UNIVERSITY OF PORT HARCOURT
FACULTY OF SCIENCE

DEPARTMENTAL HANDBOOK
2016

FOR

BSc. PROGRAMMES IN THE DEPARTMENT OF MATHEMATICS AND STATISTICS

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UNIVERSITY OF PORT HARCOURT

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND STATISTICS

CURRICULUM FOR B.Sc. DEGREE

IN

MATHEMATICS
STATISTICS
MATHEMATICS/STATISTICS
MATHEMATICS/COMPUTER SCIENCE
STATISTICS/COMPUTER SCIENCE

University of Port Harcourt Press Ltd.
Choba, Nigeria.

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INTRODUCTION

The Department of Mathematics and Statistics offers a broad integrated programme of studies in Mathematical disciplines.

The first two years of the structured programme afford each student the maximum opportunity to develop the knowledge, skills, attitudes that will best motivate and equip him/her to choose the field of endeavor most appropriate to his or her talents. Basic Mathematics knowledge and skills are emphasized at that level. In the last two years each student concentrates on one of the five areas: Mathematics, Statistics, Mathematics/Statistics, Mathematics/Computer Science, and Statistics/Computer Science.

Objective

The programmes are designed to equip graduates for a wide variety of careers in the Mathematical disciplines. The main objectives are as follows:

(i)   To solve the manpower needs of the immediate environment in particular and the nation in general as regards the disciplines of Mathematics, Statistics and Computer Science.

(ii)   To prepare students for employment in establishment and industries and for research and graduate studies in these disciplines.

The applicability of these disciplines in the modern industrial environment is highly emphasized. As industries nowadays depend heavily on the use of computers for aspects of their day-

to-day operations, the Mathematics and Statistics programme is tailored to developing computing skills that will enable the graduates to fit into the modern industrial environment. The Mathematics/Statistics programmes, as well as stressing traditional methods, also incorporates new computer-based techniques and popular statistical softwares. Consequently Student Industrial Work Experience Scheme (SIWES) is emphasized for students in the department.

Curriculum

The curriculum for the BSc. Degree programmes in the Department consists of two sections namely the introductory and the advanced sections. The introductory section consists of foundation courses which are taken by all the students of the department and it extends over the first four semester of the four-year degree programme. The foundations courses seek to provide a strong grounding in Mathematics and basic sciences.

The advanced part of the degree programme commences from the first semester of year three. The department offers five streams of courses and students can choose any of them. The following are the programmes:

(i)   Mathematics (Pure and Applied)
(ii)   Statistics
(iii)   Mathematics/Statistics
(iv)   Mathematics/Computer Science
(v)   Statistics/Computer Science

Departmental Entry Requirements

The minimum requirement for entry into a Bachelor Degree program in the Department is the SSSC or WASC or GCE O/L or the equivalent with credits (in at most two sittings) in English, Mathematics, Physics, Chemistry and one other subject, depending on the sub-programme of study. Candidates for B.Sc. Mathematics, Statistics Mathematics/Statistics, Statistics and Computer programmes require credit in Biology or Economics or Geography while candidates for B.Sc. Mathematics/Computer Science programmes require credit in Biology. Attention of each student is drawn to the document "Statement of Academic Polices" of the University of Port Harcourt general entry requirements.

Eligibility to Graduate

Students are eligible to graduate upon completion of the prescribed courses for the relevant programme including Research project, with a minimum Cumulative Grade Point Average (CGPA) OF 1.50. Computations of CGPA as well as other matters relating to students status and eligibility to graduate can be obtained from Statement of Academic Policies of the University of Port Harcourt.

Withdrawal and Academic Probation

A student whose CGPA falls below 1.00 at the end of an academic year will be placed on probation in the subsequent year and will be restricted to carry credit load of 15 to 18units. A student will be required to withdraw from a programme if the CGPA is below an approved minimum of 1.00 after a period of probation.

Auditing of Courses

Students may take courses outside their proscribed programmes. The courses shall be recorded in their transcripts. However audited courses shall not be used in calculating the CGPA.

Academic Advisers

Every student is attached to an Academic Adviser who is a member of the academic staff of the department and who will advise him/her on academic affairs as well as on personal matter where necessary. Academic Advises are expected to follow their students' academic progresses and provide counseling to them. It is the duty of the Head of Department to assign an Academic Adviser to each student at the beginning of each academic session.

Policies on examinations

The policies on examinations shall be as contained in the Academic policy of the University of Port Harcourt.

Grading System

Mark/Score (%)	Grade	Grade Point
70 and above	A	5.00
60-69	B	4.00
50-59	C	3.00
45-49	D	2.00
40-44	E	1.00
0-39	F	0.00

Degree Classification

Degree Class	CGPA Range
FIRST CLASS	4.50 - 5.00
SECOND CLASS UPPER	3.50 - 4.49
SECOND CLASS LOWER	2.40 – 3.49
THIRD CLASS	1.50 -2.39

Staff Disposition (Teaching Staff)

S/N	Name	Qualification/ Institution Of Study	Area of Specialization	Designation
1	NDUKA, E.C.	B.Sc., M.Sc., UNN, Ph.D. IBADAN	Applied Statistics/ Biometrics	Professor
2	ASIBONG-IBE U.I	B.Sc., M.Sc. ABU, M. Phil, Waterloo, Ph.D., New York	Algebra	Professor
3	IWUEZE, I.S.	B.Sc., M.Sc., Ph.D. (SHEFFIELD) ENGLAND	Time Series Analysis and Forecasting	Adjunct Professor
4	IGBOKWE D I.	B.Ed. UNN, M.Sc. UNIJOS, Ph.DUNN	Functional Analysis	Adjunct Professor
5	UMOREN M. U.	B.Sc., M.Sc., Ph.D.UNN	Experimental Design	Adjunct Professor
6	NJOSEH I.N.	B.Sc.(Ed).Ekpoma, P.GD. Comp. Sci. Benin, M.Sc., Ph.D Ibadan.	Numerical Analysis	Adjunct Reader

7	DAVID, E. E.	B.Sc., ABU. M.Sc., IBADAN, Ph.D. UPH	Algebra	Senior Lecturer
8	IWUNDU, M .P.	B.Sc., UYO, M.Sc., Ph.D. UNN	Experimental Design	Senior Lecturer
9	IJOMAH, M.A.	B.Sc. IMSU, M.Sc., Ph.D. UPH, Ph.D. NAU	Applied Statistics/ Econometrics /Acting HOD	Senior Lecturer
10	JACKREECE, P.C.	B.Sc. UST, M.Sc., IMSU., Ph.D. UST	Functional Differential Equation	Senior Lecturer
11	IWOK, I.A.	B.Sc. UNICAL, M.Sc. IBADAN, Ph.D. UST	Time Series Analysis	Senior Lecturer
12	NZEREM, F.E.	B.Sc. UNN, M.Sc., FUTO, Ph.D. UNN	Applied Mathematics	Senior Lecturer
13	EZEORA, J.N.	B.Sc. EBSU, M.Sc., EBSU, Ph.D. AUST.	Functional Analysis	Senior Lecturer
14	UDO-AKPAN, I.U.	B.Sc., SOKOTO, M.Sc. IBADAN	Applied Mathematics	Lecturer I
15	IKONWA, I.O.	B.Sc., M.Sc. UNN	Applied Mathematics	Lecturer I
16	BAZUAYE, F. E.	B.Sc., M.Sc., UNIBEN. Ph.D. EBSU.	Numerical Analysis	Lecturer I
17	OLISA, J. D.	B.Sc., UNN, M.Sc., Ph.D. UPH	Applied Mathematics	Lecturer I
18	AKPAN, N. P.	B.Sc., UYO, M.Sc., UNN, Ph.D RSUST	Operations Research	Lecturer I
19	NWAKUYA, M.T.	B.Sc., IMSU, M.Sc. IMSU, Ph.D MOUA	Econometrics	Lecturer I

20	ORUMIE, C.U.	B.Sc., UNN, M.Sc., UNN, Ph.D. UPH.	Operations Research	Lecturer I
21	MUSA, A.	B.Sc., ABRAKA, M. Sc., Ph.D. UPH	Applied Mathematics	Lecturer II
22	OGOKE, U.P.	B.Ed. – UNN, M.Sc., Ph.D. UPH.	Biostatistics	Lecturer II

Senior Staff: Non-Teaching

S/N	Name	Qualification	Designation
1	EWA VERONICA I.	B.Sc. Secretarial Administration	Personal Secretary II
2	EKEH RAPHAEL I.	B.Sc. Marketing, MBA Marketing, M.Sc. Marketing	Admin Officer
3	ONYIA OBIANUJU .F.	B.Sc. Mass Communication	Admin Officer
4	BIU, OYAINEBISUN. E.	B.Sc., Statistics, M.Sc. Statistics.	Data Processing Officer
5	MUNERIGHA EGUBANSI	WAEC	Chief Clerical Officer
6	Kiriki Goodluck	WAEC	Chief Clerical Officer

Junior Staff: Non-Teaching

S/N	Name	Qualification	Designation
1	Otosere Barilee Dolly	WAEC	Computer Operator
2	Ogbuka Comfort	WAEC	Caretaker
3	Ogboloeligo Beauty	WAEC	Messenger/cleaner
4	Adulphous Bright O	WAEC	Laboratory Assistant

