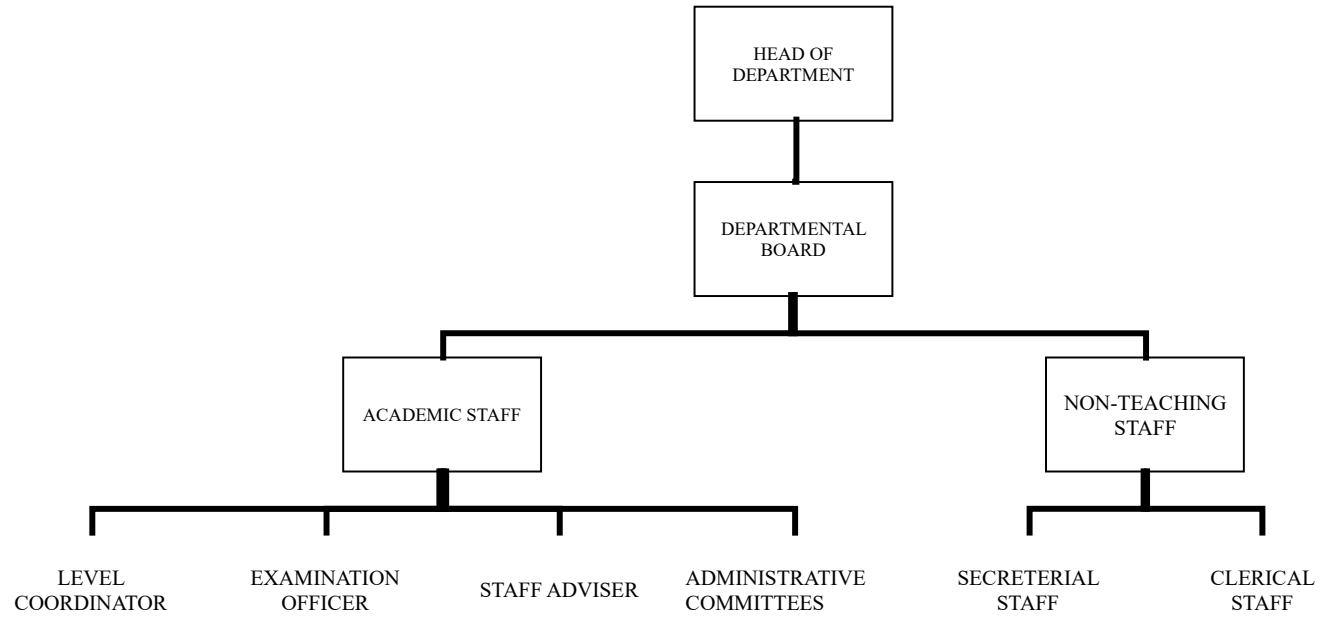
Staff members of the department have played key roles in the University of Jos and in the Nigerian University System. Professor E. N. Chukwu, the first Nigerian Head of Department was appointed the First Vice Chancellor of the University of Technology, Yola in 1980. Professor E.N. Chukwu was also the foundation Dean of the School of Postgraduate Studies of the University. He now lives in the United States of America.
Dr G.M. Habibullah who took over from Professor Chukwu as the Head of Department was appointed the Vice Chancellor at the University of Education, Lahore, Pakistan in 2007.
Professor L.S.O. Liverpool served as Director of Academic Planning, University ICT Coordinator and played a key role in the development of the first strategic plan of the University. He rendered services to the Jos Carnegie Partnership, the National Universities Commission, the National Teachers Institute and the ICT forum of Partnership Institutions. Professor P. Onumanyi was Dean, Faculty of Natural Sciences, Deputy Vice

Chancellor (Academic), University of Jos and President Mathematical Association of Nigeria before he left the services of the University to the position of Deputy Director at the National Mathematical Centre, Abuja. Professor M.S. Audu served as the Director of Academic Planning and was the Dean of the Faculty of Natural Sciences before he was appointed Vice Chancellor of the Federal University of Technology, Minna in 2007.

LIST OF HEADS OF THE DEPARTMENT TO DATE

NAME	PERIOD
Prof. S.A. Messiha	1975 – 1980
Prof. E.N. Chukwu	1980 – 1981
Dr G.M. Habibullah	1981 - 1982
Prof. L.S.O. Liverpool	1982 – 1985
Dr T. Stys	1985 – 1986
Prof. L.S.O. Liverpool	1986 - 1988
Dr K. Kumar	1988 – 1989
Prof. M.S. Audu	1989 – 1993
Prof. P. Onumanyi	1993 – 1995
Prof. M.S. Audu	1995 – 1998
Prof. S.U. Momoh	1998 – 2005
Prof. U.W.W. Sirisena	2005 – 2011
Dr S.E. Adewumi	2011 – 2012
Prof. J.P. Chollom	2012 – 2016
Dr J.N. Ndam	2016 - Date

ADMINISTRATIVE STRUCTURE OF THE DEPARTMENT



The organogram outlines the stages in handling both staff and students' grievances and suggestions. Students with academic grievances report to their level coordinator who will in turn try to solve such problems. In the event that the level coordinator is unable to handle the problem, it is brought before the Head of Department. Concerns from the entire body of students in the Department are usually reported to the Head of Department through the student staff adviser who normally makes efforts to solve the problem. If the student staff adviser is unable to resolve the matter, it is referred to the Head of Department.

Philosophy/Objectives of Programmes

The philosophy of the programmes is to give students opportunity to obtain broad knowledge in the theory and applications of Mathematics/Statistics that prepares them for careers as practising Mathematicians/Statisticians. The objectives include the following:

1. To provide students with a broad and balanced foundation in the knowledge and practical skills in Mathematics/Statistics.
2. To develop in students the ability to apply their knowledge and skills to the solutions of theoretical and practical problems in Mathematics/Statistics.
3. To develop in students a range of transferable skills of value in Mathematical or Statistical related and other employment.

4. To provide students with knowledge and skills-base from which they proceed to further studies in specialised areas of Mathematics or Statistics or multidisciplinary areas involving Mathematics/Statistics.
5. To generate in students an appreciation of the importance of Mathematics/Statistics in an industrial, economic, environmental and social context.
6. To produce graduates who will be job creators through consultancy services in related areas of Mathematics or Statistical data analysis.

Entry Requirements

Mathematics

UME: Five SSCE Credit passes to include English Language, Mathematics and Physics or Chemistry.

DE: In addition to UME requirements, two A-Level passes in Mathematics and any other Science subject, or NCE with at least Merit in Mathematics and one of Physics, Chemistry or Economics.

Statistics

UME: Five SSCE credit passes to include English Language, Mathematics and at least three subjects from Physics, Chemistry, Statistics, Further Mathematics and Economics.

DE: In addition to UME requirements, two A-Level passes in Mathematics or Statistics and any other science subject or NCE credit in relevant subjects. Accepts Diploma in Statistics (Upper Credit) from a recognized institution. Diploma in Computer Science is not accepted.

LIST OF ACADEMIC STAFF WITH QUALIFICATIONS AND AREAS OF SPECIALISATION

S/N	NAME	QUALIFICATION	RANK	AREA OF SPECIALISATION
1	Prof. M. S. Audu	Ph.D	Professor	Group Theory
2	Prof. S.U. Momoh	Ph.D	Professor	Group Theory

3	Prof. E.J.D. Garba	Ph.D	Professor	Mathematical Physics
4	Prof.U.W.W. Sirisena	Ph.D	Professor	Numerical Analysis
5	Prof. J.P. Chollom	Ph.D	Professor	Numerical Analysis
6	Dr. J.N. Ndam	Ph.D	Reader	Biomathematics
7	Dr. C. Ukwu	Ph.D	Senior Lecturer	Control Theory
8	Dr. G.M. Kumleng	Ph.D	Reader	Numerical Analysis
9	Dr. A. D. Pwasong	Ph.D	Senior Lecturer	Regression Analysis
10	Dr. R.O. Akinola	Ph.D	Senior Lecturer	Numerical Linear Algebra
11	Dr J. Sunday	Ph.D	Senior Lecturer	Computational Mathematics
12	Dr N.M. Kamoh	Ph.D	Senior Lecturer	Numerical Analysis
13	Mr. M.J. Marut	M.Sc.	Lecturer I	Complex Analysis
14	Mr. G.G. Zaku	M.Sc.	Lecturer I	Abstract Algebra
15	Mr. S.Y. Kutchin	M.Sc.	Lecturer I	Numerical Analysis
16	Mr. I.A. Nyam	M.Sc.	Lecturer I	Differential Equations
17	Mr. S. Longwap	Ph.D	Lecturer I	Complex Analysis
18	Dr. L. A. Ademola	Ph.D	Lecturer I	Group Theory
19	Mr. M.G. Datong	M.Sc.	Lecturer I	Time series Analysis and spatial Statistics
20	Dr. N.B. Jelten	Ph.D	Lecturer I	Group Theory
21	Mr. H.E. Nahum	M.Sc.	Lecturer II	Complex Analysis
22	Mrs K.V. Joshua	M.Sc.	Lecturer II	Numerical Analysis
23	Miss. E. Manga	M.Sc.	Assistant Lecturer	Statistics
24	Mr. C.B. Dang	M.Sc.	Assistant Lecturer	Mathematics
25	Mrs J.C. Umudu	M.Sc.	Assistant Lecturer	Functional Analysis
26	Mr A.H. Ujah	M.Sc.	Assistant Lecturer	Inferential Statistics
27	Mr C.N. Akanihu	M.Sc.	Assistant Lecturer	Statistics
28	Miss K.I. Apanpa	B.Sc.	Graduate Assistant	Mathematics

LIST OF NON-TEACHING STAFF

S/N	NAME	QUALIFICATION	RANK
1	Mr Akor Alacha Francis	B.A. Ed	Asst. Chief. Conf. Sec.
2	Mrs Lucy Peter Yayu	Diploma	Asst. Chief Conf. Off.
3	Mr Kangpe Biret Simon	Diploma	Computer Operator
4	Mr Ishaya Ibrahim	Diploma	Clerical Officer
5	Elizabeth Musa	SSCE	Office Assistant
6	Juliana Benjamin Adat	SSCE	Office Assistant

Student Work Load

Every student who has been offered admission into the Department of Mathematics is expected to go through a curriculum which has been divided into units called courses. Each course is assigned a weight called credit(s). The credit units refer to the number of student -Lecturer contact hours in a particular course per week per semester. There are two semesters in an academic year or session. Every student is expected to register at least 30 credit units and a maximum of 48 credit units per session spread over the two semesters.

Student Assessment

There are two forms of assessment of students' performance in any course, Continuous Assessment (CA), which consists of assignments, practicals, tests, etc, and semester examination administered at the end of each semester. Currently, the weightings are 40% for CA and 60% for Exam, making a total of 100%. The scoring system consists of the percentage score, a letter grade and a grade point (GP) as depicted in the table below.

PERCENTAGE SCORE	LETTER GRADE	GRADE POINT	REMARK
70 - 100	A	5	PASS
60 - 69	B	4	PASS
50 – 59	C	3	PASS
45 – 49	D	2	PASS
0 – 44	F	0	FAIL

At the end of every academic session, the weighted average score of each student in terms of the grade points, called Grade Point Average (GPA) is computed. The computation is done cumulatively at higher levels, hence the term Cumulative Grade POINT Average (CGPA). The class of the final degree is determined by the following approved scoring and grading system.

