MAHATHMA GANDHI UNIVERSITY

KOTTAYAM

BOARD OF STUDIES IN MATHEMATICS (UG)

CURRICULAM

FOR

B.Sc MATHEMATICS PROGRAMME

UNDER

COURSE – CREDIT AND SEMESTER SYSTEM (CCSS UG)

(Effective from 2009 admission onwards)

MAHATHMA GANDHI UNIVERSITY KOTTAYAM

Board of studies in mathematics (U G)

1. Smt . Ushakumari J , LSG ,HOD of mathematics, N.S.S Hindu College , Changanacherry (Chairperson).
2. Dr . Sunny Kuriakose, LSG , Department of mathematics, U.C. College ,Aluva.
3. Sri. N. Devadath , LSG , Department of mathematics, D.B Pampa College ,Parumala.
4. Sri. Abraham .K.Samuel, Department of mathematics, C.M.S College ,Kottayam.
5. Sri. Jose P Joseph, LSG, Department of mathematics, S.H College, Thevara.
6. Sri. Renny P Varghese, LSG, Department of mathematics, Catholicate College, Pathanamthitta.
7. Sri. Ranjan Abraham, LSG, Department of mathematics, SNM College, Maliankara.
8. Sri. Ashokan, Lect. Senior Scale, Department of mathematics, Govt. College, Kottayam.
9. Dr. Mary Metilda, LSG, HOD, Dept. of mathematics, Maharajas College, Ernakulam.
10. Sri. M.P.Sivaramakrishnan, LSG, Department of mathematics, Govt. Brennen College, Thalaserry.
11. Dr. Sreenivasan.P, LSG, Department of mathematics, Payyannur College, Payyannur.

MAHATHMA GANDHI UNIVERSITY, KOTTAYAM

B.Sc MATHEMATICS PROGRAMME

UNDER

COURSE – CREDIT AND SEMESTER SYSTEM (CCSS UG)

(Effective from 2009 admission onwards)

The courses for the UG Programme are framed using time tested and internationally popular text books so that the courses are at par with the courses offered by any other reputed university around the world.

Only those concepts that can be introduced at the UG level are selected and instead of cramming the course with too many ideas the stress is given in doing the selected concepts rigorously. The idea is to make learning mathematics meaningful and an enjoyable activity rather than acquiring manipulative skills and reducing the whole thing an exercise in using thumb rules.

As learning Mathematics is doing Mathematics, to this end, some activities are prescribed to increase students' participation in learning.

Some topics are given at the end of the syllabus as seminar topics. Students can make use of books and materials available in the web to prepare for the presentation. It is imperative that these are taken as part of the syllabus. These should be included in the internal examination. However they are not to be included for the university examinations. .

Every student has to do a project during 6^{th} semester. The topics for the project can be selected as early as the beginning of the 4^{th} semester.

Course Structure:

The U.G. Programme in Mathematics must include (a) Common courses, (b) Core courses, (c) Complementary Courses, (d) Open Courses and (e) Project and no course shall carry more than 4 credits. The student shall select any Choice based course offered by the institution depending on the availability of teachers and infrastructure facilities in the institution. Open

course may be offered in any subject and the student shall have the option to do courses offered by other departments/ or by the same department.

Courses:

The number of Courses for the restricted programme should contain 12 core courses and 1 choice based course from the frontier area of the core courses, one open course offered by other departments/ or by the same department, 8 complementary courses, or otherwise specified, from the relevant subjects for complementing the core study. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

Course Coding :

Every course in the programme is coded according to the following criteria.

1. The first two letter from the programme ie., MM (Mathematics Main)
2. One digit to indicate the semester. ie., MM1 (Mathematics Main, Ist Semester)
3. One letter from the type of courses such as common course A, core courses B, complementary courses C, open courses D. ie., MM1B (Mathematics Main, Ist Semester, Core course)
4. Two digit to indicate the course number of that semester. ie., MM1B01 (Mathematics Main, Ist Semester, Core course, Course number 01)

Objectives :

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Mathematics by providing a more complete and logic frame work in almost all areas of basic Mathematics.

By the end of the second semester, the students should have attained a common level in basic Mathematics, a secure foundation in Mathematics and other relevant subjects to complement the core for their future courses.

By the end of the fourth semester, the students should have been introduced to powerful tools for tackling a wide range of topics in Calculus, Theory of Equations and Numerical methods. They should have been familiar with additional relevant mathematical techniques and other relevant subjects to complement the core.