DEGREE PROGRAMME FOR

B.Sc. (Hons) Mathematics
(Pure and Applied)

Year I
First Semester

Course No.	Course Title	Credit Units
GES 100.1	Communication Skills in English	3
MTH 110.1	Algebra & Trigonometry	3
MTH 120.1	Calculus	3
PHY 101.1	Mechanics & Properties of Matter	3
PHY 102.1	Laboratory Practice I	1
FSB 101.1	General Biology	3
CHM 130.1	General Chemistry I	3
GES 102.1	Introduction to Philosophy & Logic	2

21 Units

Second Semester

Course No.	Course Title	Credit Units
GES 101.1	Computer Appreciation & Application	2
GES 103.2	Nigerian Peoples & Culture	2
MTH 114.2	Introduction to Set, Logic & Algebra	3
MTH 124.2	Coordinate Geometry	3
PHY 112.2	Introduction to Electricity & Magnetism	3
PHY 103.2	Laboratory Practice II	1
CHM 131.2	General Chemistry II	3

17 Units

Year II,
First Semester

Course No.	Course Title	Credit Units
MTH 210.1	Linear Algebra	3
MTH 220.1	Introduction to Real Analysis I	3
MTH 230.1	Modern Algebra I	3
CSC 280.1	Introduction to computer Programming	3
MTH 252.1	Classical Dynamics	2
MTH 270.1	Introduction to Numerical Analysis	2
STA 260.1	Introduction to Probability & Statistics	3

19 Units

Second Semester

Course No.	Course Title	Credit Units
MTH 250.2	Elementary differential Equation	3
MTH 224.2	Mathematical Methods I	2
MTH 240.2	Vector Analysis	3
MTH 226.2	Real Analysis II	3
FSC 2C1.2	Community Service	1
STA 262.2	Mathematical Statistic I	3
CSC 282.2	Database Programming	2
STA 264. 2	Statistics for Agric. and Biological Sciences	3

20 Units

Year III
First Semester

Course No.	Course Title	Credit Units
MTH 340.1	Ordinary Differential Equations I	3
MTH 312.1	Introduction to Discrete Combinatorial Mathematics	3
MTH 320.1	Real Analysis III	3
MTH 330.1	Topology	3
MTH 324.1	Complex Analysis I	2
MTH 350.1	Rigid Body Dynamics	3
GES 300.1	Fundamental of Entrepreneurship Development	2
Elective: One course from		
CSC 280.1	Structured Programming	2
STA 360.1	Mathematical Statistics II	3

21/22 Units

Second Semester

Course No.	Course Title	Credit Units
MTH 310.2	Modern Algebra II	3
MTH 342.2	Mathematical Methods II	3
MTH 352.2	Analytical Dynamics	3
MTH 326.2	Complex Analysis II	2
MTH 322.2	Measures and Integration	3
	Elective: One course from	
MTH 314.2	Number Theory	3
CSC 287.2	Object Oriented Programming	2
MTH 344.2	Mathematical Modeling	3

16/17 Units

Year IV
First Semester

Course No.	Course Title	Credit Units
MTH 410.1	Group Theory	3
MTH 440.1	Partial Differential Equation	3
MTH 420.1	Functional Analysis	3
GES 400.1	Essentials of Entrepreneurship	2
	Elective: Three courses from	
MTH 452.1	Quantum Mechanics	3
MTH 454.1	Fluid Mechanics	3
MTH 456.1	Elasticity	3
MTH 422.1	Measure Theory	3
STA 466.1	Optimization Methods	3
MTH 432.1	Functional Equations	3

20 Units

Second Semester

Course No.	Course Title	Credit Units
MTH 492.2	Numerical Methods	3
MTH 423.2	Fields and Galois Theory	3
MTH 424.2	Ordinary Differential Equations II	3
MTH 470.2	Research Project	6
	Elective: Any course from the following	
MTH 412.2	Coding and Combinatorial Mathematics	3
MTH 450.2	Continuum Mechanics	3
MTH 414.2	Introduction to Semi-group Theory	3
MTH 418.2	Rings and Modules	3
STA 474.2	Probability theory	3
MTH 458.2	Electromagnetic Theory	3
MTH 448.2	Mathematical Methods II	3
MTH 416.2	Lattices and Algebraic Systems	3

Units 18

DEGREE PROGRAMME FOR
B.Sc (Hons) Statistics

Year I
First Semester

Course No.	Course Title	Credit Units
GES 100.1	Communication Skills in English	3
MTH 110.1	Algebra & Trigonometry	3
MTH 120.1	Calculus	3
PHY 101.1	Mechanics & properties of Matter	3
PHY 102.1	Laboratory Practice I	1
FSB 101.1	General Biology	3
CHM 130.1	General Chemistry I	3
GES 102.1	Introduction to Philosophy &Logic	2

21 Units

Second Semester

Course No.	Course Title	Credit Units
GES 101.2	Computer Appreciation & Application	2
GES 103.2	Nigerian Peoples & Culture	2
MTH 114.2	Introduction to Set, Logic & Algebra	3
MTH 124.2	Coordinate Geometry	3
PHY 112.2	Introduction to Electricity & Magnetism	3
PHY 103.2	Laboratory Practice II	1
CHM 131.2	General Chemistry II	3

17 Units

Year II
First Semester

Course No.	Course Title	Credit Units
MTH 210.1	Linear Algebra	3
STA 260.1	Introduction to Probability & Statistics	3
MTH 230.1	Modern Algebra I	3
CSC 280.1	Introduction to Computer Programming	3
MTH 220.1	Introduction to Real Analysis I	3
MTH 270.1	Introduction to Numerical Analysis	2
CSC 283.1	Introduction to Information System & File Structure	3

20 Units

Second Semester

Course No.	Course Title	Credit Units
MTH 250.2	Elementary differential Equation	3
STA 262.2	Mathematical Statistic I	3
MTH 226.2	Real Analysis II	3
CSC 262.2	Database Programming	2
FSC 2C1.2	Community Service	1
MTH 224.2	Mathematical Methods I	2
MTH 240.2	Vector Analysis	3
STA 264. 2	Statistics for Agric. and Biological Sciences	3

20 Units

Year III
First Semester

Course No.	Course Title	Credit Units
STA 360.1	Mathematical Statistics II	3
SAT 370.1	Operations Research	3
STA 372.1	Sampling Theory and Quality Control	3
MTH 320.1	Real Analysis III	3
STA 374.1	Probability	3
GES 300.1	Fundamental of Entrepreneurship Dev	2
	Elective: Any course from	
CSC 288.1	Structured Programming	2
MTH 312.1	Discrete& Combinatorial Mathematics	3
MTH 324.1	Complex Analysis I	3

19/20 Units

Second Semester

Course No.	Course Title	Credit Units
STA 362.2	Statistical Inference	3
STA 363.2	Distribution Theory	2
STA 368.2	Non-Parametric Methods	3
STA 366.2	Statistical Computing	3
MTH 322.2	Measures and Integration	3
	Elective: Any course from	
CSC 287.2	Object oriented Programming	2
MTH 344.2	Mathematical Modeling	3
STA 365.2	Demography	3
MTH 310.2	Modern Algebra II	3
MTH 364.2	Analysis of Categorical Data	3
MTH 342.2	Mathematical Methods II	3

16/17 Units

Year IV
First Semester

Course No.	Course Title	Credit Units
STA 462.1	Design and Analysis of Experiments	3
STA 463.1	Multivariate Analysis	3
STA 464.1	Regression Analysis and model building	3
STA 466.1	Optimization Methods	3
GES 400.1	Fundamentals of Entrepreneurship Dev	2
	Elective: Any course from	
MTH 420.1	Functional Analysis	3
STA 469.1	Decision Theory	3
STA 468.1	Bayesian Inference	3
CSC 486.1	System Analysis and Design	3

17 Units

Second Semester

Course No.	Course Title	Credit Units
STA 472.2	Time Series Analysis	3
STA 478.2	Stochastic Processes	3
STA 477.2	Simulation and Modeling	3
STA 470.2	Project	6
	Elective: Any two courses from	
STA 476.2	Econometric Methods	3
STA 474.2	Probability Theory	3
STA 473.2	Biometry	3
CSC 494.2	Introduction to Artificial Intelligence	3

21Units

DEGREE PROGRAMME FOR
B.Sc (Hon) Mathematics /Statistics

Year I
First Semester

Course No.	Course Title	Credit Units
GES 100.1	Communication Skills in English	3
MTH 110.1	Algebra and Trigonometry	3
MTH 120.1	Calculus	3
PHY 101.1	Mechanics and Properties of Matter	3
PHY 102.1	Laboratory Practice in Physics	1
FSB 101.1	Fundamental Principles of Life	3
CHM 130.1	General Chemistry 1	3
GES 102.1	Introduction to Philosophy &Logic	2

21Units

Second Semester

Course No.	Course Title	Credit Units
GES 101.2	Computer Appreciation & Application	2
MTH 114.2	Introduction to Set, Logic &Numbers	3
MTH 124.2	Coordinate Geometry	3
GES 103.2	Nigeria People & Culture	2
PHY 112.2	Introduction to Electricity & Magnetism	3
PHY 103.2	Laboratory Practice in Physics	1
CHM131.2	General Chemistry11	3