CUMULATIVE GRADE POINT AVERAGE (CGPA)	CLASS OF DEGREE
4.50 - 5.00	First Class Honours
3.50 – 4.49	Second Class Upper Division
2.40 – 3.49	Second Class Lower Division
1.50 - 2.39	Third Class
0.00 – 1.49	Fail

Probation and Withdrawal

The Cumulative Grade Point Average is used as a guide for determining the academic performance of each student at the end of every academic session and on graduation from the department. Any student whose performance falls below 1.5 at the end of an academic year earns a period of probation for one academic session. A student who earns two consecutive periods of probation is required to withdraw from the programme. However, the student could be considered for a possible transfer to a any other programme in the University for which they are qualified.

Requirements for graduation

The Department Mathematics runs two undergraduate degree programmes; B.Sc. Mathematics and B.Sc. Statistics.

a. **Duration of programme:** The minimum number of years to be spent on each first degree programme in the Department is 4 years for a student who gained admission through UTME and 3 years through Direct Entry. However, a shall not spend more than 6 years on the 4-year programme and not more than 5 years for the 3-year programme.

b. **Graduation:** At the end of 3 or 4 years of study, a student can graduate if they have passed a cumulative total credit of at least 90 for the 3-year programme and at least 120 for the 4-year programme, including all compulsory courses. Any student who fails to graduate at the end of the maximum period allowed for the programme shall be withdrawn from the University.

Examination Regulations for Students

a. Students are expected to leave all documents outside the examination halls, except those required for accreditation for the examination such as Course Registration forms, school fees receipts and ID cards or biodata form.
b. No student will be allowed
   (i) Into the examination after the first 30 minutes of the examination
   (ii) To leave the examination hall within the first 30 minutes of the examination
   (iii) To leave the examination hall during the last 15 minutes of the examination.
c. Students shall
   (i) Use or consult during an examination, only tables, papers, notes, instruments or other materials or aids permitted or provided by the Department whose examination is being written
   (ii) Not introduce nor attempt to introduce any other items other than those mentioned in (i) above

(iii) Not pass or attempt to pass any information to one another during an examination

d. Each student should ensure that their answer booklet has been handed over to the Chief Invigilator at the end of the examination before leaving the examination hall. The student should also ensure that the attendance sheet is signed before leaving the hall

Details of the different types of examination misconducts and associated punishments are also included in another section in this document.

Learning Facilities in the Department

The Department of Mathematics runs two undergraduate programmes: B.Sc. Mathematics and B.Sc. Statistics with a combined student population varying between 700 and 800 students. In addition to the undergraduate programmes, postgraduate programmes at the Master's and Ph.D levels in Mathematics only. The following facilities are available for students' use:

a. Four undergraduate classrooms and a Postgraduate Lecture room
b. Two Computer Laboratories
c. A departmental Library
d. WIFI hotspots are also available for students around the classrooms area for internet access.

The Department renders services to all science-based faculties of the University; hence the lecture rooms are not usually adequate. However, other lecture rooms are available for use in the University.

MATHEMATICS AND STATISTICS PROGRAMMES SCHEDULES OF COURSES

The list of all the courses in the curricula of the B.Sc. Mathematics and B.Sc. Statistics programmes and their pre-requisites are as follows:

MATHEMATICS PROGRAMME
100 LEVEL COURSES
Core Courses

Course Code	Course Title	Semester	Credit Units
MTH 101	Elementary Mathematics I	1	3
MTH 102	Elementary Mathematics II	2	3
MTH 103	Elementary Mathematics III	2	3

CS 101	Introduction to Computer Science	1	3
STA 203	Statistics for Physical Sciences & Engineering	2	4
GST 101	Use of English	2	4
GST 102	Philosophy and Logic	2	2
GST 103	Nigerian People & Culture	1	2
GST 104	History and Philosophy of Science	1	2
	TOTAL CREDIT UNITS		**26**

Optional Courses

CS 102	Introduction to Computer Applications	2	3
PHY 101	General Physics I	1	3
PHY 102	General Physics II	2	3
STA 111	Probability I	1	4
STA 131	Inference I	2	4

Instructions

1. A minimum of 30 credit units must be registered at 100 level. To satisfy this requirement, students should register and pass at least 5 credit units of course(s) that are suitable from 100 level Physics, Chemistry, Geology/Mining and/or Biology.
2. The pre-requisite for any 100 level courses in Mathematics is a credit in Mathematics at Senior School Certificate Examination or its equivalent.
3. All courses registered will count towards graduation.

200 LEVEL COURSES

Core Courses

Course Code	Course Title	Semester	Credit Units	Pre-requisite
MTH 201	Mathematical Methods I	2	3	MTH 103
MTH 202	Elementary Differential Equations 1	1	3	MTH 103
MTH 203	Sets, Logic and Algebra	1	3	MTH 101
MTH 204	Linear Algebra I	1	2	MTH 101
MTH 205	Linear Algebra II	2	2	MTH 101
MTH 207	Real Analysis I	1	3	MTH 101 & MTH 103
MTH 209	Introduction to Numerical Analysis	1	3	MTH 101 & MTH 103
CS 201	Computer Programming I	1	4	CS 101
STA 211	Probability II	1	4	STA 203
GST 222	Peace and Conflict Resolution	2	2	

GST 223	Entrepreneurship Studies	1	2	
	Total Credit Units		**31**	

Optional Courses

MTH 210	Real Analysis II	2	3	MTH 101 & MTH 103
CS 202	Computer Programming II	2	3	CS 102
CS 203	Introduction to Computer Systems	2	2	CS 101
CS 204	Introduction to File Processing	2	2	CS 101
STA 231	Inference II	1	4	STA 111
STA 232	Laboratory for Inference II	2	4	STA 111

300 LEVEL COURSES

Core Courses

Course Code	Course Title	Semester	Credit Units	Pre-requisite
MTH 300	Abstract Algebra I	1	3	MTH 203
MTH 301	Metric spaces	1	3	MTH 207 or 210
MTH 302	Elementary Differential Equations II	1	3	MTH 202
MTH 303	Vector & Tensor Analysis	1	3	MTH 201 & 207
MTH 304	Complex Analysis I	1	3	MTH 203 & 207
MTH 305	Complex Analysis II	2	3	MTH 203 & 207
MTH 306	Abstract Algebra II	2	3	MTH 203
MTH 307	Real Analysis II	2	3	MTH 207 or 210
MTH 308	Introduction to Mathematical Modelling	2	3	MTH 201, 202 & 204
	Total Credit Units		**27**	

Optional Courses

MTH 309	Discrete Mathematics	1	4	MTH 203 or 204
MTH 312	Optimization Theory	2	4	MTH 201 & 202
MTH 313	Geometry	1	3	MTH 102
MTH 314	Analytical Dynamics	1	3	MTH 102
MTH 315	Dynamics of a Rigid Body	2	3	MTH 102
MTH 316	Introduction to Operations Research	1	3	MTH 201 & 205
MTH 317	Advanced Calculus II	2	3	MTH 313
MTH 318	Numerical Analysis II	1	3	MTH 209
STA 311	Probability III	1	3	STA 211
STA 321	Distribution Theory	1	2	STA 231
STA 324	Regression Analysis I	2	2	STA 231
STA 325	Analysis of Variance I	2	2	STA 231
STA 341	Sampling Theory & Survey Methods	1	4	STA 231, 321
STA 343	Statistical Quality Control	2	4	STA 231

Instructions

1. A minimum of 3 credit units must be passed from the list of elective courses.
   Students may also select course that are suitable for them from 300 levels Computer Science, Physics or Chemistry and for which they have the pre-requisites.

2. (a) Not all elective courses listed will necessarily be available in any session.
   (b) Information on the elective course that may be available in any one semester will be given at the beginning of each session.

1. All courses registered will normally count towards graduation.

400 LEVEL COURSES

Core Courses

Course Code	Course Title	Semester	Credit Units	Pre-requisite
MTH 401	Ordinary Differential Equations II	1	2	MTH 302
MTH 402	Partial differential Equations	2	3	MTH 302
MTH 403	Functional Analysis	1	3	MTH 301
MTH 404	Project	1 & 2	6	
MTH 405	General Topology	2	3	MTH 301
MTH 406	Lebesque measure & Integration	1	3	MTH 207
	Total Credit Unit		20	

Optional Courses

MTH 407	Mathematical Methods II	2	3	MTH 203 or 204
MTH 408	Quantum Mechanics I	1	3	
MTH 409	General Relativity	1	3	
MTH 410	Electromagnetism	2	3	
MTH 411	Analytical Dynamics II	2	3	MTH 314
MTH 412	Field Theory	2	3	MTH 300
MTH 413	Fluid Dynamics	1	3	MTH 314
MTH 415	Control Theory	1	3	
MTH 416	Measure Theory	2	4	MTH 207 & 307
MTH 417	Abstract Algebra III	2	3	MTH 306
MTH 418	Theory of Numbers	1	3	MTH 306
MTH 419	Topics in Finite Groups	1	4	MTH 306
MTH 420	Representation of Finite Groups	2	3	MTH 306
MTH 421	Homological Algebra	2	3	MTH 403
MTH 422	Hilbert Spaces	1	3	MTH 403
MTH 423	History of Mathematics	2	3	
MTH 424	Modules	2	3	MTH 300 or 306
MTH 425	Topics in Complex Analysis I	2	3	MTH 304 & 305

MTH 426	Topics in Complex Analysis II	2	3	MTH 304 & 305
MTH 427	Numerical Analysis II	1	3	MTH 318
MTH 428	Perturbation Theory	2	3	MTH 302
MTH 429	Dynamical Systems	1	3	MTH 308

Instructions

1. A minimum of 10 credit units must be passed from the list of elective courses above. No elective course may be selected from Outside Mathematics, Computer Science and Statistics.
2. (a) Not all elective courses listed will necessarily be available in any one academic year.

   (b) Information on the elective courses that may be available in any one semester will be given at the beginning of each session.

3. All students registering MTH 404 must be in his/her final year.

4. All courses registered will normally count towards graduation.

COURSE DESCRIPTION
MATHEMATICS COURSES

100 Level Courses

MTH 101: Elementary Mathematics I: (3 Units)
L 30: P O: T 15, (Algebra and Trigonometry)

Elementary set theory, subsets, union, intersection, complements, Venn diagrams, Real numbers: Integers, rational and irrational numbers, mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem. Complex numbers: algebra of complex numbers: The Argand Diagram, De Moivre's theorem, nth roots of unity. Circular measure, trigonometric ratio of angles and magnitude, addition and factor formulae. Indices and logarithms, matrices and determinants, partial fractions.

MTH 102: Elementary Mathematics II: (3 units)
L 30 P O: T 15 (Vectors, Geometry and Dynamics)

Geometric representation of vectors in 1-3 dimensions, components direction cosines. Addition and Scalar, multiplication of vectors, linear independence, scalar and vector products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola, tangents, normal, kinematics of a particle. Components of velocity and acceleration of a particle moving in plane. Force, laws of motion under gravity, projectiles, resisted vertical motion elastic string, simple pendulum impulse. Impact of two smooth-spheres and of a sphere on a smooth surface. Vector equations of lines and planes.