By the end of sixth semester, the students should have covered a range of topics in almost all areas of Mathematics including Graph Theory, Programming in C, and had experience of independent works such as project, seminar etc.

B.Sc Programme in Mathematics (Core Courses):

The following table shows the structure of the programme which indicates Code of the courses, title of the courses, instructional hours, credits, university examination style and the components for internal and external evaluation.

Details Mathematics (Core Courses)

Semester	Title of the Course	Number of hours per week	Total Credits	Total hours/ semester	University Exam Duration	Weightage	
						IA	EA
1	MM1B01-Foundation of Mathematics	4	3	72	3 hrs	1	3
2	MM2B01 –Analytic Geometry ,Trigonometry and Matrices	4	3	72	3	1	3
3	MM3B01 – Calculus	5	4	90	3	1	3
4	MM4B01– Vector Calculus, Theory of Equations and Numerical Methods	5	4	90	3	1	3
5	MM5B01 – Mathematical Analysis	5	4	90	3	1	3
	MM5B02 – Differential Equations	6	4	108	3	1	3
	MM5B03 – Abstract Algebra	5	4	90	3	1	3
	MM5B04 – Fuzzy mathematics	5	4	90	3	1	3
	MM5D – Open course	4	4	72	3	1	3
6	MM6B01 – Real Analysis	5	4	90	3	1	3
	MM6B02 – Complex Analysis	5	4	90	3	1	3
	MM6B03 – Discrete Mathematics	5	4	90	3	1	3

6	MM6B04 – Linear Algebra and Metric Spaces	5	4	90	3	1	3
	MM6D – Choice Based Course	4	3	72	3	1	3
	MM6B05 – Project	1	1	18	-	-	-

Open Course for students of other/own departments during the Fifth Semester

Code	Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MM5D01	Mathematical Modeling	4	4	3 hrs
MM5D02	Applicable Mathematics	4	4	3 hrs
MM5D03	Financial Mathematics	4	4	3 hrs
MM5D04	Mathematical Economics	4	4	3 hrs

Choice Based Course for students of our own department during the Sixth Semester

Code	Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MM6D01	Operations Research	4	3	3 hrs
MM6D02	Programming in C	4	3	3 hrs
MM6D03	Topology	4	3	3 hrs
MM6D04	Theory of Computations	4	3	3 hrs

Projects :

All students must do a project. The project can be done individually or as a group of maximum 3 students. However, the viva on this project will be conducted individually. The projects are to be identified during the IVth semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department and are to be produced before the examiners appointed by the University for Valuation.

COMPLEMENTARY COURSES:

1. Mathematics for B.Sc Physics / Chemistry / Petro chemicals / Geology

Semester	Title of the paper	Number of hours per week	Total Credits	Total hours / semester	University Exam Duration	Weightage	
						IA	EA
1	MP1C01 – **Differential Calculus and Trigonometry**	4	3	72	3 hrs	1	3
2	MP2C01 – **Integral Calculus and Matrices**	4	3	72	3	1	3
3	MP3C01 – **Vector Calculus , Differential Equations and Analytic Geometry**	5	4	90	3	1	3
4	MP4C01- **Fourier Series , Differential Equations, Numerical Analysis and Abstract Algebra**	5	4	90	3	1	3

2. Mathematics for B.Sc Electronics and B.Sc Computer Science

Semester	Title of the paper	Number of hours per week	Total Credits	Total hours / semester	University Exam Duration	Weightage	
						IA	EA
1	MEC1C01: Vector Analysis, Differential Equation, Fourier series and Integral Transform	4	4	72	3 hrs	1	3
2	MEC2C01 : Linear Algebra and Graph theory	4	4	72	3	1	3
3	MEC3C01 : Numerical methods	4	4	72	3	1	3

3. Mathematics for B.A Economics

Semesters	Title of the paper	Number of hours per week	Total Credits	Total hours / semester	University Exam Duration	Weightage	
						IA	EA
1	**ME1C01**: Graphing functions, Equations and Linear Algebra	6	4	108	3 hrs	1	3
2	**ME2C01:** Calculus, Exponential and Logarithmic Functions	6	4	108	3 hrs	1	3