17 Units

Year II
First Semester

Course No.	Course Title	Credit Units
MTH 210.1	Linear Algebra	3
STA 260.1	Introduction to Probability & Statistics	3
MTH 230.1	Modern Algebra 1	3
CSC 280.1	Introduction to computer programming	3
MTH 252.1	Classical Dynamics	2
MTH 220.1	Introduction to Real Analysis	3
MTH 270.1	Numerical analysis	2

Units 19

Second Semester

Course No.	Course Title	Credit Units
MTH 250.2	Elementary Differential Equations	3
STA 262.2	Mathematical Statistics	3
MTH 226.2	Real analysis II	3
CSC 282.2	Database Programming	2
FSC 2C1.2	Community Service	1
MTH 224.2	Mathematical Methods II	2
MTH 240.2	Vector Analysis	3
STA 264. 2	Statistics for Agric. and Biological Sciences	3

Units 20

Year III
First Semester

Course No.	Course Title	Credit Units
MTH 320.1	Real Analysis III	3
MTH 340.1	Ordinary Differential Equation I	3
STA 360.1	Mathematical Statistics II	3
STA 370.1	Operations Research	3
STA 372.1	Sampling Theory and Quality Control	3
MTH 324.1	Complex Analysis I	3
GES 300.1	Fundamental of Entrepreneurship Dev	2
	Elective: Any course from	
CSC 288.1	Structured Programming	2
MTH 312	Discrete& Combinatorial Mathematics	3

22/23 Units

Second Semester

Course No.	Course Title	Credit Units
MTH 322.2	Measures and Integration	3
MTH 326.2	Complex Analysis II	2
STA 362.2	Statistical Inference	3
STA 366.2	Statistical Computing	3
STA 368.2	Non-Parametric Methods	3
	Elective: Any course from the following	
MTH 310.2	Modern Algebra II	3
STA 363.2	Distribution Theory	3
CSC 397.2	Object Oriented Programming	2
MTH 287.2	Mathematical Modeling	3
STA 365.2	Demography	3
STA 364.2	Analysis of Categorical Data	3
MTH 342.2	Mathematical Methods	3

16/17 Units

Year IV
First Semester

Course No.	Course Title	Credit Units
MTH 420.1	Functional Analysis	3
STA 462.1	Design and Analysis of Experiments	3
STA 463.1	Multivariate Analysis	3
STA 464.1	Regression Analysis and model building	3
STA 466.1	Optimization Methods	3
GES 400.1	Essentials of Entrepreneurship	2
	Elective: Any course from	
STA 469.1	Decision Theory	3
STA 468.1	Bayesian Inference	3
CSC 486.1	System Analysis and Design	3
MTH 430.1	Functional Equations	2

19/20Units

Second Semester

Course No.	Course Title	Credit Units
STA 472.2	Time Series Analysis	3
STA 478.2	Stochastic Processes	3
MTH 442.2	Numerical Methods	3
MTH 470.2	Project	6
	Elective: Any course from	
STA 476.2	Econometric Methods	3
STA 474.2	Probability Theory	3
STA 473.2	Biometry	3
STA 477.2	Simulation and Modeling	3

18 Units

DEGREE PROGRAMME FOR
B.Sc (Hon) Mathematics /Computer Science

Year I
First Semester

Course No.	Course Title	Credit Units
GES 100.1	Communication Skills in English	3
GES 102.1	Introduction to Philosophy &Logic	2
MTH 110.1	Algebra and Trigonometry	3
MTH 120.1	Calculus	3
PHY 101.1	Mechanics and Properties of Matter	3
PHY 102.1	Laboratory Practice in Physics	1
FSB 101.1	Fundamental Principles of Life	3
CHM 130.1	General Chemistry 1	3

21 Units

Second Semester

Course No.	Course Title	Credit Units
GES 101.2	Computer Appreciation & Application	2
GES 103.2	Nigeria People & Culture	2
MTH 114.2	Introduction to Set, Logic &Numbers	3
MTH 124.2	Coordinate Geometry	3
PHY 112.2	Introduction to Electricity & Magnetism	3
PHY 103.2	Laboratory Practice II	1
CHEM131.2	General Chemistry11	3

17 Units

Year II
First Semester

Course No.	Course Title	Credit Units
MTH 210.1	Linear Algebra	3
MTH 220.1	Introduction to Real Analysis	3
MTH 230.1	Modern Algebra 1	3
CSC 280.1	Introduction to computer programming	3
CSC 283.1	Introduction to Information Systems & File Structures	2
MTH 270.1	Numerical Analysis	2
STA 260.1	Introduction to Probability & Statistics	3
CSC 288.1	Structured Programming	2

21 Units

Second Semester

Course No.	Course Title	Credit Units
MTH 250.2	Elementary Differential Equations	3
MTH 224.2	Mathematical Methods I	2
MTH 226.2	Real analysis II	3
FSC 2C1.2	Community Service	1
STA 264. 2	Statistics for Agric. and Biological Sciences	3
STA 262.2	Mathematical Statistics I	3
CSC 282.2	Database Programming	2
CSC 286.2	Data Structures	2
	Elective: One course from	
MTH 240.2	Vector Analysis	3
CSC 287.2	Object Oriented Perogramming I	2

21/22Units

Year III
First Semester

Course No.	Course Title	Credit Units
MTH 340.1	Ordinary Differential Equation I	3
MTH 312.1	Discrete& Combinatorial Mathematics	3
CSC 396.1	Automata Theory, Computability & FormalLanguage	3
CSC 382.1	Computer Architecture I	2
CSC 394.1	Operating Systems	3
GES 300.1	Fundamental of Entrepreneurship Dev	2
	Elective: Choose **One** course from	
STA 370.1	Operation Research	3
STA 372.1	Sampling Theory &Quality Control	3

19 Units

Year III - Second Semester

Course No.	Course Title	Credit Units
MTH 300.2	Industrial Work Experience	9

9 Units

Year IV
First Semester

Course No.	Course Title	Credit Units
MTH 410.1	Group Theory	3
MTH 440.1	Partial Differential Equations	3
CSC 480.1	Database Management	3
CSC 482.1	Compiler Construction	2
CSC 486.1	System Analysis and Design	3
CSC 498.1	Data Communication & Network	3
GES 400.1	Essentials of Entrepreneurship	2

19Units

Second Semester

Course No.	Course Title	Credit Units
MTH 442.2	Numerical Methods	2
CSC 492.2	Computer Graphics	2
CSC 494.2	Introduction to Artificial Intelligence	3
STA 470.2	Project	6
	Elective: One course from	
STA 477.2	Simulation and Modeling	3
MTH 412.2	Coding and Combinatorial Mathematics	3
MTH 310.2	Modern Algebra II	3
STA 366.2	Statistical Computing	2
MTH 344.2	Mathematical Modeling	3
MTH 342.2	Mathematical Methods II	2
MTH 423.2	Fields and Galois Theory	3
STA 474.2	Probability Theory	3

15/16Units

DEGREE PROGRAMME FOR
B.Sc (Hon) Statistics/Computer Science

Year I
First Semester

Course No.	Course Title	Credit Units
GES 100.1	Communication Skills in English	3
GES 102.1	Introduction to Philosophy &Logic	2
MTH 110.1	Algebra and Trigonometry	3
MTH 120.1	Calculus	3
PHY 101.1	Mechanics and Properties of Matter	3
PHY 102.1	Laboratory Practice in Physics	1
FSB 101.1	Fundamental Principles of Life	3
CHEM 130.1	General Chemistry 1	3

21 Units

Second Semester

Course No.	Course Title	Credit Units
GES 101.2	Computer Appreciation & Application	2
GES 103.2	Nigeria People & Culture	2
MTH 114.2	Introduction to Set, Logic &Numbers	3
MTH 124.2	Coordinate Geometry	3
PHY 112.2	Introduction to Electricity & Magnetism	3
PHY 103.2	Laboratory Practice II	1
CHEM131.2	General Chemistry11	3

17 Units

Year II
First Semester

Course No.	Course Title	Credit Units
MTH 210.1	Linear Algebra	3
MTH 220.1	Introduction to Real Analysis	3
STA 260.1	Introduction to Probability & Statistics	3
CSC 280.1	Introduction to computer programming	3
CSC 288.1	Structured Programming	2
MTH 270.1	Numerical analysis	2
CSC 283.1	Introduction to Information Systems & File Structures	2
	Elective: One course from	
MTH 230.1	Modern Algebra 1	3
CSC 284.1	Introduction to Digital Systems	3

21 Units

Second Semester

Course No.	Course Title	Credit Units
MTH 250.2	Elementary Differential Equations	3
MTH 226.2	Real analysis II	3
FSC 2C1.2	Community Service	1
STA 262.2	Mathematical Statistics I	3
CSC 282.2	Database Programming	2
CSC 286.2	Data Structures	2
MTH 240.2	Vector Analysis	3
	Elective: One course from	
MTH 224.2	Mathematical Methods I	2
PHY 351.1	Electronics I	2
CSC 287.2	Object Oriented Programming I	2

19 Units

Year III
First Semester

Course No.	Course Title	Credit Units
STA 360.1	Mathematical Statistics II	3
STA 370.1	Operation Research	3
STA 372.1	Sampling Theory &Quality Control	3
CSC 394.1	Operating Systems	3
GES 300.1	Fundamental of Entrepreneurship Dev	2
	Elective: Choose **One** course from	
CSC 382.1	Computer Architecture I	2
MTH 312.1	Discrete& Combinatorial Mathematics	3
MTH 340.1	Ordinary Differential Equations I	3
CSC 397.1	Computational Methods	2