MTH 103: Elementary Mathematics III: (3 units) L 30: P O T 15 (Calculus)

Function of a real variable, graphs, limits and idea of continuity. The derivation of derivative as limit or rate of change. Techniques of differentiation. Extreme curve sketching. Integration as an inverse of differentiation, methods of integration. Define integrals. Application of integration to areas and volumes. Applications to moments of inertia and lengths of arcs.

CS 101: Introduction to Computer Science (2 Units) L 20: P 0: T 10

History of Computers. Functional Components of Computer. Characteristics of a Computer. Problem Solving Methods (Algorithms and Flow charts). Computer Structure (Organization and Functions of the Control Unit, Arithmetic-Logic Unit, Memory Unit of the CPU, and the Relationship among the CPU, Memory, and Peripheral Devices). Software - Types, Levels, Programming and Application Packages. Relationship between Hardware and Software.

STA 203: Statistics for Physical Science and Engineering (4 Units)

L 45: P 0: T 15

Measure of Location and Dispersion in Simple and Grouped Data. Elements of Probability and Probability Distributions; Normal, Binomial, Poisson. Geometric, Negative Binomial Distributions, Estimation and Tests of Hypotheses Concerning the Parameters of Distributions. Regression, Correlation and Analysis of Variance. Contingency Table. Non-Parametric Inference.

200 Level Courses

MTH 201: Mathematical Methods I: (3 Units) L 30 P O: T 15
Pre-requisite MTH 103

Real-valued functions of a real variable. Review of differentiation and integration and their applications. Mean value theorem. Taylor series. Real-valued functions of two or three variables. Partial derivatives, chain rule, extreme, Lagrange multipliers. Increments, differentials and linear approximations. Evaluation of line integrals, multiple integrals.

MTH 202: Elementary Differential Equations I: (3 Units) L 30 P O: T 15 Pre-requisite MTH 103.

First order ordinary differential equations. Existence and uniqueness. Second order ordinary differential equations with constant co-efficient. General theory of nth order linear equation. Laplace transform, solution of initial-value problems by Laplace transform method. Simple treatment of partial differential equations in two independent variables. Application of O.D.E. and P.D.E. to physical, life and Social Sciences.

MTH 203: Sets, Logic and Algebra: (3 Units) L 30 P O: T 15 Pre-requisite MTH 101

Introduction to the language and concepts of modern mathematics. Topics include: Basic set theory, mappings, relations, equivalence and other relations. Cartesian products. Binary logic, methods of proof. Cartesian products. Binary operations. Algebraic structures, semigroups, rings integral domains, field, Number systems: properties of integers, rationales, real and complex numbers.

MTH 204: Linear Algebra I: (2 Units) L 15 P O: T 15 Pre-requisite MTH 101, Co-requisite – MTH 203

Vector space over the real field. Subspaces, linear dependence and independence, basis, and dimension. Linear transformations including linear operators, linear transformations, singular transformations and matrices. Algebra of matrices.

MTH 205: Linear Algebra II: (2 Units) L 15 P O: T 15 Pre-requisite MTH 101 Co-requisites MTH 203, 204

Systems of linear equations change of basis, equivalence and similarity, Eigenvalues and eigenvectors. Minimum and characteristics polynomial of a linear transformation (matrix). Cayley – Hamilton theorem. Bilinear and quadratic forms, orthogonal diagonalisation. Canonical forms.

MTH 207: Real Analysis I: (3 Units) L 30: P O: T 15 Pre-requisite MTH 101 & 103

Bounds of real numbers, convergence of sequence of numbers. Monotone sequences, the theorem of nested intervals, Cauchy sequences, tests, for convergence of series. Absolute and conditional convergence of series and re-arrangements.

Completeness of reals and incompleteness of rationals. Continuity and differentiability of functions in IR. Rolle's and mean value theorems for differentiable functions. Taylor series.

MTH 209: Introduction to Numerical Analysis: (3 Units) L 30: P O: T 15 Pre-requisite MTH 101 & 103

Solutions to algebraic and transcendental equations. Curve fitting. Error analysis. Interpolation and approximation. Zeros or non-linear equation to one-valued systems of linear equations. Numerical differentiation and integral equations. Initial value problems for ordinary differential equations.

MTH 210: Further Real Analysis: (3 Units) L 30: P O: T 15 Pre-requisite MTH 101 & MTH 103

Integration- The Riemann Integral. Exponential and Logarithmic functions. The trigonometric functions. The Gamma function. Vectors in Real Analysis. Vector functions- Convergence and Continuity, Vector derivatives. Directional Derivatives. Partial Derivatives. Local Maxima and Minima. Stationary Points and Classification. Mean value theorems and Differentials.

CS 201: Computer Programming I (4 Units)

L 30: P 15: T 15 Pre-requisite: CS 101

Introduction to Problem Solving Methods and Algorithm Development: Designing, Coding, Debugging and Documenting Programs Using Techniques of a Good Programming Language Style; Computer Organization; Programming Language and Programming Algorithm Development. A widely used programming language should be used in teaching the above.

CS 202: Computer Programming II (3 Units)

L 15: P 15: T 15 Pre-requisite: CS 101

Introduction to Object-oriented Programming. Programs Decomposition into Classes and Objects. Inheritance, Exceptions, Interface, Design by Contract, Basic Design Patterns, and Reuse. Design, Implement, and Debug Object-oriented Programs Composed of Multiple Classes and over a Variety of Data Structures. An Overview of the Issues Involved in the Design and Implementation of Graphical User Interfaces, Database Access and Windows Applications. An Object-Oriented Programming Language such as C++, Java should be used in teaching this course.

CS 203: Computer Architecture I (3 Units)

L 30: P 0: T 15 Pre-requisite: CS 101

Basic Structure of Computer Hardware and Software; Logic Circuits and Designs (Gates, Combinational, Sequential) Computer architecture and Organization; Computer Memory and Storage Unit; Overview of Registers; Basic Directives and Instructions; Data Types and Addressing Modes; The FLAG register; Jumping and Looping Instructions; The Stack Segment and Subroutines. Assembly Language (MIPS can be used).

300 Level Courses

MTH 300: Abstract Algebra I (3 Units) L 30: P O: T 15
Pre-requisite MTH 203

Group's definition, examples include permutation groups, subgroups, Cosets. Lagrange's theorem and applications. Cyclic groups, Rings: definition, examples including Z, Z_n, rings of polynomials and matrices. Integral domains, fields, polynomial rings, factorization. Euclidean algorithm for polynomials H.C.F. and L.C.M. of polynomials.

MTH 301: Metric Space Topology (3 Units) L 30: P O: T 15
Pre-requisite MTH 207 & MTH 210

Sets, Metrics and examples. Open spheres (or balls). Opens sets and neighbourhoods. Closed sets. Interior, exterior, frontier, limit points and closure of a set. Dense subsets and separable space. Convergence in metric space, homoeomorphisms. Continuity and compactness, connectedness.

MTH 302: Elementary Differential Equations II (3 Units) L 30: P O: T 15 Pre-requisite MTH 202

Series solutions of second order linear equations. Bessel, Legendre and hypergeometric equations and functions. Gamma, Beta functions, Sturm-Liouville problems. Orthogonal polynomials and functions. Fourier, Fourier-Bessel and Fourier-Legendre series. Fourier transformation solution of Laplace, Wave and heat equations by Fourier method.

MTH 303: Vector and Tensor Analysis (3 Units) L 30: P. O: T 15
Pre-requisite MTH 201 & MTH 204

Vector algebra. Vector, dot and cross products. Equations of curves and surface. Vector differentiation and applications. Gradient, divergence and curl, vector integrals, line, surface and volume integrals. Green's, Stoke's and Divergence theorems. Tensor products of vector spaces. Tensor algebra. Symmetry, Cartesian tensors.

MTH 304: Complex Analysis I (3 Units) L 30: P. O: T 15
Pre-requisite MTH 203 & MTH 207

Functions of complex variable. Limits and continuity of functions of a complex variable. Deriving the Cauchy-Riemann equations. Analytic functions. Bilinear transformations, conformal mapping. Contour integrals. Cauchy's theorems and its main consequences. Convergence of sequences and series of functions of a complex variable. Power series. Taylor series.

MTH 305: Complex Analysis II (3 Units) L 30: P. O: T 15
Pre-requisite MTH 203 & MTH 207 Co-requisite MTH 307

Laurent expansions. Isolated singularities and residues. Residue theorem, calculus of residue and application to evaluation of integrals and to summation of series. Maximum modules principles. Argument principle. Rouches's theorem. The fundamental theorem of algebra. Principle of analytic continuation. Multiple valued functions and Riemann surfaces.

MTH 306: Abstract Algebra II (3 Units) L 30: P. O: T 15
Pre-requisite MTH 203 Co-requisite MTH 300

Normal subgroups and quotient groups. Homomorphism, isomorphism theorem. Cayley's theorems. Direct products. Groups of small order. Group acting on sets. Sylow theorems. Ideal and quotient rings. P.I.D. and U.F.D's. Euclidean rings. Irreducible, Field extensions, degree, of an extension, minimum polynomial. Algebraic and transcendental extension. Straight edged and compass constructions.

MTH 307: Real Analysis II (3 Units) L 30: P. O: T 15
Pre-requisite MTH 207 & 210

Riemann integers of function $\Re \to \Re$. Continuous monopositive functions of bound variation. The Riemann-Stieltjes integral. Pointwise and uniform convergence of sequences and series of functions $\Re \to \Re$. Effect on limits (sums) when the functions are continuously differentiable or Riemann integrable power series.

MTH 308: Introduction to Mathematical Modelling (3 Units) L 30: P O: T 15
Pre-requisite MTH 201, 202 Co-requisites MTH 302, 303

Methodology pf model building; Identification, formulation and solution of problems, cause-effect diagrams. Equations types. Algebraic, Ordinary differential, partial differential, difference; integral and functional equations. Application of mathematical models to physical, biological, social and behavioural sciences.

MTH 309: Discrete Mathematics (4 Units) L 45: P. O: T 15
Pre-requisite MTH 203 & MTH 204

Groups and subgroups: Group Axioms, Permutation Group. Cosets, Graphs; Directed and undirected graphs, subgroups, cycle, connectivity. Application (flow charts) and state transition graphs, lattices and Boolean algebra. Finite fields, minimum polynomials.

Irreducible polynomials, polynomial roots. Application (error-correcting codes, sequences generators).

MTH 312: Optimization Theory (4 Units) L 45: P. O: T 15
Pre-requisite MTH 203 & 204

Linear Programming Models. The simplex method: formulation and theory. Quality integer programming. Transportation problem. Two-person zero-sum games. Nonlinear programming, quadratic programming Kuhn-tucker methods. Optimality criteria. Simple variable optimization. Multivariable technique. Gradient methods. Assignment problems.

MTH 313: Geometry (3 Units) L 30: P. O: T 15
Pre-requisite MTH 201 & 204

Co-ordinates in R^3. Polar co-ordinates: Distance between points, surfaces and curves in space. The plane, straight line. Basic projective Geometry. Affine and Euclidean Geometries.

MTH 314: Analytical Dynamic (3 Units) L 30: P. O: T 15
Pre-requisite MTH 102

Degrees of freedom. Holomonic and holonomic constraints, geometry co-ordinates. Lagrange's generalized co-ordinates, Lagrange's equations for holonomic systems, face dependent on co-ordinates only, force obtainable from potential. Impulsive force.