4. Mathematics for B.Sc Statistics

Semester	Title of the paper	Number of hours per week	Total Credits	Total hours / semester	University Exam Duration	Weightage	
						IA	EA
1	MS1C01 – Differential Calculus, Logic & Boolean algebra	4	3	72	3 hrs	1	3
2	MS2C01 – Integral Calculus & Fourier Series	4	3	72	3	1	3
3	MS3C01 – Vector Calculus, Differential equations & Laplace Transform	5	4	90	3	1	3
4	MS4C01– Abstract algebra, Linear Algebra, Theory of Equations, Special functions	5	4	90	3	1	3

English:

Semester	Title of the Course	Number of hours per week	Total Credits	Total hours/ semester	University Exam Duration	Weightage	
						IA	EA
1	English I	5	4	90	3 hrs	1	3
	English /Common course I	4	3	72	3	1	3
2	English II	5	4	90	3	1	3
	English /Common course II	4	3	72	3	1	3
3	English III	5	4	90	3	1	3
4	English - IV	5	4	90	3	1	3

Second Language:

Semester	Title of the Course	Number of hours per week	Total Credits	Total hours/ semes	University Exam	Weightage	
						IA	EA
1	Second Language I	4	4	72	3 hrs	1	3
2	Second Language II	4	4	72	3	1	3
3	Sec. Lang./Common course I	5	4	90	3	1	3
4	Sec. Lang./Common course II	5	4	90	3	1	3

SEMESTERS - COURSES

Sl: No	Semester	Papers	Hours	credits
1	I	English I	5	4
		English /Common course I	4	3
		Second Language I	4	4
		Mathematics Core Course - 1	4	3
		Complimentary1 Course - 1	4	3
		Complimentary 2 Course – 1	4	3
2	II	English II	5	4
		English /Common course II	4	3
		Second Language II	4	4
		Mathematics Core Course - 2	4	3
		Complimentary1 Course – 11	4	3
		Complimentary2 Course – 11	4	3
3	III	English III	5	4
		Sec. Lang./Common course I	5	4
		Mathematics Core Course - 3	5	4
		Complimentary1 Course – 11	5	4
		Complimentary2 Course – 11	5	4
4	IV	English IV	5	4
		Sec. Lang./Common course II	5	4
		Mathematics Core Course - 4	5	4
		Complimentary1 Course – III	5	4
		Complimentary2 Course – III	5	4

5	V	Mathematics Core Course - 5	5	4
		Mathematics Core Course - 6	5	4
		Mathematics Core Course - 7	5	4
		Mathematics Core Course - 8	6	4
		Open course	4	4
6	VI	Mathematics Core Course - 9	5	4
		Mathematics Core Course - 10	5	4
		Mathematics Core Course - 11	5	4
		Mathematics Core Course - 12	5	4
		Choice Based Course	4	3
		Project	1	1

Examinations :

The evaluation of each course shall contain two parts such as Internal or In-Semester Assessment (IA) and External or End-Semester Assessment (EA). The ratio between internal and external examinations shall be 1 : 3 . The Internal and External examinations shall be evaluated using Direct Grading system based on 5-point scale.

Internal or In-Semester Assessment (IA):

Internal evaluation is to be done by continuous assessments on the following components. The Components of the internal evaluation for theory and practical and their weights are as below.

Theory :

Component	Weight
Attendance*	1
Assignment	1
Seminar	1
Best of two test papers	2

***Attendance**

%age of Attendance	Grade
>90%	A
Between 85 and 90	B
Between 80 and 85	C
Between 75 and 80	D
< 75	E

Assignments:

Best of two assignments are considered per course. The student has to take a minimum of 1 seminar per course. A minimum of 2 class tests are to be attended. The grades of best 2 tests are to be taken.

The evaluation of all components is to be published and is to be acknowledged by the candidate. All documents of internal assessments are to be kept in the institution for 2 years and shall be made available for verification by the university. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the course.

External or End-Semester Assessment (EA) :

The external examination of all semesters shall be conducted by the university on the close of each semester. There will be no supplementary exams. For reappearance/ improvement, students can appear along with the next batch.

Pattern of Question Paper :

A question paper shall be a judicious mix of objective type, short answer type, short essay type/ problem solving type and long essay type questions. Different types of questions shall be given different weights to qualify their range.

For each course the external examination is of 3 hours duration. The question paper has 4 parts. Part A is compulsory which contains 16 objective type / multiple choice type questions set into 4 bunches of four questions. Each bunch has weightage 1. Part B contains 8 short answer questions of which 5 are to be answered and each has weightage 1. Part C has 6 short essay questions of which 4 are to be answered and each has a weightage 2. Part D has 3 long essay questions of which 2 are to be answered and each has a weightage 4.