16/17 Units

Year III
Second Semester

Course No.	Course Title	Credit Units
MTH 300.2	Industrial Work Experience	9

9 Units

Year IV

First Semester

Course No.	Course Title	Credit Units
STA 462.1	Design & Analysis of Experiments	3
STA 464.1	Regression Analysis and Model Building	3
CSC 486.1	Systems Analysis and Design	3
CSC 480.1	Database Management	3
STA 366.1	Statistical Computing	2
CSC 482.1	Compiler Construction	2
GES 400.1	Essentials of Entrepreneurship	2
	Elective: Any course from	
CSC 471.1	Object Oriented Programming II	3
STA 463.1	Multivariate Analysis	3
CSC 498.1	Data communication and Network	
STA 469.1	Decision Theory	3
STA 468.1	Bayesian Inference	2
STA 466.1	Optimization Methods	3
MTH 310.1	Modern Algebra II	2
STA 364.1	Analysis of Categorical Data	3
MTH 410.1	Group Theory	3

20/21 Units

Second Semester

Course No.	Course Title	Credit Units
CSC 492.2	Computer Graphics	2
STA 476.2	Econometric Methods	2
STA 362.2	Statistical Inference	3
STA 477.2	Simulation and Modeling	2
STA 470.2	Project	6
	Elective: One course from	
CSC 494.2	Introduction to Artificial Intelligence	3
CSC 469.2	Software Systems	3
MTH 310.2	Modern Algebra II	3
MTH 344.2	Mathematical Modeling	3
MTH 412.2	Coding and Combinatorial Mathematics	3

STA 472.2	Time Series Analysis	3
STA 478.2	Stochastic Processes	3
STA 474.2	Probability Theory	3
STA 469.2	Decision Theory	3

18Units

University of Port Harcourt
Faculty of Sciences
Department of Mathematics and Statistics

COURSE DESCRIPTION
YEAR I COURSES FOR B.Sc PROGRAMMES

GES 100.1   Communication Skills in English   3 units
The course seeks to develop in the students a well-informed attitude to the English Language and to equip them with the knowledge of English communication and study skill that will facilitate their work in the University and beyond.

MTH 110.1   Algebra And Trigonometry   3 units
Elementary notions of sets, Subsets, Union, Intersection, Compliments, Venn Diagrams. Real Numbers Integers, rational and Irrationals, Mappings of a set. Real functions and their compositions. Quadratic functions. Cubic function, Roots of quadratic and cubic functions. Partial fractions. Equations with complex roots. Complex number. Geometric representation of complex numbers, De Moirvers, Series and sequences. Principle of mathematical induction, Binomial theorem. Trigonometry functions of angles. Circular function. Addition Theorems. Double and half angles.

MTH 120.1   Calculus   3 units
Function of a real variable, graphs, limits and idea of continuity. The derivative as limit of rate of change. Technique of differentiation. Extreme curve sketching; integration as an inverse of differentiation. Methods of integration. Definite integrals. Application to areas, volumes.

PHY 101.1   Introduction of Mechanics and Properties of Matter   3 units
Topics covered in this course will include the following:- Motion in one dimension, motion in a plane, work and energy, conservation laws, collision, solid friction, rotational kinematics and rotational dynamics, equilibrium of rigid bodies, oscillations, gravitation, fluid statics and fluid dynamics. Surface Tension, Viscosity and Hydrostatics.

PHY 102.1   Laboratory Practice I   1 unit
This course emphasizes experimental verification and quantitative measurements of physical laws, treatment of measurement errors and graphical analysis. The experiments include studies of mechanical systems, static and rotational dynamics of rigid bodies, viscosity, elasticity, surface tension and hydrostatics.

FSB 101.1   General Biology I   3 units
Characteristics of life. Investigations in Biology, the scientific method; the substance of life, the unit of life (including methods of study); activities of cells, the control of metabolic activities; basic principles of inheritance (Genetics), Evolution.

CHM 130.1   General Chemistry I   3 units
Basic principles of matter and energy from the chemist's point of view. A broadly based course suitable for students from various schools as well as those from the Faculty of Science. Topics to be covered will include atomic theory and molecular structure, stoichiometry, the periodic classification of the elements, atomic structure, chemical bonding, properties of gases, solids, liquids and solutions, chemical equilibrium, Ionic equilibrium, chemical thermodynamics, electrochemistry and chemicals kinetics.

GES 102.1   Introduction to Logic and Philosophy 2 units

A brief survey of the scope, notions, branches and problems of philosophy symbolic logic, specific symbolic logic, specific symbolic logic, specific symbols in symbolic logic. Conjunction, affirmation, negations, disjunction, equivalence and conditional statements. Law of thought. The method of deduction, using rule of inference and bi-conditions. Quantitative theory.

GES 101.2   Computer Appreciation and Applications 2 units
History of Computers, Generation and Classification of computers; IPO model of a computer Components of a computer system-Hardwares and Softwares; Programming Language, Organization of Data; Data Computer techniques; Introduction to Computer Networks; Software and its applications; Use of Key board as an input device; DOS Windows, Word processing Spreadsheets; Application of Computers in Medicine, Social Sciences, humanities, Education and Management Sciences.

GES 103.2   Nigerian People and Culture   2 units
The overall objective of this course is to help students understand the concept of culture and its relevant to human society especially as it relates to development. In more specific terms, the course will be designed to help the students know the history of various Nigerian cultures beginning with pre-colonial Nigeria society. Colonialism constitutes a vital watershed in Nigerian history. This the course will

1. Identify the influence of colonialism on Nigerian culture.
2. Focus on contemporary Nigerian culture explaining issues that relate to the political, economic, educational, religious and social institutions in the nation.

The course outline includes: the concept of culture.

MTH 114.2   Introduction to Sets, Logic and Algebra   3 units
Set Theory –with proofs of set theoretic theorems involving union, intersection, and compliments of sets.
Difference sets, De Morgan's Laws, Power Sets; Poset Diagrams, Cardinality of a set. Product sets and relations on sets. Logic- statements and statement formula, connectives and truth tables. Implication and equivalence. Quantifiers and quantified statements. Truth functions. Substitution and replacements inn statements. Elementary notions of prepositional and predicate logic proofs. Rules of inference Techniques (direct, indirect, elimination and contradiction). Demonstration of proof.

MTH 124.2   Coordinate Geometry   3 units
Straight lines, circles, parabola, ellipse, hyperbola. Tangents, normal. Addition of Vectors. Scalar and Vector products. Vector equation of a line and place. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion, under gravity projectiles, resisted vertical motion, elastic string, simple pendulum impulse. Impact of two smooth spheres. Addition of Vectors

PHY 112.2   Introduction to Electricity and Magnetism: 3 units
This is the introductory course on Electricity and Magnetism. Topics covered will include:-
the Electric field, Gauss's Law Electric potential, Capacitors and Dielectric, current and resistance, electromotive force and circuits, the magnetic field, Ampere's Law, Faraday's Law of induction.

PHY 103.2   Laboratory Practice II   1 unit

The experiment carried out in this course will cover areas discussed in PHY 1122.Tes experiments include verifications of the current electricity, measurement of the electrical properties of conductors, d.c. and a.c. circuit properties, series and parallel resonant circuits, transformer characteristics and other electrical

CHEM 131.2 General Chemistry II   3 units
Application of the principles of chemical and physical change to the study of the behavior of matter and the interaction between matter. Course content includes:- the chemistry of the representative elements and their common compounds with emphasis on graduation of their properties, brief chemistry of the first series of transition elements, general principles of extraction of metals, introductory nuclear chemistry.

STA 160.1   Descriptive Statistics   3 units
Essence of Statistics, Methods of Data Collection, Collation. Tabulation and Presentation. Statistical Notations.
Charts: Pie Simple, Component, Multiple bar charts etc.
Diagrams: Tree, Stem-and-Leaf, Box-and-Whisker etc.
Graphs: Histogram, frequency polygon, cumulative frequency distribution (Ogive), line graphs etc.
Measures of Central Tendency (location): Arithmetic, Geometric and Harmonic Means, Mode Median, Quartiles etc. Measures of Variation: Range, Variance, Standard deviation, etc. Measures of Symmetry: Skewness and Kurtosis. Etc.

YEAR II COURSES FOR B.Sc PROGRAMMES

MTH 210.1   Linear Algebra   3 units
Vectors space over the real field. Subspaces, linear independence, basis and dimension. Linear transformations and their representation by matrix – range, null space, rank. Singular and non-singular transformation and matrices. Systems linear equation and change of basis, equivalence and similarity. Eigenvalues and Eigenvectors. Minimum and characteristic polynomials linear transformation (Matrix).
Caley-Hamilton Theorem. Bilinear and quadratic.

MTH 220.1   Introduction to Real Analysis   3 units
Real numbers: order – upper and lower bounds. Least upper bounds axiom for real numbers and its consequences. Basic properties of convergent sequences. Upper and lower limits. Monotonic sequences. Cauchy's principles of convergence. Series (of positive terms): Integral test. Euler's constant. Index and ration tests. Comparison test for series. Alternating series tests for series. Series in General Absolute and conditional convergence. Atel and Dirichet test. Rearrangement properties. Power series – Circle of convergence and multiplication series. Function of a Real variables: Continuity of a set. Elementary properties of continuous functions, uniform continuity. Monotonic functions. Differentiation of functions of a real variable: Mean value theorem Rolle's Theorem. etc. and its applications. De L' Hospital's theorem. Tailors series with remainder. Maxima and minima.