MTH 315: Dynamic of a Rigid Body (3 Units) L 30: P. O: T 15
Pre-requisite MTH 102

General motion of a rigid body as a translation plus a rotation. Moment and products of inertia in three dimensions. Parallel and perpendicular axes theorems. Principal axes. Angular momentum, kinetic energy of a rigid body. Impulsive motion. Examples involving one- and two-dimensional motion of simple systems. Moving frames of references: rotating and translating frames of reference Coriolis force. Motion near the earth's surface. The Foucault's pendulum. Euler's dynamic equations for motion of a rigid body with one point fixed. The symmetrical top procession. Instantaneous centre; centre of mass.

MTH 316: Introduction to Operations Research (3 units) L 30: P. O: T 15

Phases of operation research study. Classification of operation research models. Linear, dynamic and integer programming. Decision theory, Inventory Models. Critical Path Analysis and Project controls.

MTH 317: Differential Geometry (3 Units) L 30: P. O: T 15
Pre-requisite MTH 313

Vector functions of a real variable. Boundedness Limits, continuity and differentiability. Functions of Class Cm. Taylor's formulae. Analytic functions. Curve regular differentiable and smooth. Curvature and torsion Tangent line and normal planes. Vector functions of vector variable. Linear continuity and limits. Directional functions of class Cm. Taylor's

theorem and inverse function theorem concept of a surface: parametric representation, tangent plane and normal lines. Topological properties of simple surface.

MTH 318: Numerical Analysis I (3 Units) L 30: P. O: T 15
Pre-requisite MTH 209

Solution of linear difference equations. Implicit and explicit multistep methods for solving initial problems. Analysis of convergence, multistep methods. Runge-Kutta methods. Theorem about convergence of Runge-Kutta methods. Numerical methods for solving stiff systems of ordinary differential equations.

400 Level Courses

MTH 401: Ordinary Differential Equations II (3 Units) L 30: P. O: T 15
Pre-requisite: MTH 302

The general first order equation, existence and uniqueness theorem. Singular points. Differential inequalities. Autonomous systems-orbit, limit and invariant sets. Linearization. Stability Lyapunov theory. Green's function. Periodic solution. Special topics.

MTH 402: Partial Differential Equations (3 Units) L 30: P. O: T 15
Pre-requisite MTH 302

Inequalities, correctness, uniqueness, Eigen-functions, Eigenvalues. Constructions of formal solutions, properties of solutions.

MTH 403: Functional Analysis (3 Units) L 30: P. O: T 15
Pre-requisite: MTH 301

Normed vector space, normed space, LP-spaces. Elements of Hilbert space theory. Inner products. Convex sets. Examples of Banach space techniques. Banach spaces, contracting mapping principle. Baire's theorem and its consequences, the Banach-Steinhaus theorem, the open mapping theorem, Hann-Banach theorem, closed graph theorem, weak convergence. The conjugate space the second conjugate weak convergence bounded linear transformation. Completely continuous transformations.

MTH 404: Project (6 Units)

MTH 405: General Topology (3 Units) L 30: P. O: T 15
Pre-requisite MTH 301

Topological spaces, definition, open and closed sets, neighbourhoods. Coarser and finite topologies. Basis and sub bases. Separation axioms, compactness, local compactness, connectedness. Construction of new topological spaces from given ones; sub-spaces, quotient space. Continuous functions, homeomorphisms, topological invariants, spaces of continuous functions. Pointwise and uniform convergence.

MTH 406: Lebesque Measure and Integrals (3 Units) L 30: P. O: T 15
Pre-requisite MTH 207 & 307

Lebesque measure: measurable and non-measurable sets. Measurable functions. Lebesque integral of non-negative functions, the general integral convergence theorems.

MTH 407: Mathematical Methods (3 Units) L 30: P. O: T 15
Pre-requisite: MTH 201 & 301, Co-requisite 405, 406

Calculus of variation: Lagrange's functional and associated density. Necessary condition for a weak relative extremum. Hamilton's principles. Lagrange's equations and geodesic problems. The Du Bois-Raymond equation and corner conditions. Variable end-points and related theorems. Sufficient conditions for a minimum. Isoperimetric problems. Variational integral transforms. Laplace, Fourier and Hankel transforms. Complex variable methods, convolution theorems. Application to solution of differential equations.

MTH 408: Quantum Mechanics (3 Units) L 30: P. O: T 15
Pre-requisite: None

Particle-wave duality. Quantum postulates. Schrödinger equation of motion. Potential steps and wells in 1-dim Heisenberg formation. Classical limit of Quantum mechanics. Computer brackets. Linear harmonic oscillator. Angular momentum. 3-square well potential. The hydrogen atom collision in 3-dim. Approximation methods for stationary problems.

MTH 409: General Relativity (3 Units) L 30: P. O: T 15
Pre-requisite: None

Particles in a gravitational field. Curvilinear co-ordinates, intervals, covariant differentiation; Christoffel symbols and metric tensor. The constant gravitational field. Rotation. The Curvature tensor. The action function for the centrally symmetric gravitational field. The energy momentum pseudo-tensor. Gravitational fields at large distances from bodies. Isotropic space, space-time metric in the closed and in the open isotropic models. The re shift.

MTH 410: Electromagnetics 3 Units) L 30: P. O: T 15
Pre-requisite: None

Maxwell's field Electromagnetic waves and Electromagnetic theory of lights. Plane Electromagnetic waves in non-conducting media, reflection and refraction at Plane boundary. Waves, guides and resonant cavities. Simple radiating systems. The Lorentz-Einstein transformation. Energy and momentum. Electromagnetic 4 vectors. Transformation of (E. H) fields. The Lorentz force.

MTH 411: Analytical Dynamics II (3 Units) L 30: P. O: T 15
Pre-requisite MTH 314

Lagrange's equations foe non-holonomic systems. Lagrangian multipliers. Variational principles; Calculus of variation, Hamilton's principle, Lagrange's equation from Hamilton's

Principles. Canonical transformations. Normal models of vibrations. Hamilton-Jacobian equations. Euler's angles.

MTH 412: Field theory (3 Units) L 30: P. O: T 15
Pre-requisite MTH 303

Gradient, divergence and curl: Further treatment and application of the differential definitions. The integral definition of gradient, divergence and curl: Line, surface and volume integrals; Green's, Gauss' and Stroke's theorems. Curvilinear co-ordinates. Simple motion of tensors. The use of tensor notation.

MTH 413: Fluid Dynamics (3 Units) L 30: P. O: T 15
Pre-requisite MTH 314

Real and Ideal fluids. Differentiation following the motion of fluid particles. Equations of motion and continuity for incompressible inviscid fluids. Velocity potentials and Stroke's stream functions. Bernoulli's equation with application to flow along curved paths. Kinetic energy. Sources, sinks, doubles in 2 and 3-dimensions, limiting stream lines. Images and rigid planes. Kutta-Joukowski's theorem. Vorticity, Circulation, Blasius theorem, Irrotational flow.

MTH 414: Elasticity (3 Units) L 30: P. O: T 15
Pre-requisite MTH 303

Particle gravitational field, curvilinear co-ordinates, intervals. Covariant differentiational. Christoffel symbols and metric tensor. The constant gravitational field. Rotation. Stresses and strains, strain-energy function. Dilation and distortion. Generalized Hooke's law.

MTH 415: System Theory (4 Units) L 30: P. O: T 15
Pre-requisite: None

Lyapunov Theorems. Solution of Lyapunov stability equation ATP+PA=Q. controllability and observability. Theorem on existence of solution of linear systems of differential operations with constant coefficients. Normality, proper systems, Reachability; stability, attainable sets.

MTH 416: Measure Theory (4 Units) L 30: P. O: T15
Pre-requisite MTH 207 & MTH 307

Abstract integration on LP-spaces.

MTH 417: Abstract Algebra III (3 Units) L 30: P. O: T 15
Pre-requisite MTH 306

Minimal polynomial of an algebraic number, Einstein's irreducibility criterion. Splitting fields and normal extensions. Simple extensions. Primitive element theorem. Galois group of a polynomial. Field degrees and group orders. Galois correspondence. The fundamental theorem of Galois Theory.

MTH 418: Theory of Numbers (3 Units) L 30: P. O: T 15

Pre-requisite MTH 306

Congruencies. Linear Diophantine equations. Quadratic residues. Legendre symbol. Law of quadratic reciprocity. Primitive roots. Continued fractions, Quadratic irrationality. Poll's equation. Sums of two and four squares. Arithmetic functions (the functions …) and the greatest integer function. The Mobius function. Mobius inversion formula. Algebraic numbers and algebraic integers. Integers in quadratic fields. Fermat's last theorem. Proof of Fermat's last theorem for exponent three.

MTH 419: Topics in finite groups (4 Units) L 45: P. O: T 15
Pre-requisite MTH 306

Basic group-theoretic concepts. Series of groups. Jordan-Holder theorems. Further group actions. Semi-direct products. Finite p-groups. Sylow theorems and applications. Characteristic sub-groups Commutators. Finite nilpotent and soluble groups. Transitive and primitive groups. The simplicity of $A_n\ (n \geq 5)$.

MTH 420: Representation of finite groups (4 Units) L 45: P. O: T 15
Pre-requisite MTH 306

Reducible and irreducible representations. Mashke's theorem on complete reducibility. Characters. Schur's orthogonality relations. Induced representations and induced characters. Burnside's p^a q^b theorem. Frobenius reciprocity theorem. Frobenius theorem on the normality of Frobenius kernel in a Frobenius group.

MTH 421: Homological Algebra (3 Units) L 30: P. O: T 15
Pre-requisite MTH 306

Free, projectiles and injective modules. Categories and factors. Pull-outs and push back. Adjoint functions. The functions Roe and Ext. definition of (Co) Homology group.

MTH 422: Hilbert Spaces (3 Units) L 30: P. O: T15
Pre-requisite MTH 306

Hilbert spaces. Inner product, linear functionals, the Riesz representation theorem, reflexibility. Orthogonality, orthogonal basis, bounded operators, compact operators. Spectrum of compact self-adjoint operator.

MTH 423: History of Mathematics (3 Units) L 30: P. O: T 15
Pre-requisite: None

The origin of Mathematics: historical relations between geometry and algebra. The origin and development of calculus and analysis. Euclidean and non-Euclidean geometry, the development of algebra groups.

MTH 424: Modules (4 Units) L 45: P. O: T 15
Pre-requisite MTH 300 or 306

Modules and submodules: Homomorphism of modules: quotient modules. Finitely generated modules: Direct sum of modules; Torsion and free modules; Submodules of a free Module over Principal Ideal Domains. Splitting Property; Bases and Ranks Sequences

of Invariant Factors and of Modules, uniqueness theorem: Primary or p-torsion modules: Examples.

MTH 425: Topics in Complex Analysis I (3 Units) L 30: P. O: T 15
Pre-requisite MTH 304

The algebra of complex numbers Geometric representation of Complex Numbers and the Spherical representation. Analytic functions. Power series. The Exponential and Logarithm function. Analytic functions and mappings. Cauchy's theorem and the Cauchy Integral formula. Local properties of Analytic Functions. The general form of Cauchy's theorem. The Calculus of Residues. Harmonic functions.