Part	No. of Questions	No. of questions to be answered	Weightage
A (Objective type)	4 bunches of 4 questions	All	4x1 = 4
B (Short Answer)	8	5	5x1 = 5
C (Short Essay)	6	4	4x2 = 8
D (Long Essay)	3	2	2x4 = 8

Total Weightage 25

Evaluation of problem in grading system

Problem in mathematics shall be graded in the following way

1. Correct formula with correct substitution and answer : A
2. Correct formula with correct substitution and answer but wrong or no unit : B
3. Correct formula with correct substitution and wrong answer: C
4. Formula alone is correct : D
5. Even formula is not correct : E

Promotion to the next Semester:

The student who registers his/ her name for the external examination for a semester shall be eligible for promotion to the next semester.

Student Strength:

The strength of students for each course shall remain as per existing regulations. For open course, the student strength shall be 15 or more.

Eligibility for Degree Certificate:

The student who scores a separate minimum of Grade D for all the courses and scores a minimum CGPA of 2.00 or an overall grade of C+ and above is eligible for awarding Degree Certificate.

Final Grade Card:

The final Grade Card issued at the end of the final semester shall be based on the CGPA of the Core Courses and Complimentary Courses of the entire Programme. The CGPA should contain the awarded GRADE LETTER and the corresponding GRADE POINT in two decimal places.

Syllabus of Courses:

The detailed syllabus of the courses for core, complimentary etc. is appended.

For the Board of Studies in Mathematics (U G)

Prof. Usha Kumari J (Chairperson)

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE1)
FIRST SEMESTER
MM1B01: FOUNDATION OF MATHEMATICS

4 hours/week **3 credits**

Aims

The course aims:

- to explain the fundamental ideas of sets and functions;
- to introduce basic logic;
- to introduce basic Number Theory;

Brief Description of the Course

This course introduces the concepts of sets and functions, mathematical logic, and methods of proof. A brief introduction of theory of Numbers is also included. These topics are foundations of most areas of modern mathematics, and are applied frequently in the succeeding semesters.

Learning Outcomes

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

- prove statements about sets and functions;
- analyze statements using truth tables;
- Construct simple proofs.
- Familiarize mathematical Symbols and standard methods of proofs.

Syllabus

Text Books:

1. K.H. Rosen: Discrete Mathematics and its Applications (Sixth edition), Tata McGraw Hill Publishing Company, New Delhi.
2. S. Bernard and J.M Child: Higher Algebra, AITBS Publishers, India,2009

Module 1 **(15 hours)**

Set theory: Sets, set operations, functions, sequences and summations

(Text - 1 Chapter - 2)

Module 2 **(20 hrs)**

Relations: Relations and their properties, n-ary relations and their applications, representing relations, equivalence relations, partial orderings.

(Text – 1 Chapter 7 excluding Section 7.4)

Module 3 **(20 hrs)**

Basic Logic

Pre-requisite: Nil.

Syllabus: Propositional logic, Propositional equivalences, Predicates and quantifiers nested quantifiers, Rules of inference, Introduction to proofs, Proof methods and strategy.

(Text book 1, Chapter - 1).

Module 4 Theory of Numbers **(17 hrs)**

Syllabus: Divisibility theory in the integers, the greatest common divisor, the Euclidean algorithm (division algorithm), Primes. The fundamental theorem of arithmetic. The theory of congruence. Basic properties of congruence. Fermat's little theorem Wilson's theorem. Euler's phi-function. Euler's generalization of Fermat's theorem.

(Text – 2 , Chapter – 1 and 26)

References :

1, Lipschutz: Set Theory and related topics (Second Edition), Schaum Outline Series, Tata McGraw-Hill Publishing Company, New Delhi. (Reprint 2009).