MTH 230.1   Modern Algebra   3 units
Review of mappings relations, permutations, equivalence relations on a set. Review of integers- divisibility, division algorithm congruence modulo and Diophantine equation. Binary operations, algebraic structures-groups, semigroups, rings groups

with examples, Groups and subgroups. Cossets in groups. Legranges theorem and applications. Cyclic subgroups and cyclic groups. Normal subgroups. Homomorphism of groups quotient groups. Isomorphism of groups. Concrete examples of groups. Groups of orders 2 to 8 including permutation group S and dinedrol groups D_4. Partially orders set diagram of sub-groups.

CSC 280.1   Introduction to Computer Programming   3 units
Historical details of computers. Principles of programming. Programming with FORTRAN Language.

CSC 280.1 Structured Programming   3 units
Function of several Variables: The n-dimensional Euclidean space. Continuity, Partial and total derivatives. Chain rule. Implicit functions theorem. The inverse function theorem. Directional derivatives. Higher partial derivatives. The mean value theorems. Taylor series. Maxima and minima of function of several variables. Necessary conditions for free and constrained cases. Lagrange multi-pliers. Integration of Functions of Several Variables. Definition of multiple integrals as limit of sum. Evaluation of multiple integrals (transformation of integrals). Line
integrals and Green's formula. Uniform Convergence: Uniformly convergent sequences and series of analytic functions and their properties. Infinite products. Absolute and uniform convergence of infinite products.

MTH 270.1   Introduction to Numerical Analysis   2 units
Solution of algebraic and transcendental equations. Curve fitting. Error analysis. Interpolation and approximation. Zeros or non-linear equation to one variable Systems of linear equations. Numerical differentiation and integral equation. Initial value problems for ordinary differential equation.
STA 260.1   Introduction to Probability and Statistics 3 units

Definition of probability, frequency and probability of events. Equally likely events counting techniques. Conditional probability. (Baye's Theorem) independent events, random variables, probability distributions. The central limit theorem, mathematical expectation, moments, the mean, variance, variance of a sum, covariance and correlation, conditional expectation. Analysis of variance plus contingency tables plus parametric inference.

MTH 250.2   Elementary Differential Equations   3 units

First order ordinary differential equations. Existence and uniqueness. Second order ordinary differential equations with constant co-efficient. General theory of nth order linear equations. Laplace transform solution of initial-value problem by Laplace transform method. Sturm Liurville problems and applications. Simple treatment of partial differential equations in two independent variables. Application of O.D.E to physical, life and social sciences. Pre-requisite MTH120.1.

MTH 224.2   Mathematical Methods I   2 units

Review of differentiation and integration and their applications and mean value theorem. Taylor series. Real –valued functions or two or three variables. Partial derivatives chain rule, extreme Lagrange multipliers. Increments, differentials and linear approximations. Evaluation of line, integrals, multiple integrals. Integrals transform and applications

MTH 240.2   Vector Analysis   3 units

Review of vectors. Equation of curves and surfaces. Vector differentiation and applications. Gradient, divergence and curl. Vectors integrals, line, surface and volume integrals. Green's, Stoke' and divergence theorems. Applications. Tensor products of vector spaces. Tensor algebra. Symmetry. Cartesian tensors.

STA 264.2   Statistics for Agric. and Biological Sciences
Use of Statistical methods in biology and agriculture. Frequency distributions. Laws of probability. The binomial. Poisson and normal probability distributions. Estimation and tests of hypothesis. The binomial design of simple agricultural and biological experiments. Analysis of variance and covariance, simple regression and correlation, contingency tables. Some non-parametric test. (MTH 129.1 or MTH 110.1) (This course is not for Students in Mathematics and Statistics, computer Science Department).

MTH 226.2   Real Analysis II   3 units
Metric spaces: Metrics, Norms. Examples of metric spaces. Minikowski's inequality. Open balls, closed balls, spheres. Open sets, closed sets. Closure of a set. Foundary and diametric subspaces of a metric space. Continuous functions on metric spaces. Complete metric spaces. Subsets of complete metric spaces. Complete metric spaces. Subsets of complete metric space. Completion of compact spaces. Finite intersection property. The Heine-Borel Theorem.
Integration: The Riemann-Stieljes integral of bounded functions. Conditions of integrality. Properties of Riemann integrals. Fundamental theorem of integration. Mean value theorems of integrals. Integration by parts and by substitution.

FSC 2C1.2:   Community Service   1 unit
The course is geared towards community development with the aim of creating a positive influence to the immediate environment and host community.

STA 262.2 Mathematical Statistics I   3 units
Distribution of random variables, the probability density function, the distribution function, the moment generating

function, characteristic functions, factorial moments, Chebyshev's inequality. Conditional probability and stochastic independence marginal and conditional distributions, the correlation coefficient covariance.

Distributions of functions of random variables, sampling theory, transformation of variables of the discrete and continuous types, the t and F distributions, the moment generating function technique.

CSC 282.2   Computer Programming II   3 units
Review of Fortran programming with exercises. Principles of good programming, structured programming concepts, debugging and testing, string processing, file principles internal searching and sorting, data structures, recursion.

YEAR III COURSES FOR B.Sc PROGRAMMES

MTH 340.1   Ordinary Differential Equations   3 units
Series solution of second order linear equations. Bossel, Legendre and hypergeometric equations and functions gamma Beta functions sturnliovelle problems. Orthogonal polynomials and functions, fourier, Fomier-Bessel and Fmier Legendre series. Fourie transformation. Solution of laplace, wave ad heat equations by Fourier method. MTH 424.

MTH 312.1   Discrete Mathematics   3 units
Groups and subgroups, group axioms, Permutation groups, cosets, Generation of groups and defining relations. Graphs, directed and undirected graphs, subgraphs, cycles, connectivity, application (flow charts) and state transition graphs-lattices and Eollean algebra, finite fields, minipolynomials. Irreducible polynomials, polynominal roots application (error-correcting codes, sequences generators) coding theory. Introduction to combinatorics.

MTH 320.1   Real Analysis III   3 units
Integration: Review of Riemann-Stieljes integrals. Improper Riemann-Stieljes integrals. Functions of Bounded variations, Sequences and Series of Function, Sequences in metric spaces. Cluster points of a sequence, Cauchy sequence, Sequences and series of functions. Uniform convergence of sequences and of functions. Test for uniform convergence of series, and properties of uniformly convergent series power series. Weiestrass approximation theorem.

MTH 330.1   Topology   3 units
Review of metric spaces. Dence subsets of metric space. Compactness connectedness of metric space. Topological spaces, definition, open and closed sets, neighbourhoods, Coarser and finer topologies. Basis and sub-bases. Separation axioms, Compactness, local compactness, connectedness. Construction of new topological spaces from given homeomorphism, topological invariance, spaces of continuous function: point-wise and uniform convergence.

MTH 324.1   Complex Analysis   2 units
Functions of a complex variable. Limits and continuity of functions of complex variable. Deriving the Cauchy-Riemann equations. Analytic functions. Bilinear transformations, conformal mapping contour integrals. Cauchy's theorems and consequences. Convergence of sequences and series of functions of complex variable. Power series. Taylor series. Laurent expansions. Isolated singularities and residues.

MTH 350.1   Rigid Body Dynamics   3 units
General motion of a rigid body and a translation plus a rotation. Moment. And products of inertia in three dimension. Parallel and

perpendicular axes theorems. Principles axes, Angular momentum, kinetic energy of a rigid body. Impulsive motion. Examples involving one and two dimensional motion of simple systems. Moving frames of reference rotating and translating frames of reference. Coriolis force. Motion near the Earth's surface. The Foucault's pendulum. Euler's dynamical equations for motion of a rigid body with one point fixed the symmetrical top.

GES 300.1 Fundamental of Entreprenuership Development

STA 360.1   Mathematical Statistics II   3 units
Non parametric: Order statistics and their distributions. Kolmogorov type of tests statistic. Common non-parametric test including runs, sing rank order and rank correlation. Null distribution: Bivariate normal distribution, the gamma, chi-square, 2 types of beta distribution of functions of random variables. Probability integral transformation. Bivariate moment generating functions, univariate characteristic functions. Various modes of convergence, laws of large numbers and the central limit theorem using characteristic functions.

MTH 310.2   Modern Algebra II   3 units
Rings, integral domains, division rings, field rings of polynomials, and matrices, quaternious rings. Homomorphism theorem for rings. Quotient rings. Ideals Polynomial rings and factorization-Euclidean algorithm and god for rings. Fundamental theorem of algebra.

MTH 342.2   Mathematical Methods II   3 units
Calculus of variation: Lagrange's functional and associated density, Necessary condition for a weak relative

extremumhamilton's principles. Lagrange's equations and geodesic problems. The Du Bois-Raymond equation and corner condition. Variable end-points and related theorms. 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 352.2   Analytical Dynamics   3 units
Degrees of freedom. Holonomic and holonomic constraints Generalised co-ordinates Lagrange's equations for holonomic system's face dependent on co-ordinates only, force obtainable from a potential. Impulsive force.