MTH 426: Topics in Complex Analysis II (3 Units) L 30: P. O: T 15
Pre-requisite MTH 304

Series and product developments. Infinite products, canonical products. The Gamma function and Stirling's formula. Entire functions. The Riemann Zeta functions. Normal families. The Riemann mapping theorem, Harmonic and subharmonic functions. Canonical mappings of multiply connected Regions. Elliptic functions. Analytical Continuation; Algebraic functions. Picard's theorem. Linear Differential Equations.

MTH 427: Numerical Analysis II (3 Units) L 30: P. O: T 15
Pre-requisite MTH 318

The Finite difference methods. Maximum principles. Convergence and stability of Finite difference Schemes. Solution of elliptic: parabolic and hyperbolic equations by finite difference methods. The methods of lines and collocation.

MTH 428: Perturbation Theory (3 Units)
L 30: P 0: T 15 Pre-requisite: MTH 302

Asymptotic Solutions of Algebraic Equations, Regular Perturbation Methods for ODEs, Multiple Scales and WKB Methods, Singular Perturbation and the Method of Matched Asymptotic Expansions, Methods of Steepest Descents.

MTH 429: Dynamical Systems (3 Units)
L 30: P 0: T 15 Pre-requisite: MTH 308

The Concept of Dynamical Systems and Maps, Analysis of Dynamical Systems and Application to Real-Life Problems such as Predator-Prey Interactions, Spread of Infectious Diseases, etc., The Idea of a Chaotic System. Application of Software Package e.g. MATLAB, Maple.

B. STATISTICS PROGRAMME

100 LEVEL COURSES

Core Courses

Course code	Course Title	Semester	Credit Units

STA 111	Probability I	1	4
STA 131	Statistical Inference I	2	4
STA 132	Laboratory for Statistical Inference I	2	2
MTH101	Elementary Mathematics I	1	3
MTH 103	Elementary Mathematics III	2	3
CS 101	Introductory Computer Science	1	2
GST 101	Use of English	2	4
GST 102	Philosophy and Logic	2	2
GST 103	Nigerian People &culture	1	2
GST 104	History & Philosophy of Science	1	2
		Total credits	28

Optional Courses

MTH 102	Elementary Mathematics II	2	3
CS 102	Introduction to Programming	2	3
PHY 101	General Physics I	1	3
PHY 102	General Physics II	2	3

200 LEVEL COURSES

Core Courses

Course code	Course Title	Semester	Credit Units	Pre-requisite
STA 211	Probability II	1	4	STA 111
STA 231	Statistical Inference II	2	4	STA 131
STA 232	Laboratory for Statistical Inference II	2	2	STA 131
MTH 201	Mathematical Methods I	2	3	MTH 103
MTH 203	Set Logic and Algebra	1	3	MTH 101
MTH 204	Linear Algebra I	1	2	MTH 101
MTH 205	Linear Algebra II	2	2	MTH 101
CS 201	Computer Programming I	1	4	CS 101
GST 222	Peace and Conflict Resolution	2	2	
GST 223	Entrepreneurship Studies	1	2	
		Total credits	28	

Optional Courses

STA 202	Statistics for Biosciences	1	4	STA111
MTH 202	Elementary Differential Equations I	1	3	MTH 103
MTH 207	Real Analysis I	1	3	MTH 101 & MTH103
MTH 209	Introduction to Numerical Analysis I	1	3	MTH 101 & MTH103
CS 202	Computer Programming II	2	3	CS 102
CS 203	Introduction to Computer Systems	2	2	CS 101

CS 204	Introduction to File Processing	2	2	CS 101

300 LEVEL COURSES

Core Courses

Course code	Course Title	Semester	Credit Units	Pre-requisite
STA 311	Probability III	1	4	STA 211
STA 321	Distribution Theory	1	2	STA 231
STA 324	Regression Analysis I	1	2	STA 231
STA 325	Analysis of Variance I	2	2	STA 231
STA 331	Statistical Inference III	2	4	STA 231
STA 332	Laboratory for Analysis & Inference	2	2	
STA 341	Sampling Theory and Survey Methods	1	4	STA 231
STA 342	Laboratory & Field Work Sampling	1	2	
STA 343	Statistical Quality Control	2	4	STA 231
STA 344	Laboratory for Statistical Quality Control	2	2	STA 231
		Total credits	28	

Optional Courses

Course code	Course Title	Semester	Credit Units	Pre-requisite
MTH 308	Mathematical Modelling	2	3	MTH 201,202 & 204
MTH 316	Introduction to Operations Research	1	3	MTH 201 & 205
STA 322	Econometrics	1	3	
STA 323	Biometry I	2	3	
STA 333	Educational Statistics	1	3	STA 211
STA 351	Demography	2	2	
STA 362	Operations Research	1	4	MTH 204 & 205

400 LEVEL COURSES

Core Courses

Course code	Course Title	Semester	Credit Units	Pre-requisite
STA 411	Probability IV	1	4	STA 311
STA 412	Stochastic Processes	2	4	STA 311
STA 413	Time Series Analysis	1	4	
STA 421	Design & Analysis of Experiment	1	4	STA 321 or 331

STA 422	Regression Analysis II	1	3	STA 324
STA 424	Analysis of Variance II	2	2	STA 325
STA 491	Project	1, 2	6	
		Total credits	27	

Optional Courses

Course code	Course Title	Semester	Credit Units	Pre-requisite
STA 423	Biometry II	2	4	STA 323
STA 431	Bayesian Inference	2	4	STA 311
STA 432	Non-Parametric Methods	2	4	STA 321 or 311
STA 433	Multivariate Methods	2	4	STA 321 or 331
STA 434	Psychometrics	1	4	STA 321 or 331
STA 441	Sampling Theory and Survey Methods	1	4	STA341

Instructions

1 A minimum of 3 credit units must be passed from the list of elective courses. Students may also select courses that are suitable from 400 level Computer Science or Mathematics and from which they have the pre-requisites.

2 (a) Not all elective courses listed will necessarily be available in any one session.
(b) Information on the elective courses that may be available in any one semester will be given at the beginning of each session.

3 All courses registered will normally count towards graduation.

4 Any student registering STA 491 must be in his/her final year.

COURSE DESCRIPTON
STATISTICS COURSES
100 LEVEL

STA 111 – Probability 1 (4 Units) L. 60: P. O.: T. O Pre-requisite: Credit in O/L Maths. or its Equivalent.

Generation of statistical events from set-theory and combinatorial methods. Elementary principles of probability. Types and distributions of random variables; the binomial, Poisson hypergeometric, normal distribution; Expectations and moment of random variables; Probability sampling from tables of random numbers; selected applications.

STA 131 – Inference 1 (4 Units) L. 60: P. O.: T. O Pre-requisite: Credit in O/L Maths. or its Equivalent.

Statistical data, their source, collection and preliminary analysis by tables and graphs. Time series, demographic measures and index numbers. Inference estimation and tests for hypothesis. Regression and correlation of data.

STA 132 –Laboratory for Inference 1 (2 Units) L.30: P.O.: T. O Pre-requisite: Credit in O/L Maths. or its Equivalent.

Presentation and analysis of data; curve fitting and goodness-of-fit tests. Construction of questionnaires and simple index numbers. Use of random numbers and statistical tables.

200 LEVEL

STA 202 – Statistics for Agricultural &Biological Sciences (4 Units) L. 60: P. O.: T. O Pre-requisite – Credit in O/L Maths. or its Equivalent.

Use of statistical methods in biology and agriculture. Frequency distributions. Laws of probability. The binomial, Poisson and normal probability distributions. Estimation and test of hypothesis. Design of simple agricultural and biological experiments. Analysis of variance and covariance, simple regression and correlation, contingency tables. Some non-parametric tests.

STA 203 – Statistics for Physical Sciences and engineering (4 Units) L. 60: P. O.: T. O Pre-requisite – Credit in O/L Maths. or its Equivalent.

Measure of location and dispersion in simple and grouped data exponential. Elements of probability and probability distributions. Estimation and tests of hypotheses concerning the parameters of distributions. Regression, correlation and analysis of variance, contingency table. Non-parametric inference.

STA 211 – Probability II (4 Units) L. 60: P. O.: T. O Pre-requisite – STA111 or STA 203

Combinatorial analysis. Probability models for the study of random phenomena in finite sample spaces. Probability distributions of discrete and continuous random variables. Expectations and moment generating functions, Chebyshev's inequality, bivariate, marginal and conditional distributions and moments. Convolution of two distributions, the central limit theorem, and its uses.

STA 231 – Inference II (4 Units) L. 60: P. O.: T. O Pre-requisite – STA131 or STA 203

Use of Neyman Pearson lemma. Hypotheses testing, the power of a test. Point and interval estimation. (Testing and estimation of large samples and in some standard small samples situations) binomial, Poisson, normal contingency tables. Goodness-of-fit tests.

STA 232 –Laboratory for Inference 1 (2 Units) L. 40: P. O.: T. O Pre-requisite – STA 132 or STA203

Computations based on curve fitting goodness-of-fit tests, estimation, test of hypotheses and contingency tables.

300 LEVEL

STA 311 – Probability III (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 211

Brief revision of basic concepts. Probability generating functions. Univariate and Bivariate moment generating functions, univariate characteristic functions, formula. Various modes of convergence, Laws of large numbers and the central limit theorem using characteristics functions. Random walk and Markov chains. Introduction to Poisson processes.

STA 321 – Distribution Theory (2 Units) L. 30: P. O.: T. O Pre-requisite – STA 203 or STA211

Bivariate normal distribution, the gamma, chi-square, 2 types of beta, F and t distribution of functions of random variables, cumulative distribution function, moment generating function and transformation techniques. Probability integral transformation. Order statistics and their functions.

STA 323 – Biometry (4 Units) L. 60: P. O.: T. O Pre-requisite

Purpose, history and structure of biological assays. International standards. Statistical Science and biological assays. Terminology and notations. Types of biological assays. Nature of direct assays. Applications strophanthus. Precision of estimates.

STA 324 – Regression Analysis (2 Units) L. 30: P. O.: T. O Pre-requisite – STA 231 or 232

Multiple linear regression models polynomial regression. Tests of independence and goodness-of-fit. Use of dummy variables. Non-linearity in parameters simple transformation.

STA 325 – Analysis of Variance 1 (2 Units) L. 30: P. O.: T. O Pre-requisite – STA 231 or 232

Analysis of simple, double and multiple classifications of balance data in crossed and nested arrangements. Analysis of two-ways, three-ways contingency tables for tests of homogeneity, independence and interactions. Analysis involving incomplete tables, missing values, etc.

STA 331 – Inference III (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 231

Point estimation by least and maximum likelihood methods. Properties of point estimators, unbiasedness, sufficiency, completeness, minimum variance unbiasedness. Rao-Cramer inequality, consistence intervals. Gauss-Markov and Fisher-Cochran theorems. Tests of hypothesis, Neyman-Pearson theorem.

STA 332 – Laboratory for Analysis and Inference (2 Units) L. 30: P. O.: T. O Pre-requisite

Computations involving point and interval; estimation, tests of hypotheses, analysis of variance, goodness-of-fit tests and contingency tables.

STA 341 – Sampling Theory and Survey Methods (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 231

Basic sampling methods, Stratification. Use of auxiliary information. Multi-state sampling errors. Estimation of population mean and total in simple and in stratified random sampling Methods of social investigation; planning, survey, problems, designs of survey, error and bias, methods of collection of data, processing, analysis and interpretation. Nigeria's experience in sampling surveys.