2. P.R. Halmos : Naive Set Theory, Springer. .

3. George E. Andrews : Number Theory, HPC.

4. Ian Chiswell & Wifrid Hodges: Mathematical Logic, Oxford university press

5. Graham Everest, Thomas Ward: An Introduction to Number Theory, , Springer

6. Fernando Rodriguez Villegas: Experimental Number Theory, Oxford University Press

7. Richard Johnsonbaugh – Discrete Mathematics (Pearsons)

8. C.Y Hsiung Elementary Theory of Numbers, Allied Publishers

9. Thomas Koshy - Elementary Number Theory with Applications, Academic Press

Seminar Topics:

1. History of Mathematics in Kerala and in India
2. Logical Paradoxes
3. Axiomatic Set Theory
4. Multivalued Logic

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	3	1	1	-
II	5	2	1	1
III	4	2	2	1
IV	4	3	2	1
Total	**16**	**8**	**6**	**3**

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 2)
SECOND SEMESTER
MM2B01: ANALYTIC GEOMETRY, TRIGONOMETRY AND MATRICES

4 hours/week **3 credits**

Aims

The course aims:

- to explain more ideas of conics;
- to introduce Circular and hyperbolic functions of a complex variable:
- to explain rank of a matrices , Characteristic roots and characteristic vectors.

Brief Description of the Course

This course introduces tangents, normal, pole, polar ,chords of conics and also their polar equations. This course introduces the concept of circular and hyperbolic functions of a complex variable and their properties.

Explain the rank of a matrices and its Canonical form, Normal form. Express Systems of Linear equations in matrix form and to find the solution of the systems. Characteristic roots and characteristic vectors are also introduced.

Learning Outcomes

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

- find the equation to tangent, normal at a point on a conic ;
- find the polar equation of a line, circle , tangent and normal to conics
- familiarize real and imaginary parts of a circular and hyperbolic functions of a complex variable
- solve a System of Linear equations using the inverse of a matrix
- familiarize characteristic roots and characteristic vectors.
- To find the inverse of a matrix by Cayley-Hamilton theorem

Syllabus

Text books:

1. Manicavachagom Pillay , Natarajan – Analytic Geometry (Part I, Two Dimensions)
2. S.L. Loney – Plane Trigonometry Part – II, S. Chand and Company Ltd.
3. Frank Ayres Jr - Matrices , Schaum's Outline Series, TMH Edition.

MODULE I **(25hrs)**

Tangents and Normals (parametric form only) of a conic, Orthoptic locus. Pole and Polar. Chord in terms of given points. Conjugate diameters of ellipse and hyperbola. Asymptotes of a hyperbola, conjugate hyperbola and rectangular hyperbola.

(Relevant sections of Text 1)

MODULE II **(10 hrs)**

Polar co-ordinates, polar equation of a line, polar equation of a circle and polar equation of a conic. Polar equations of tangent and normal to these curves.

(Relevant sections of Text 1)

MODULE III

Trigonometry **(17 hrs)**

Circular and hyperbolic functions of a complex variable. Separation into real and imaginary parts. Factorisation of x^n-1, x^n+1, $x^{2n} - 2x^n a^n \cos n\theta + a^{2n}$. Summation of infinite series by C + i S method

(Relevant sections of Text 2, Chapter – V , VII , IX)

MODULE IV

Matrices **(20 hrs)**

Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only.

Systems of Linear equations: System of non homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem (statement only) and simple applications

(Text 3, Chapters – 5, 10, 19, 23).

Reference Books:

1. S.K . Stein – Calculus and analytic Geometry , (McGraw Hill)
2. A. N. Das – Analytic Geometry of Two and Three Dimension (New Central Books)
3. Thomas and Finney - Calculus and analytical geometry (Addison-Wesley)
4. Shanti Narayan - Matrices (S. Chand & Company)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	7	3	2	1
II	2	1	1	-
III	3	2	1	1
IV	4	2	2	1
Total	**16**	**8**	**6**	**3**

B.Sc DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 3)

THIRD SEMESTER

MM3B01: CALCULUS

5 hours/week **4 credits**

Brief Description of the Course

This course introduces higher order derivatives, Leibnitz theorem, for higher derivatives of the product of two functions. Series expansions of functions using Maclaurin's theorem and Taylor's theorem are discussed. Some applications of derivatives in finding maxima, minima, point of inflection, curvature etc are introduced. The concept of partial derivatives and its properties are also introduced.

In integral calculus, certain reduction formulae are discussed. Application of integrals in finding plane area, surface area, arc length, and volume of solids of Revolution are introduced and double and triple integrals and some applications are also introduced.