MTH 326.2   Complex Analysis II   2 units
Calculus of residue, and application to evaluation of integrals and to summation of series. Maximum modulus principle. Argument principle. Rouche's theorem. The fundamental theorem of algebra. Principle of analytic continuation. Multiple valued functions and Riemann surfaces.

MTH 322.2   Measures and Integration   3 units
Countability of sets and cardinal numbers, out measure measurable set and Lebseque measure, measureable functions, the Lebesque integral, convergence of sequence of measure le functions General Lebesque integral. Lp spaces, riesz-Fischer theorem.

MTH 314.2   Number Theory   3 units
Residue classes, the Fermat-Euler theorem. Solution of congruence of a prime modulus. Primitive roots Arithmetic functions, multiplicative functions. The function (n), u(n), d(n), o(n), r(n). Orders of magnitude of these functions. The representation f numbers as sums of squares. Some simple

Diophantine equations. Rationals and irrationals. The distribution of prime numbers. The work of Tchebycheff, Hertens and Riemann, The Riemann Zeta-function. The prime theorem with de la ValleePoussin's form of the error term. Dirichlet characters and series primes in arithmetic progression.

MTH 344.2   Mathematical Modelling   3 units

Modeling with differential and integral equations; The logistic curve Problem of growth and decay. Solution of problem of growth of two conflicting populations physical models-sterring, rocket and flow problems. Differentive models. Chemical Models. Mathematical modeling of intramuscular injection. The problem of the pendulum and introduction to elliptic integrals. Radiative test transfer and solution of integral equations. Stochastic modules and applications to games theory-network flow problems.

STA 360.1   Mathematical Statistics II   3 units

Non parametric: Order statistics and their distribution. Kolmogorov type of tests statistic. Common non-parametric test including runs, sing rank order and rank correlation. Null distribution and their approximations.

Distribution: Bivariate normal distribution, the gamma, chi-square, 2 types of beta distribution of functions of random variables. Probability integral transformation. Bivariate moment generating functions, univariate characteristic functions. Various modes of convergence, laws of large numbers and the central limit theorem using characteristic function.

STA 370.1   Operations Research   3 units

Definition and scope of operations research. Elementary inventory models, replacement maintenance and reliability

problem. Linear programming: formulations and simplex method. Allocation problems (simplex, assignment and transportation algorithms) and their applications to routing problems. Queueing theory, Game theory, sequencing problems.

STA 372.1   Sampling Theory and Quality Control.   3 units
Fundamentals of survey sampling; survey and sampling designs, mechanical selection, randomization and frames. Review of sampling techniques; simple random sampling, stratified, cluster, quota and systematic sampling. Sub-sampling and multi-stage sampling. Statistical analysis of the sampling methods.

STA 362.2   Statistical Inference   3 units
Estimation with normal models. Point estimation, by least square, and maximum likelihood methods. Properties of point estimators; unbiasedness sufficiency, completeness, uniformly minimum variance unbiasedness. Cramer-Rao inequality, consistence, efficiency, best asymptotic normality. Interval estimaties; esatimation of mean and variance, comparison of two means and two variances; estimation involving pair observations. General methods of finding confidence bound.
Test of hypothesis: types of errors, power function, one tailed and two tailed tests, other chi-squared test and contingency test. Likelihood ratio. Nyman-Pearson theorem. Rayesian estimates, Checking the model, goodness of fit test; Empirical cumulative distribution function and quantile plots. Fitting a straight line, linear models, parameter estimates tests of significance and confidence intervals, residual plot and tests of fit.

STA 364.2   Analysis of Categorical Data   3 units
Analysis of simple, double and multiple classification of balanced data in crossed and nested arrangement. Analysis of two-ways,

three-ways contingency tables for test of homogeneity, independence and interactions. Analysis involving incomplete tables, missing values, etc. analysis of variance involving unbalanced data. Multi-variate analysis of variance. Analysis of multi-factor, multi-response of variance such as missing observations. Non-normality, heterogeneity of variance,

STA 366.2   Statistical Computing   3 units
General principles. Summary and inspection of data using tables and graphical methods. Sorting and ranking. Simulation. Algorithms for generation of uniform distribution in a given interval. Generation of random samples from non-uniform distribution such as exponential, normal, binomial distributions. Simple Data manipulation and use of files using a high level programming language, significance tests and confidence intervals.

Regression and ANOVA: computational techniques for fitting a given regression. Solution normal equations for full rank and less then full rank cases-Algorithm for solving triangular system of equations. e.g. Caussian elimination. Choleshy LU decomposition & variants of it, Householder transformations. Pre-requisite MTH260.1, MTH 262.2.

STA 368   Non-Parameter Methods   3 units
Order Statistics and their distributions. Kolmogorov type of test statistic. Common non-parametric test including runs, sing rank order and rank correlation. Nuldistributons ad their approximations, efficiency properties. Estimates based on test statistics.

STA 363.2   Distribution Theory   3 units
Bivariate normal distribution, the gamma, chi-squared, beta I2types), t and f, distribution. Distribution of functions of random

variables: Cumulative distribution function, Moment generating function Transformation (change of variable) techniques. Distribution of order statistics.

STA 365.2   Demography   3 units
Definition of Basic concepts. Sources and assessment of Demographic data. Construction and uses of life tables. Estimation of Population parameters (also from defective data). Stable and Quasi-stable population. Models for population projections (examples from Nigerian Population.)

STA 374.1   Probability I   3 units
Expectations (moments) and Moment generating functions, Chabychev's Inequality. Bivariate, marginal and conditional distributions and their moments.   Convolution of two distributions.

STA 376.1   Statistical Quality Control
Process Control: Construction and uses of Control Charts (x, b and range). Tolerance limits Product control: Design of Sampling Plans (simple, double, multiple and sequential). Comparison of different sampling plans, Cusum, Mcusum etc.

YEAR IV COURSES FOR B.Sc PROGRAMMES

MTH 410.1   Group Theory   3 units
Abelian groups. Structure of finality generated abelian groups. Permutation representation of group actions. Burnside lemma; Sylow theorems. Derived groups. Nilpotent and soluble groups. Free groups. Groups of order 8 to 15.

MTH 440.1   Partial Differential Equation   3 units
Linear equations of the first order, non-linear equations of the first order. Characteristics. Existence and uniquences of solutions.

Second order linear and quasi-linear equations in two independent variables. Elliptic, hyperbolic and parabolic equations. Well set mathematical problems. Applications to equations of mathematical physics.

MTH 420.1   Functional Analysis   3 units
Contraction mapping theorem. Arzela-Ascoli lemma. Stone-Weierstrass theorem. Categories. Nowhere differentiable continuous functions.

Normedspaces: Banach spaces. Hahn-Banach theorem. Uniform boundedness principle. Open mapping and closed graph theorem. Riecz lemma. Duality theory in Banch spaces. Dual of LP spaces. Riecz representation theorm. Compact operators. The Riecz-Schauder theory.

Helbert spaces: Projection theorem. Riecz representation theorem.

*Banch Algebras:*Commutative Banachalgegras. Maximal ideals Gelfard representation for Banach algebras with identity.

GES 400.1 Essential of Entrepreneurship   2 units
Opinion Poll Data Consultancy Service and Feasibility Study for Social Research. Meaning of Social Research. Quantitative and Qualitative Debate in a Social Research. Primary assumptions of the ethicals of Social Research. Definitions and types of Ethics. Rules of Social Research. Foundation of Social Research. Data Consultancy.   Definitions, Management, types of Data, Consultancy. Entrepreneurship significant of Data Consultancy. Feasibility Study. Elements of good feasibility study. Factors of feasibility study.

MTH 452.1   Quantum Mechanics   3 units
Dirac Formulation os Quantum Mechanics: linear spaces and operators, kets and bras. Hermitian operators; observables, eigen-

functions, eigen-values, expectation values, probability omplitueds. Quantization conditions: poisson brackets and commutators; schrodinger representation in Cartesian coordinates. Upitary operators, corresponding to spatial translations and their infinitesimal generator, conservation of momentum. Schrodinger. And Heisenbery pictures. Heisenbery equations of motion. Creation and amitilation operators. Angular Momentum: Angular momentum operators as infinitesimal rotation generators (j) representation. Spin; Pauli matrices. Addition of angular moments with calculation of Clebach-Cordon coefficients. Wigher-theorem. Identical Particles and Spin: Physical meaning of identity. Symmetric and ant-symmetric wave function. Distinguishability of identical particles. The exclusion principles connection with statistical mechanics. Collision of identical particles. Spin and statistics. Hydrogen-like atom.

MTH 454.1   Fluid Mechanics   3 units
Cartesian tensors and the Navier Stokes equation; some exact solutions. Regnolds Number.
Invisid flow: The Eulers equation. Velocity potential and stream functions. Sources and sinks. Circulation and vorticity. Flow past a circular cylinder. Complex potential. Confermal transformation. Viscous flow: the boundary layer approximations in incompressible flow. Similar exact solutions. Approximate solutions. Heat transfer in boundary layer flows. Boundary layer theory. Free convection flows.