STA 342 – Laboratory & Field Work Sampling (2 Units) L. 30: P. O.: T. O Pre-requisite- STA 231

Field and laboratory appraisal of some of the techniques and problems in sample surveys.

STA 343 – Statistical Quality Control (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 231

Process control. Use of control charts to achieve process stability. Tolerance limits as a function of components variability. Product control design of simple, double, multiple and sequential sampling plans. Comparison of different sampling plans. Cumulative sum charts, feedback theory for controlling continuous process.

STA 344 – Laboratory & Field Work Statistical Quality Control (2 Units) L. 30: P. O.: T. O Pre-requisite

Practical construction of control charts. Computations involving tolerance, limits, simple, multiple and sequential sampling plans. Design and analysis of various rectification schemes.

STA 351 – Demography (2 Units) L. 30: P. O.: T. O Pre-requisite

Demographic data; Sources, assessment of and use in construction of life tables. Definition of basic concepts. Estimation of population parameters from defective data. Stable and quasi-stable population, population projections.

STA 352 – Laboratory & Field Work for Demography (2 Units) L. 30: P. O.: T. O Pre-requisite

Computation involving life tables, estimation of demographic parameters from Nigerian population.

STA 362 – Operations Research I (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 211

Classical methods of optimization. Maxima and Minima, Lagrange's multipliers Linear Programming. Convex sets and functions, simplex and revised simplex methods, duality theory, and applications. Games Theory, two persons' zero-sum games, saddle point, dominance, strategies. Linear programming applications.

STA 363 – Laboratory for Operations Research (2 Units) L. 30: P. O.: T. O Pre-requisite

Exercises on problem formation involving linear programming applications. Computation using simplex revised simplex algorithms to solve non-trivial linear programming problems. Use of linear programming, computer packages.

400 LEVEL

STA 411 – Probability IV (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 311

Probability spaces, measures, and distribution. Distribution of random variables as measurable functions. Product spaces, product of measurable spaces. Product probabilities. Independence and expectation of random variables. Convergence of random variables. Weak convergence, convergence almost everywhere, convergence in path mean. Central Limit Theorem, Laws of large numbers, characteristic function and Laplace transforms.

STA 412 – Stochastic Processes (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 311 or 331

Random walk, simple and general random walk with absorbing and reflecting barriers. Markovian processes with finite chains. Limit Theorem. Poisson, branching birth and death process. Queuing processes; M/M/1, M/M/S/ M/G/1 queues and their waiting time distribution. Relevant applications.

STA 413 – Time Series (4 Units) L. 30: P. O.: T. O Pre-requisite – STA 311 or 321

Components of time series, measurement of trend, the seasonal index, the cyclical component and random fluctuations. Serial correlation, the cyclical component and random fluctuations. Serial correlation, correlogram. Stationary time series, estimation of mean and their covariance function; Linear prediction in time series, autoregressive series.

STA 421 – Design & Analysis of Experiments (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 321 or 331

Application of statistical methods to the efficient design of experiments. One factor and multi-factor experiments in randomized blocks, Latin squares, split-plots, etc. 2n factorial experiments with confounding and fractional replications. Problems in experimentation. Missing values heterogeneous data, etc.

STA 422 – Regression Analysis (2 Units) L. 30: P. O.: T. O
Pre-requisite – STA 324

Partial and conditional regression and correlation models. Canonical correlation. Tests of independence of regression coefficients. Multicollinearity and other problems associated with "Best Regression models".

STA 423 – Biometry (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 323, 324 and 325

Feller's theorem and its two analogues. The Behrens distribution. Fiducial limits in the strophanthus assay. Dilution assays. Adjustments for body weight. Direct assay with covariance efficiency and utility of concomitant measurements. Design and criticisms of direct assays. Indirect assays. The dose-response regression. The condition of similarity. Assay validity. Preliminary regression investigation. The condition of monotony. Linearising transformation.

STA 424 –Analysis of Variance (2 Units) L. 30: P. O.: T. O
Pre-requisite – STA 325

Analysis of variance involving unbalanced data. Multi-variant analysis of variance. Analysis of multi-factor, multi-response of variance such as missing observations, Non-normality, heterogeneity of variance, etc.

STA 431 – Bayesian Inference (4 Units) L. 60: P. O.: T. O Pre-requisite

Bayer's Theorem, Posterior distributions. One parameter cases in some standard continuous and discrete distributions. Point and interval estimation. Prediction of future observation. Choice of priors, natural conjugate families of prior distribution, simple non-informative priors. Comparison of the means and variance of two normal and Poisson distribution. Linear regression. Tests of hypothesis.

STA 432 – Non-Parametric Methods (4 Units) L. 60: P. O.: T. O
Pre-requisite – STA 321 or 311

Order statistics and their distributions. Kolmogorov type of test statistics. Common non-parametric test including runs, sign rank order and rank correlation. Null distribution and their approximations. Efficiency properties. Estimates based on test statistics.

STA 433 – Multivariate Methods (4 Units) L. 60: P. O.: T. O
Pre-requisite – STA 321 or 331

Multivariate normal and related distributions. Inference about mean vectors, Hotelling T^2 and Mahalanobis D^2 statistics. Discrimination and classification. Tests of independence. Principal components and factor analysis.

STA 434 – Psychometrics (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 321 or 331

The foundations of metal measurement theory; Measurement in Psychology and Education. The construction of true and error scores. The classical test theory model, fixed length, variable length. Some estimates of parameters of the classical model. Other weak true-score models, parallel measurements. Types of reliability co-efficient and their estimation. Some test theory for equivalent measurements. Item, sampling in test theory and in research design.

STA 441 – Sampling Theory and Survey Methods (4 Units) L. 60: P. O.: T. O Pre-requisite – STA 341

Single and multi-stage cluster sampling. Equal and unequal clusters. Double sampling; Further use of auxiliary information. Multivariate ratio estimation. Unequal probability sampling with or without replacement. Ordered and unordered estimators.

STA 491 – Project (6 Units) L. 60: P. O.: T. O

Individual work on a selected topic illustrating application of some of the theories and techniques covered in the course.

REVISED UNIVERSITY OF JOS EXAMINATION REGULATIONS AND GUIDELINES

1. Leakages

All cases of leakages established should be reported to the Senate Examinations Misconduct Committee for consideration. The relevant Departments or units of the University affected and those responsible for handling such matters shall carry out preliminary investigation. The report shall be forwarded to the Senate Examinations Misconduct Committee through the Vice Chancellor.

Punishment

a. If found liable, the student shall be immediately expelled from the university.

b. If the student is not found liable, the result shall be released and the student allowed to continue with his/her study.

c. If the person involved in the leakage is not a student of the University, he/she shall be handed over to the police by the Security Division of the University for prosecution.

d. The staff alleged to be involved shall be reported to the appropriate Staff Disciplinary Committee.

2. Impersonation

This includes among others, hiring of and arranging with examination touts, contractors, etc., whether students of the University or outsiders, to write examinations for other students who hired or contracted them.

Punishment

a. The student who hires or contracts somebody to write the examination shall be expelled from the university.

b. If the impersonator is a student of the University of Jos, he/she shall be expelled.

c. If the impersonator is not a student of the University of Jos, he/she shall be handed over to the police by the Security Division of the University for prosecution.

3. Bringing Foreign Unauthorized Materials into the Examination Hall

This includes smuggling of items hidden in different parts of the body, scripts, textbooks, notebooks, pages of textbooks, question papers of previous examinations, handsets, Bluetooth, electronic wristwatches, electronic slippers, unauthorized computers, blank pieces of paper or notes on handkerchiefs, notes on shirts, notes on waist slips, currency notes with notes, photocopies, notes on palms, notes on receipt or course registration forms, notes on calculators, etc.

Punishment

a. If found liable, the student shall be suspended for the next two semesters and the student's result in the affected paper(s) shall be cancelled.

b. If caught the second time in the same misconduct, the student shall be expelled from the University.

c. If the student is not found liable, the result shall be released and the student allowed to continue with his/her study.

4. Taking Examination Script out of Examination Hall

Any candidate who takes out, throws out or fails to submit his/her examination scripts commits a serious misconduct.

Punishment

a. If found liable, the student shall be suspended for the next two semesters and the student's result in the affected paper(s) shall be cancelled.

b. If caught a second time in the same offence, the student shall be expelled from the University.

c. If not found liable, the result shall be released and the student allowed to continue with his/her study.

5. Unauthorized Exchange of Information in or out of the Examination Hall

This includes collusion, consultation, copying, peeping and copying ("giraffing") from another person's script and all forms of assistance and similar offences.

Punishment

a. If found liable, the student shall be suspended for the next two semesters and the student's result in the affected paper(s) shall be cancelled.

b. If caught a second time in the same offence, the student shall be expelled from the University.

c. If not found liable, the result shall be released and the student allowed to continue with his/her study.

6. Consulting Unauthorized Materials or Persons Outside the Examination Hall during Examination

This includes going outside the examination hall to consult lecture notes, materials related to examinations not allowed in examination halls or discussing with persons outside the examination hall.

Punishment

a. If found liable, the student shall be suspended for the next two semesters and the student's result in the affected paper(s) shall be cancelled.

b. If caught a second time in the same offence, the student shall be expelled from the University.

c. If not found liable, the result shall be released and the student allowed to continue with his/her study.

7. Insult on Supervisors, Invigilators and other Staff Members Associated with the Examination

This includes verbal attack on supervisors (Deans, Heads of Department, Examination Officers), Invigilators and any other member of the staff associated with the examination in question.

Punishment

a. If found liable, the student shall be suspended for the next two semesters and the student's result in the affected paper(s) shall be cancelled.

b. If caught a second time in the same offence, the student shall be expelled from the University.

c. If not found liable, the result shall be released and the student allowed to continue with his/her study.

8. Assault or Battery on Supervisors and Invigilators

This includes physical attack on supervisors (Deans, Heads of Department, Examination Officers), Invigilators and any other member of the staff associated with the examination in question.

Punishment

a. If found liable, the student involved shall be expelled from the University.

b. If not found liable, the result shall be released and the student allowed to continue with his/her study.

9. Carelessness in the Examination Hall

Proven cases of carelessness include the following: allowing unauthorized materials to lie under the writing desk, on top of it, on the floor, near or beside the student(s) or assisting others to pick unauthorized materials without the express permission of the invigilator(s) or mutilating examination materials, writing notes on question papers, etc.

Punishment

a. If found liable, warning letters shall be written to the student(s) by the Registrar, copying the relevant Heads of Department, Dean of Faculty and Senate Examination Misconduct Committee for the records.

b. If the student(s) is/are caught again in the same offence, he/she shall be suspended for two semesters from the University.

c. If the student is caught more than twice in the same misconduct, the student(s) shall be expelled from the University.

Unauthorized materials in this context mean materials that are prohibited from being brought into the examination hall and are relevant to the examination in question.

10. Suspension and Withholding of Results of Students Involved in Examination Misconduct Cases

a. The Senate shall suspend the student(s) allegedly involved in examination misconduct who fail(s) to honour and appear before the Senate Examination Misconduct Committee from registration and lectures pending the determination of their cases.
b. On no account shall the Department/Faculty release the results of the affected student(s) before the determination of such cases by the Senate.
c. The Senate Examination Misconduct Committee shall conclude all cases of examination misconduct as soon as possible preferably within six (6) weeks of the alleged misconduct, to enable the student(s) that may be exonerated to register without undue delays.
d. In unusual cases where more time would be required to get to the truth of the matter, the Senate Examination Misconduct Committee shall apply to the Vice-Chancellor for more time to conclude the case.
e. The Registrar shall promptly notify all students who are exonerated from examination misconduct allegations and direct their Departments/Faculties to release their results to enable them register and continue from where they stopped.

11. Unforeseen Methods of Examination Misconduct

Any other misconduct in the course of an examination not covered or described above shall be classified as a General Examination Misconduct and shall attract the same punishment as bringing unauthorized materials into the Examination Hall in Paragraph 3 above.

The Senate Examination Misconduct Committee shall report such new misconduct to Senate immediately and the Senate may decide to classify such misconduct and prescribe appropriate punishment thereto.

12. Forwarding Misconduct Cases to the Senate Examination Misconduct Committee

a. Departments/Faculties where misconduct cases have occurred shall adhere strictly to the Senate guidelines in dealing with the matter.

b. All students involved in examination misconduct cases must be promptly issued with letters by the Faculty/Department instructing them to stay behind immediately after the period of examination to appear before Senate Examination Misconduct Committee to defend themselves. Copies of such letters shall be sent to the Senate Examination Misconduct Committee.
c. In cases of examination misconduct committed by any student outside his/her Department/Faculty, the Head of Department where the misconduct was committed shall report the case to the Senate Examination Misconduct Committee and inform, in writing, the Head of the student's Department/Faculty who, in turn, shall instruct the student to stay behind immediately on the conclusion of semester examination to appear before the Senate Examination Misconduct Committee.
d. All cases of examination misconduct shall be reported to Senate Examination Misconduct Committee using the appropriate examination misconduct form not later than 24 hours after the conclusion of the examination, failure which the Department would be required to give an explanation of the delay to Senate.

13. Mitigation

All pleas for mitigation of punishment shall be directed to the Chairman of Senate and shall be taken on the floor of the Senate.

14. Rights of Students Caught in Examination Misconduct Cases

a. Students caught in examination misconduct should be allowed to continue the examination in question after the misconduct has been duly documented as prescribed above by the invigilator and the student(s) involved have completed the examination misconduct form.
b. Supervisors and invigilators are not allowed to insult/assault students allegedly involved in examination misconduct.

15. Failure to Honour Senate Examination Misconduct Committee's Invitations

Students who, without good cause, fail to honour the invitation of the Senate Examination Misconduct Committee after being given the opportunity in writing on the first instance shall be suspended. Should the student fail to present himself/herself on three occasions after the written invitation, he/she shall be expelled from the University.

16. Students Who Served Suspension for Examination Misconduct and Commit Examination Misconduct Again

A student suspended for examination misconduct who commits examination misconduct the second time shall be expelled from the University.

17. Staff Involved in Examination Misconduct Cases

All cases of examination misconduct involving staff, both teaching and non-teaching, shall be forwarded to the appropriate Staff Disciplinary Committee by the Senate.

18. Powers of Senate

Where special or exceptional circumstances exist, Senate may decide to prescribe a lesser punishment than that presented above.

POSTGRADUATE PROGRAMMES IN THE DEPARTMENT OF MATHEMATICS

A) The Department offers the following postgraduate programmes in Mathematics

1. M.Sc. Mathematics programme (full Time and part-time)
2. M.Phil/Ph.D Programmes in Mathematics (full-time and part-time)

A) M.Sc. MATHEMATICS FULL TIME PROGRAMME

This course is designed for those interested in various aspects of professional development in teaching, research or industry. It attempts to bring every student's knowledge of central mathematic concepts and techniques and its application to problems relevant to the growing industries (e.g. oil and steel) in the country. The Programme consists of series of core courses in pure and applied mathematics.

Management and Entrepreneurship, Information and Communication Technology (ICT) and Research Methodology.

Although the course is application oriented, it is so conducted that students can choose their research projects in both pure and applied mathematics. It thus aims to provide young Mathematicians with a sound training to meet manpower needs in institutions of higher learning and the various industries in the country. Full time programme lasts for 12 full months.

B) M.Sc. MATHEMATICS PART TIME PROGRAMME

The main attraction of this programme is that it is designed to enable candidates who are otherwise fully employed during the academic year to pursue degree course at the University of Jos. The study is oriented towards the theory and applications of some of the following topics: Analysis, Algebra, Differential Equations, Numerical Analysis, Control Theory: Complex Analysis, Fluid Mechanics and Statistics. The Degree is designed for students interested in further professional development within the field of teaching, research and industry. It attempts to bring every student's knowledge to central mathematical concepts, and techniques and its application to problems relevant to the growing industries, (e.g. oil, steel) in the country. Although the programme is application oriented, it is so conducted that students are able to choose their topics in both Pure and Applied Mathematics. It thus aims to provide young Mathematicians with sound training to meet indigenous manpower needs, both in industries and institution of higher learning.

REGULATIONS

With respect to admission, registration, duration, mode and programme of study, supervision, examinations, etc. the provisions of the University of Jos Regulations Governing Higher Degrees and Diplomas for Master's degree programmes primarily by coursework shall take precedence over Departmental requirements.

B) List of Courses

Candidates can choose in consultation with Head of Department any of the following courses:

Areas of Specialization

a) Pure Mathematics
b) Applied Mathematics

Core Courses

Generic Core Courses

SCI 801 : Management and Entrepreneurship (2 Credit Units)
SCI 802: ICT and Research Methodology (2 Credit Units)

Programme Core Courses

MAT	800	Research Project	(6 Credit Units)
MAT	801	Algebra	(3 Credit Units)
MAT	802	Topology	(3 Credit Units)
MAT	803	Real Analysis	(3 Credit Units)
MAT	804	Complex Analysis	(3 Credit Units)
MAT	805	Partial Differential Equations	(3 Credit Units)
MAT	824	Seminar	(2 Credit Units)

Elective Courses

A) For Pure Mathematics

MAT	806	Group Representation Theory	(3 Credit Units)
MAT	807	Number Theories	(3 Credit Units)
MAT	808	Category Theories	(3 Credit Units)
MAT	809	Lie Groups	(3 Credit Units)
MAT	810	Differential Manifolds	(3 Credit Units)
MAT	811	Theory of Integration	(3 Credit Units)
MAT	812	Integral Equations	(3 Credit Units)
MAT	813	Theory of Distributions	(3 Credit Units)
MAT	814	Introduction to Mathematical Modelling	(3 Credit Units)
MAT	827	Commutative Algebra	(3 Credit Units)
MAT	828	Permutation Groups	(3 Credit Units)

B) For Applied Mathematics

MAT	815	Quantum Mechanics I	(3 Credit Units)
MAT	816	Fluid Mechanics	(3 Credit Units)
MAT	817	Elasticity	(3 Credit Units)
MAT	818	Electromagnetic Theory	(3 Credit Units)
MAT	819	Quantum Mechanics II	(3 Credit Units)
MAT	820	Visco-Elasticity and Plasticity	(3 Credit Units)
MAT	821	Control Theory	(3 Credit Units)
MAT	822	Finite Elements Methods	(3 Credit Units)
MAT	823	Biomathematics	(3 Credit Units)
MAT	825	Numerical Solutions of Ordinary Differential Equations (3 Credit Units)	
MAT	826	Numerical Solutions of Algebra Equations	(3 Credit Units)

MAT 801 Algebra (3 Credit Units)

Sylow theorems, direct products, Fundamental theorem of finite Abelian groups, field of quotients, Euclidean rings, Polynomial rings over commutative rings, inner product spaces, theory modules, sub-modules, quotient modules, modules over principal idea domains. Applications finitely generated Abelian group fields extension fields elements of Galois theory, solvability radicals.

MAT 802 Topology (3 Credit Units)
Review of categories and functors. Homology, fundamental group, covering transformation, simplicial complexes. Singular homology, Universal co-efficient theorem for homology and cohomology, Spectral sequence.

MAT 803 Real Analysis (3 Credit Units)
Measures and Integration. Outer measure. Lebesgue Measure. Basic Properties of Banach and Hilbert spaces. Operators, Duality. Basic theorems in functional analysis. Classical Banach spaces. Spectral theory of Operators in Hilbert spaces. L_2 space as a Hilbert space. Banach algebras. Gelfand theory, compact operators. Examples and applications to classical analysis.

MAT 804 Complex Analysis (3 Credit Units)
Periodic functions, Weierstrass functions, elliptic curves. Modular forms. Algebraic functions, Riemann surfaces, Covering surfaces, covering transformations. Discontinuous groups of linear transofrs, automorphic forms.

MAT 805 Partial Differential Equations I (3 Credit Units)
Basic examples of linear partial differential equations and their fundamental equations and their fundamental solutions. Existence and regularity of solutions (Local or Global) of the Cauchy problems; boundary value problems and mixed boundary value problems. The fundamental solutions of their partial differential equations.

MAT 806 Group Representation Theory (3 Credit Units)
Representations of groups by linear transformations; group algebras, character theory and modular representations. Representation theory of algebraic groups; representation of finite groups; representation of Lie groups. Unitary representation theory.

MAT 807 Number Theory (3 Credit Units)
Algebraic integers. Completions, the different and discriminant. Cyclotomic fields. Parallelotopes. Class-Number. Ideles and Adeles. Elementary properties of Zeta-functions.
L-functions.

MAT 808 Category Theory (3 Credit Units)

Categories, functions natural-transformation. Functor Categories, limits. Products and corproducts. Pushbacks and Pushouts, adjoin functors. Normal and exact categories: Abelian categories, quotient categories.

MAT 809 Lie Groups (3 Credit Units)
Lie groups and their Lie algebras, subgroups. Matrix groups: One-parameter groups, exponential map, Campbell-Hausdorff formula, Lie algebra of a matrix group, integration on matrix groups. Abstract Lie groups.

MAT 810 Differentiable Manifolds (3 Credit Units)
General Manifolds. Topics such as smooth mappings. Immersions, submersions, transversality, intersection theory, vector fields of manifold; orientation of manifolds: Gaussian curvature, Riemannian manifolds, differential forms, integration on manifolds tensors and connections are included.

MAT 811 Theory of Integration (3 Credit Units)
The theory on closed and bounded intervals: Gauges and integrals. Basic properties of the integral, The fundamental theorems of calculus. The Saks-Henstock Lemma. Measurable functions. Absolute integrability. Convergence theorems. Integrability and mean Convergence. Measure, measurability and multipliers. Mode of Convergences, substitution theorems. Applications. The theory on infinite intervals: General insight into integration on infinite intervals.

MAT 812 Integral Equations (3 Credit Units)
Basic existence theorems: Equations with L_2 kernels: Fredholm Theory; Nonlinear equations, Schauder fixed point theorem. Dual integral and series equations. Wiener-Hope equations and Technique. Singular Integral equations. Applications.

MAT 813 Theory of Distributions (3 Credit Units)
Topological vector spaces and generalized functions; Distribution calculus and topology; convolution; Tempered distributions and their Fourier transforms. Integral transforms of Mathematical Physics. Application.

MAT 814 Introduction to Mathematical Modelling (3 Credit Units)
Mathematical Modelling. The Art of Transforming Real Life Situation into Mathematical statements. Examples will be drawn from Areas such as Biology, Business, Deformable Media, Industry, and other dynamical system. Case studies.