MTH 456.1   Elasticity   3 units
Analysis of Stress and strain: the stress vector and the stress tensor. The body stress equation. The displacement vector. Strain

components. Stress and strain invariants. Transformation of stress and strain. Equations of compatibility of strain and equation of equilibrium. The Elastic Solid: The Lame's stress-strain relations of isotropic elasticity. Young's modulus and Poisson's ratio. Strain energy function and derivation of general stress-strain relations. The fundamental partial differential wquatuion for the distortional vector. Velocities of dillational and distortional waves. The equations of elasticity in complex coordinates. Uniqueness of solution; Saint-Venant principles. Generalized Hooke's law, anisotropy, isotopy and elastic constants. Two-Dimensional Elasticity: Plane strain and generalized plane stress by Airy stress function and complex potential method. Tension, torsion and flexure with sheer of beams and rods. Elementary theory of thin plates under trans-verse loads.

Three-Dimensional Elasticity: Simple three-dimensional solution of the fundamental equation: force-nucleus in infinite solid. Isolated force on Plane boundary of semi-infinite solid. Rigid sphere cemented into infinite elastic solid. Orthogonal curvilinear coordinates. Application to circular cylindrical shafts in steady motion; torsion of shafts or verying circular cross-section; live'sbiharmonic stress function in problems of axial symmetry.

STA 466.1   Optimization Methods   3 units

Linear Programming: Revised Simplex methods, duality theory and applications. Unconstrained Optimization: Search methods, Grid, Nelder and Meads Methods. Gradient methods for unconstrained optimization; steepest descent, Newton-Raphson, constrained: classical methods of optimization, Maxima and Minima, Lagrange's multipliers. Kuhn-Tucker conditions. Parametric programming, integer programming. Dynamic programming. Pre-requisite MTH 370.1.

MTH 432.1   Functional Equations   3 units
Equation for functions of a single variables, methods of Solutions, Continuity, Monotonuity and uniqueness of solution of the form $F(G(x,y))=F(f(x),y)$ and similar types. Cauchy's and Jensen's functional equation and applications. D'Alemburt's functional equations and application. Functional Equations and addition theorems. Plexider's functional Equations and related ones. Wilson's generalizations of D'Alemburt's equation.

MTH 492.2   Numerical Methods   3 units
Solution of ordinary Differential Equations: Linear equations, finite difference method for boundary value problems. Non-linear equations, Runge-Kutta and Shooting algorithms. Method of quasi-linearization. Partial differential equation: Parabolic equations, explicit finite, differences scheme. Implicit scheme. Elliptic and hyperbolic equations and finite differences. Finite element methods.

MTH 423.2   Fields and Galois Theory   3 units
Fields, homomorphisms of fields. Finite fields. Prime fields. Guotient rings which are fields. Irreducibility Esenstein criterion. Field extensions degree of an extension, minimum polymonial algebraic and transcendental extensions, straightedge and compass construction. Algebraic closure of a field. The JacobsorBourbaki correspondence. MTH 310.2, MTH 423.

MTH 450.2   Continuum Mechanics   3 units
Tensor Calculus of double fields. Deformation and its derivative tensor. Kinematics of lines, surfaces and volumes, Analysis for Stress. Isotropy groups of material. Equations of balance with and without discontinuity surfaces. Thermoechanical constitutive

relations for various materials with the without kinematics constaints. Solution of simple equations of motion of selected materials.

MTH 414.2   Introduction to Semigroup Theory   3 units
Basic Notions of Semigroups. Monogenic semigroups. Ordered Sets, seim-lattices and lattices. Congruences. Three semigroups. Grenn's relations. The structure of D_classes. Regular D_classes. Regular Primitive idempotents. Semilattice of groups. Invsersesemigroups.

MTH 418.2   Rings and Modules   3 units
Modules –Basic Notions, Submodules, homomorphism of modules. Artunian and Noetherian modules. Jordan-Holder theorem. The krull Schmidt theorem. Rings_Primitive and Semiprimitive rings, radical of a ring. Density theorems and Artinian rings. The structure of algebras. Prime ideals, Ni-radical. Prime spectrum of a commutative rings. The basis theorem. Deurapostition of rings and modules

STA 474.2   Probability Theory   3 units
Probability spaces, measures and distribution. Distribution of random variables as measureable functions. Product spaces; product of measurable spaces, product probabilities. Independence and expectation of random variables; weak convergence, convergence almost everywhere, convergence in n^{th} mean, central limit theorem, laws of large number. Characteristic function and Laplace transforms.

MTH 458.2   Control Theory   3 units
Dynamical systems in the state space, Reachability, stabilizability and detecability. Equivalences of controllability and pole assignability. The Calculus of variations. Generalized Huygen's principle. Reachable sets. Optimal Control with quadratics cost.

Pontryagin's maximum principles. The Algebraic Riccati equation. Lyapunov stability. Applications to Economic stabilization, planning, manpower development, resource allocation under constraints etc.

MTH 416.2   General Algebraic System   3 units
Lattices-Basic notions of lattices distributive lattices, modular and non-lattices. Sublattices and homomorphisms of lattices. Category Theory: Basic Notion of categories, objects and maps. Functors and natural transformations Concrete Examples of categories, Universal subalgebras, homomrphism of algebras products. Congruences, congruence lattice on algebras. Free algebras, concrete examples universal algebras. Subdirect products

MTH 455.2   General Relativity   3 units
General theory principles of equivalence, Riemann_Christorffelecurvature tensor, field equation of the general theory and their rigorous solutions, experimental tests, and equations of motion; and unified field theories. Weyl's gauge-invariant geometry, Kaluza's five dimensional theory and projective field theories, and a generalization of Kaluza's theory., (MTH 240, MTH 343).

STA 462.1   Design and analysis of Experiments   3 units
Basic design, completely random, randomized block and Latin square designs. Use of models for estimating effects; missing data and confidence limits. Graeco Latin square and split plot designs. Analysis is variance and hypotheses tests. Factorial experiments, the 2^2 and 2^3 experiments, standard errors for factorial effects. Confounding factorials in blocks, fractional factorials factors at 2 levels and 3 levels. In complete block designs, estimation of model parameters analysis of variance of BIB experiments (with symmetrical BIB arrangement). Pre-requisite MTH 360.1.

MTH 454.2 Electromagnetic Theory 3 units

Review of curvilinear coordinates.
Electrostatics-Gauss's law, electrostatic scalar potential, dipoles and quadrupoles. Solution of Laplace equation in Cartestian, cylindrical and spherical polar coordinates. Two-dimensional problems and complex variable methods. Magnetic field of currents- EiotSavat Law. Complete Maxwell's equations. Vector potential Special Relativity and Maxwell's equations.
Electromagnetic Waves.

MTH 430.1 Algebraic Topology 3 units

Brief review of basics from general topology L-connectedness, components, paths, path-connectedness, path-components, the set (x). Algebraic background, including free groups, groups defined by deneraters and relations, exact sequences. Homotopy, homotopy equivalence, retracts and deformation retracts, contractible spaces, the fundamental group. Simplexes, simplicial simplexes, subcomplexes, simplical maps derived (barycentric) subdivision, simplical approximation theorem. The edge-path group, its isomonphism with the fundamental group, calculations of 1 (k) especially for closed surfaces, Brouwer fixed point theorem in the plane. Simplicial homology groups. The induced homoorphism f* when f is simplicial, outline proof of topological invariance of the homology groups. Calculation of $H_n(S^m)$, proof that Sn and Sm are not homotopy equivalent and Rn and Rm are not homonorphic (n=m), generalized Brouwer fixed point theorem. Mayer-Vietoris sequence calculation of homology groups, especially for closed surfaces.

STA 463.1 Multivariate Analysis 3 units

The multivariate normal distribution. Estimation of mean vector and the covariance matrix. The distribution and used of sample correlation coefficient. The generalized T^2- statistics.

Classification of observations. Procedures of classification into one of two or three specified multicariate normal populations. Discriminant function when populations are unknown. Principal components and factor analysis

STA 464.1   Regression Analysis and Model Building   3 units
Multiple linear regression models, polynomial regresson. Tests of independence and goodness-of- fit. Use of summy variables. Non-linearity in parameters requiring simpletransformation. Partial and conditional regression and correlation models. Canonical correlation. Tests of independence of regression coefficients. Other problems associated with "Best Regression Models"

STA 466.1   Optimization Methods   3 units
 Linear Programming: Revised Simplex methods, duality theory and applications. Unconstrained Optimization: Search methods, Grid, Nelder and Meads Methods. Gradient methods for unconstrained optimization; steepest descent, Newton-Raphson, constrained: classical methods of optimization, Maxima and Minima, Lagrange's multipliers. Kuhn-Tucker conditions. Parametric programming, integer programming. Dynamic programming. Pre-requisite MTH 370.1.

STA 468.1   Bayesian Inference   3 units
Bayes' Theory. Posterior distributions. One parameter cases in some standard continuous 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 distributions, linear regression. Tests of hypothesis.

STA 472.2   Time Series Analysis   3 units

Components of time series, measurement of trend, the seasonal index, 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 process. Moving average process. Seasonal models. Models identification.

STA 476.2   Econometric Methods   3 units

Nature and quality of econometrics data and use of econometric models. Problems of regression analysis; multicollinearity, heteroscedasticity, Autocorrelation, Errors in Variables and their effects. Time as a variable, Dummy Variable, Grouped data. Lagged variables and distributed lag models; application to cross-section and time series data, demand studies, measurement of production, consumption and investment functions. Simultaneous equation and identification, Bias in reduced form. Estimation: Indirect least squares and two –stage lease squares. Ideas of model specification and specification error. Maximum likelihood methods applied to econometric.