MAT 815 Quantum Mechanics I (3 Credit Units)
Background of the axiomatic approach to Null et al. Axioms of continuum and Basic Concepts. Constitutive Relations. Equations of Motion and other Equations.

Equations of Motions and other Equations of Balance. The place of the Classical Theories.

MAT 816 Fluid Mechanics (3 Credit Units)
Thermodynamics Compressible flow; waves; sheeks; supersonic flow; Boundary layer Theory; stability; Turbulence.

MAT 817 Elasticity (3 Credit Units)
Formulation of the Linear Theory; General Theorems; Plane Strain and generalized Plane stress; Ary's solution: Papkovich Neuber representation; Basic singular solutions; Boundary-value and Boundary-initial value problem.

MAT 818 Electromagnetic Theory (3 Credit Units)
Maxwell's Equations; Electromagnetic Potentials; Tensor Calculus; Stress and Energy; Electro Static and Magnetostatics, plane Waves, cylindrical and Spherical waves; Boundary Value Problems; Relativistic Kinematics and Lorentz Transformation: Electrodynamics.

MAT 819 Quantum Mechanics II (3 Credit Units)
Schrodinger equations; Stone's Theorem and its applications. Unitary transformations: Heisenberg representation: Measurement: Quantum Theory of Scattering; Angular Momentum. Motion in an external field; Base and Fermi Statistics: Perturbation Theory.

MAT 820 Visco-Elasticity and Plasticity(3 Credit Units)
Characteristics of various visco-elastic and Plastic material, Basic equations. Boundary Value Problems. Elastic-plastic problem.

MAT 821 Control Theory (3 Credit Units)
Dynamical Systems in the State Space. Reachability. Stabilizability and Detectability. Equivalence of Controllability and Pole Assignability. The Calculus of Variations. Generalized Huygen's Principle. The Algebraic Riccati Equation. Lyapunov Stability. Applications to Economic Stabilization. Planning. Manpower Development. Resource Allocation under Constraints, etc Case Studies.

MAT 822 Finite Element Methods (3 Credit Units)
Introduction to the Finite Element Method: Formulation of the Finite Element Method using the Principle and Virtual Displacement. General Isoparametric Formulation, and Variational Techniques. Generalization of the theory. Application of the Finite Element Method to the solution of Engineering Problems, e.g., in Solid Mechanics. Heat Transfer. Fluid Dynamics and Mass Transfer. Development of appropriate Computer Programme. Case Studies.

MAT 823 Biomathematics (3 Credit Units)
Mathematical Methods of Deterministic or Stochastic aspects of Biological Systems, e.g., Population dynamics, species interaction malaria epidemic, etc.

MAT 825. Numerical Solutions of Ordinary Differential Equations (3 Credit Units)
Numerical Methods for solving Ordinary Differential equations. Boundary Value Problems methods of Solutions. Applications of ODE in Chemical Prological/ Civil/Environmental and electrical engineering. Case Study.

MAT 826 Numerical Solutions of Algebraic Equations (3 Credit Units)
Direct Methods for Linear Equations, Orthogonal factorization, Sparse Matrix techniques, Markowitz. Criterion Nested dissection, Applications. Interactive Methods for nonlinear equations. One-point iterative methods; Newton and Brown's methods; convergence of these methods, multistep iteration methods; secant methods; convergence and stability of these methods, Special Methods Applications.

MAT 827 Commutative Algebra (3 Credit Units)
Ring and Module structures, operations on Ideals, Free modules, Exact-sequences and corrected Ideals in rings of fractions. Noetherian and Artinian rings and modules, primary decomposition, integral dependence chain conditions, semi simple rings, Jacobson and nil radicals, Discrete Valuation rings, Prufer domains, Dedekind domains, completions, Dimension theory, prime spectrum and Krull dimension, some applications to Algebraic geometry.

MAT 828 Permutation Groups (3 Credit Units)
Orbits, Cycle structures, Semi-regular and set wise stabilizers, Constitutions, Semiregular and regular groups, ½ transitivity, multiple transitivity and primitivity Frobenius groups, Kernels and Complements. Group action on set and on groups, semi-direct and wreath products, Permutations Modules of transitive p-groups; Ascending and descending. Loewy Series, the trace sub Modules and argumentations, Dimensions of the factors. Examples and applications.

M.Phil/Ph.D Programme

A Candidate for the degree of Doctor of Philosophy or Master of Philosophy must fulfil conditions as prescribed in the University of Jos Regulations Governing Higher Degrees, Diplomas and is supposed first to pass two semesters of M.Sc. programme. Normally, a candidate without M.Sc. degree of the University of Jos,

or any other recognized University, cannot be registered for M.Phil/Ph.D Programme. They will be expected to take courses equivalent to University of Jos M.Sc. courses. Exemptions may be granted to M.Sc. degree holders of other recognized universities on individual merit. The quality of the Master's Degree must meet the standard prescribed by Regulation 44(3), i.e. a cumulative score average of 60% or above and a score on the research project not below 60%.

Duration of Programme

i) A full time Doctoral Programme shall run for a minimum of six (6) semesters and a maximum of eight (8) semesters.

ii) Part-time Doctoral programme shall run for a minimum of eight (8) semesters and a maximum of ten (10) semesters.

iii) For extension beyond the specified maximum period, a special permission of Senate shall be required.

Requirements for Graduation

Doctorate (Ph.D) programme will be primarily by research. However, the Departmental Postgraduate committee may prescribe some courses of not more than 12 credit units to be taken by candidates. A Doctoral (Ph.D) thesis of 12 credits must be defended before a panel of internal and external examiners. All other requirements are as prescribed in the NUC benchmark on minimum academic standards for postgraduate programmes in sciences in Nigerian Universities.

Postgraduate Teaching Staff List

S/No	Name of Lecturer	Rank	Area of Specialization
1.	Prof. E.J.D. Garba	Professor	Mathematical Physics
2.	Prof. M.S. Audu	Professor	Group Theory
3.	Prof. S.U. Momoh	Professor	Group Theory
4.	Prof. U.W. Sirisena	Professor	Numerical Analysis
5.	Prof. J.P. Chollom	Professor	Numerical Analysis
6.	Dr. J.N. Ndam	Reader	Biomathematics
7.	Dr. G.M. Kumleng	Reader	Numerical Analysis
8.	Dr C. Ukwu	Senior Lecturer	Control Theory
9.	Dr. R.O. Akinola	Senior Lecturer	Computational and Applied Mathematics
10.	Dr. J. Sunday	Senior Lecturer	Computational Mathematics
11.	Dr N.M. Kamoh	Senior Lecturer	Numerical Analysis

12.	Dr. S. Longwap	Lecturer I	Complex Analysis

PROPOSA WRITING FOR POSTGRADUATE RESEARCH IN THE DEPARTMENT

Every postgraduate student is expected to write a research proposal and project and defend same before graduation. Below is the outline of a typical research proposal in Mathematics.

Definition

A research proposal is the outline of activities the researcher intends to undertake in order to realise the set objectives of the proposed study.

It serves as a guide to the investigator and keeps them on track as they try to work according to the work plan.

- A good research proposal hinges on a good idea and a clear understanding of the proposed research topic.
- It should contain all the key elements involved in the research process and should include adequate information to guide the researcher or the intended readers to assess the study.
- Every research proposal should address the what, why and how of the proposed study. That is,
  - What you plan to accomplish in the proposed research
  - Why you want to do it
  - How you intend to go about it
- A research proposal can either be for a grant, admission or for thesis writing.
- A research proposal should include the following essential components:
  - Title
  - Abstract
  - Introduction
  - Literature Review

- Methods
- References

Components of a Research Proposal

Title: The title should be precise, but comprehensive enough to reflect the nature of the research.

Abstract: This describes the knowledge domain of the proposed research area. It explains the opportunities for scientific research and captures the approach, statement of the problem and the proposed approach, outlining the likely advantages of the approach or method. The expected outcomes of the research as well as the anticipated implications are mentioned.

Sample title page

On a derivative-free Newton-Raphson's method for the solutions of nonlinear algebraic equations

Adewale Audu Chinedu
UJ/2000/PGNS/0000

A Research Proposal in the Department of MATHEMATICS, Faculty of Natural Sciences, submitted to the School of Postgraduate Studies, University of Jos, in partial fulfilment of the requirements for the award of MASTER OF SCIENCE/ DOCTOR OF PHILOSOPHY in Mathematics of the UNIVERSITY OF JOS

Introduction: In the introduction, the subject matter of the proposed research is put into perspective. It consists of the following subsections:

- Background of the study
- Significance of the study
- Statement of the problem
- Aims/Objectives of the Research
- Delimitation of the research
- Definition of key concepts

The introduction gives an overview of the research project you propose to undertake. It explains the background of the research topic and tries to justify that the issues under consideration are worthy of attention.

It also contains a precise statement of the problem which can be in form of a research question or research statement. It provides a clear demarcation of the boundaries of the research.

Statement of the problem

The statement of the problem is of great importance in any research work. The statement of problem must be understood and properly defined in clear terms. There are various ways of stating a research problem. What is essential is that the researcher knows exactly the problem they intend to solve.

Below is an example of a statement of problem for the topic:

"*A travelling wave solution of the Fisher's equation*".

Fisher's equation models the propagation of an advantageous gene in humans. It is a nonlinear Partial Differential Equation (PDE), hence it has no exact solution. Many attempts have been made to estimate the solution numerically. However, this type of approach does not provide a way of evaluating the solution at any given point. Moreover, some Pdes are known to admit travelling wave solutions, and since Fisher's equation models a wave of a gene propagating in human beings, it is expected that the TW solution approach could be a more appropriate procedure for estimating its

solution. Hence, this research intends to investigate the existence or otherwise of a TW solution to the Fisher's equation.

What will be your statement of problem for each of the following topics?

- Continuous block Simpson's method for the solutions of ODEs
- A mathematical model for the dynamics of two competing species in the presence of a predator
- On a derivative-free Newton-Raphson's method for the solutions of nonlinear algebraic equations

Literature Review

This is a purposeful review of relevant works of other scholars with a view to establishing

- The current state of knowledge in the field
- Research gaps that need to be addressed.

Review of literature helps the researcher to avoid "reinventing the wheel" and to fine-tune and refocus his own research direction.

A literature review

- Should be presented as a clear and coherent analysis of the works of other scholars which are relevant to the research in hand
- Must be a critical evaluation, integration and synthesis of the relevant literature and not just summaries of the works of other researchers
- Should present relevant information either in chronological order of publications or in order of contextual similarities
- All publications consulted must be acknowledged by citing both in text and in the reference listing

Methods

Here, the researcher proposes approaches or methods to the solution of the research problem. He provides a justification for the appropriateness of the chosen method(s). The expected results of the research as well as the anticipated implications are also mentioned here.

References

All published works consulted must be properly cited in the body of the review as well as listed at the end of the work.

Reference listing is according to the APA format as recommended by the Postgraduate School.

Examples:

Stokes, T.E., Hocking, G.C. and Forbes, L.K. (2003).
Unsteady free-surface flow induced by a line sink.
Journal of Engineering Mathematics, 47, 137-160.

Ladyzhenskaya, O.A. (1969). *The Mathematical Theory of Viscous Incompressible Flow.* New York, Gordon Breach, Science Publishers, 224p.

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