STA 478.2 Stochastic Processes   3 units

Introduction to Stochastic and definition of terms, e.g. absorbing and reflecting barriers. Random walk. Examples of random walk with reflecting and absorbing barriers, and examples from queuing theory. The general Markov Chain, a two-state Markov Chain, the classification of states and the limit theorem, closed set of states Stationary transition probabilities. Morkov processes with discrete state in continuous time, the Poission process. Pre-requisite MTH 360.1, MTH 320.1.

STA 473.2   Biometry

Purpose, history and structure of biological assays. Types of Bioassays. Feller's theorem and its analogurs. The Behrens distribution. Dillution assays adjustments for body weight. Direct assay with covariance. Design and criticisms of direct assays. Indirect asays. The dose-response regression.

STA 477.2   Simulation and Modeling

Basic Concepts: Philosophy, development implementation and design of simulation models.

Pseudo-Random Numbers: Generation of random numbers, Uniform distribution and its importance to simulation.

Simulation Techniques: Mid-square, mid-product, Fibonacci, Congruential, mixed method, multiplicative etc.

Tests for Random Number Generator: Frequency, Gap, Runs, Poker etc.

Simulation Languages: Overview and Comparison, GPSS, GASP, SIM ULA, DYNAMO etc.

*Simulation Modeling:*Queues, sales of insurance policies production line maintenance.

MTH 470.2:   Research Project   6 units

Students are expected to carry out research works in areas that are of interest to the students and are related to the mathematical knowledge and skills gained during the course work.The research work shall be in line with the degree to be awarded. The research work shall be summarised in a project report to be examined by internal and   external examiners.

COURSES FROM COMPUTER SCIENCE PROGRAMME

COMPUTER SCIENCE COURSE DESCRIPTION

CSC 280.1   Introductions to Computer Programming (2 Unit)

Principles of programming. Program design, algorithms, flowcharts, pseudocodes.   Programming   with   FORTRAN: declarations,

input/output, loops, decisions, arithmetic/assignment statements. Arrays and subroutines.

CSC 281.1   Computer Systems Fundaments   (3 Units)
The Von-Neumann computer. Simple computer organization. Alu Registers: accumulator register, instruction register, instruction pointer. The instruction fetch-execute cycle. Microinstructions, Microprograms,   Microprogram   Execution.   Hard-wired Microprograms. Memories: memory cycles, memory buffer register, word lengths, memory hierarchies-RAM, LI cache, L2 cache. The bootstrap loader. Loaders and link editors. Assembly languages and assemblers-the two-stage operation of the assembler. Machine instruction sets.

CSC 282.2   Database Programming   (3 Units)
Characteristics of business programming. Records, files. File creation, accessing. Record accessing, insertion, updating, deletion. Searching and retrievals. Programming with dBase, and MS Access, or other suitable language. Introduction to SQL.

CSC 283.1 Information Systems and File Structures   (2 Units)
Data hierarchy: bits bytes, data types, records, files. File design: serial and sequential files, random and index sequential files. File maintenance: master files, transaction files, etc. Tape and disk devices: timing, record blocking, etc.

CSC 286.2 Data Structures   (2 Units)
Bits, Bytes, words, linear structures and lists structures; arrays, tree structures, sets and relations, higher level language data types and data-handling facilities. Techniques for storing structured data list, files, tables trees, etc., their space and access time properties, algorithm for

manipulating linked lists, binary, b-trees, b*trees, and A VIAL trees. Algorithm for transversing and balancing trees.

CSC 287.2 Object Oriented ProgrammingI   (3 Units)

Preprocessor directives, library naming and access, comments, statements. Data types, constants, variables, expressions and assignment statements. String class. Input/output statements. Selection, repetition. Functions. Arrays. File manipulation, Pointers, and Classes. Use C language, C++ or C# to illustrate these concepts.

CSC 288.1 Structured Programming   (2 Units)

Principles of good programming style, expression; structured programming concepts; control flow-invariant relation of a loop; stepwise refinement of both statement and data; program modularization (Bottom up approach, to-down approach, nested virtual machine approach); languages for structured programming debugging testing verifying code inspection; semantic analysis. Test construction. Program verification, test generation and running. The use of PASCAL to illustrate these concepts. String processing, Record Structures, file Processing, Dynamic data types for lists, etc. Recursion for tree search, sorting, etc. writing efficient programs. Turbo PASCAL project management facilities.

CSC 289.2   Object Oriented Programming I Practicals   (1 Unit)

CSC 291.1   FORTRAN Programming Practicals   (1 Unit)

CSC 292.2   Database Programming Practicals   (1 Unit)

CSC 382.1 Computer Architecture 1   (2 Units)

Basic logic design and Circuits; Data representation; instruction formats; computer Architecture; Study architecture of an actual simple mini-computer. Assembly languages and assemblers-the two-stage

operation of the assembler. Machine instruction sets. Bootstrap Programs and Link Editors.

CSC 394.1 Operating Systems   (3 Units)
Principles of operating systems; Types of operating systems, batch, multi- programming multiprocessing. Processes, inter processor communication, synchronization, deadlocks storage management and resource allocation. illustrated from a popular operating system such as UNIX.

CSC 395.1 Operating Systems Practicals   (1 Unit)

CSC 398.1   Computational Method   (2 Unit)
Computational Geometry-convex hull, triangulation, curves and surfacing. Formal specification, Bunches and bunch theory, pigeonhole principles, surjection, injections, inverses, composition, reflexivity, equivalence relations, transitivity, cardinality – relate practical examples to appropriate termination detection. Implications of uncomputability, tractable and intractable problems. Optical computing – integrity models such as Biba and Clark – Wilson.

CSC 480.1   Database Management   (3 Units)
Basic concepts. Data integration. Data independence. Functions and architecture of a DBMS. Data models. Storage structures and access stractegies. Relations and relational operations. Relational algebra and calculus. Normalization. Security and integrity issues. Relational systems, INGRES, DBASE entity – relationship model. E-R. diagrams. Semantic and semantic nets. IKBS's

CSC481.1 Object-Oriented Programming II (3 units)
Object-Oriented programming structures and principles. Practical illustration with Java, Rubby, and Python programming languages. Preprocessor directives, library naming and access, comments, statements. Data types, constants, variables, expressions and assignment statements. String class. Input/output statements. Selection,

repetition. Functions. arrays. Files manipulation. Classes and object-oriented design.

CSC 482.1 Compiler Construction (2 Units)

Translators; compilers, assemblers, interpreters, preprocessors. Functional blocks of a complier. The compilation process – Lexical analysis, syntax and semantic analysis. Code generation, code optimization. Error detection and recovery. Lexical analysis, transition diagrams. Review of context – free grammars. Parsing context –free expressions. Top-down and bottom-up praising. LL(K) & LR parsing. Operator –precedence paring. Symbol table structures.

CSC 483.1 Algorithms (2 Units)

Design and specification of algorithms. Efficiency of algorithms: running and memory usage, polynomial time and super-polynomial time algorithms. Analysis of algorithms: best-case, average-case, worst-case analyses. Asymptotic programming, randomized algorithms. Searching: sequential and binary search. Sorting algorithms: bubble, insertion quick sort, merge sort, heap sort. Exponential algorithms: performance optimization.

CSC 486.1 Systems Analysis And Design (3 Units)

Introduction to systems analysis, structured and object-oriented analysis and design, structured and object-oriented tools, the systems life cycle. Organizational structure. Systems investigation. Feasibility studies. Determination and evaluation of alternatives designs of input, output and file structures. Documentation. Choice of system characteristics (Hardware and software). Testing, conversion. Parallel runs. Evaluation of system performance. Maintenance.

CSC 492.2 Computer Graphics (3 Units)

Hardware aspect; plotters microfilm, plotters displays, graphic-tablets, light pens, other graphical input aids. Facsimile and its problems. Refresh display, refresh buggers, changing images light pen interaction. Two and three dimensional transformation perspective. Clipping algorithms, hidden live removal, Holden surface removal; warrock's

method, shading, data reduction for graphical input. Institution to hand writing and character recognition. Curve synthesis and fitting. Contouring ring structures versus doubly linked lists. Hierarchical structures; Data structure; organization for inter-active graphics.

CSC 496.1 Programming Languages (3 Units)

Introduction to 4th and 5th Generation Programming Languages, The role and comparison of programming languages generations. Benefits of Fourth and Fifth Programming languages. Data manipulative based fourth generation language- Structured Query Language Programming, logic based Fourth Generation Languages-Ruby and /or Python, Advanced Queries and Object-Oriented Query handling. General purpose/multi purpose representations in 4GL – Input/Ouput, Types, objects and declarations. Expression and statements. Methods, Practical Illustrations.

CSC 498.1 Data Communication and network (3 Units)

Introduction, waves Fourier analysis, measure of communication channel characteristics, transmission media, noise and distortion, modulation and demodulation; multiplexing TDM FDM and FCM. Parallel and serial transmission (synchronous vs anachronous). Bus structures and loop systems, computer network. Examples and design consideration: data switching principles; broadcast techniques; network structure for packet switching, protocols, description of network e.g. ARPANET, DSC etc.

CSC 499.2 Computer Graphics Practicals (1 Unit)