Objectives

After completing this course the learner should be able to

- Find the higher order derivative of the product of two functions.
- Expand a function using Taylor's and Maclaurin's series.
- Conceive the concept of asymptotes and obtain their equations.
- Learn about partial derivatives and its applications.
- Find the area under a given curve, length of an arc of a curve when the equations are given in parametric and polar form.
- Find the area and volume by applying the techniques of double and triple integrals

Syllabus

Text Books:

1. George B. Thomas Jr. (Eleventh Edition) – Thomas' Calculus, Pearson, 2008.
2. Shanti Narayan and P. K. Mittal– Differential Calculus (S. Chand & Co.) 2008.

Module I

Differential Calculus (30 hrs.)

Successive Differentiation . Expansion of functions using Maclaurin's theorem and Taylor's theorem. Concavity and points of inflexion. Curvature and Evolutes. Length of arc as a function derivatives of arc, radius of curvature – Cartesian equations. Centre of curvature,

Evolutes and Involutes, properties of evolutes. Asymptotes and Envelopes.(Pedal equation and Newtonian Method excluded)

(Text 2 Chapter - 5, Chapter – 6, Chapter 13, Chapter – 14 , Chapter - 15 section 15.1 to 15.4, Chapter – 18 section 18.1 to 18.8)

Module II

Partial Differentiation (20 hrs.)

Partial derivatives, The chain rule., Extreme values and saddle points, Lagrange multipliers, Partial derivatives with constrained variables.

(Text 1 Section 14.3 , 14.4, 14.7, 14.8, 14.9)

Module III

Integral Calculus (20 hrs.)

Substitution and area between curves, volumes by Slicing and rotation about an axis. Volumes by cylindrical shells, Lengths of Plane Curves, Areas of surfaces of Revolution and the theorems of Pappus..

(Text 1 Section 5.6, 6.1, 6.2, 6.3, 6.5)

Module IV

Multiple Integrals. (20 hrs.)

Double integrals, Areas, Double integrals in polar form, Triple integrals in rectangular coordinates, Triple integrals in cylindrical and spherical coordinates, substitutions in multiple integrals.

(Text 1 Section 15.1, 15.2 (area only) 15.3 , 15.4, 15.6 ,15.7)

Reference:

1. T. M. Apostol – Calculus Volume I & II (Wiley India)
2. Widder – Advanced Calculus ,2nd edition
3. K. C. Maity & R. K. Ghosh – Differential Calculus (New Central Books Agency)
4. K. C. Maity & R. K. Ghosh – Integral Calculus (New Central Books Agency)

5. Shanti Narayan, P.K. Mittal - Integral Calculus – (S. Chand & Co.)

6. Anton: Calculus, Wiley.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	5	2	2	1
II	3	2	1	-
III	4	2	2	1
IV	4	2	1	1
Total	16	8	6	3

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 4)
FOURTH SEMESTER
MM4B01 : Vector Calculus, Theory of Equations and Numerical Methods

4 credits

5 hours/week

Text Books:

1. George B. Thomas Jr. (Eleventh Edition) – Thomas' Calculus, Pearson, 2008.
2. Bernard and Child - Higher Algebra, AITBS Publishers, India
3. S.S. Sastry - Introductory Methods of Numerical Analysis, Fourth Edition, PHI.

Module I

(20 hrs)

(A quick review)

Lines and planes in space., Cylinders and Quadric surfaces, Vector functions Arc length and Unit tangent vector, Curvature and Unit normal vector, torsion and Unit Binormal vector, Directional derivatives and gradient vectors , tangent planes and Differentials
(Sections 12.5 ,12.6 , 13.1 , 13.3 , 13.4 , 13.5 , 14.5 , 14.6 of Text 1)

Module II

(30 hours)

Integration in Vector Fields

Line integrals, Vector fields, work circulation and flux, Path independence, potential functions and conservative fields, Green's theorem in the plane, Surface area and surface integrals, Parameterized surfaces, Stokes' theorem (statement only), Divergence theorem and unified theory (no proof).
(Sections 16.1 to 16.8 of Text 1)

Module III

(25 hours)

Theory of Equations

Statement of fundamental Theorem of algebra. Deduction that every polynomial of degree n has n and only n roots. Relation between roots and coefficients. Transformation of equations. Reciprocal equations. Cardan's method, Ferrari's method. Symmetric functions of roots.
(Chapter 6 and Descartes Rule of signs also, 11 , 12 of Text 2)

Module IV

Introductory Methods of Numerical Solutions **(15 hours)**

Bisection Method, Method of False position, Iteration Method, Newton - Raphson Method (Sections 2.2, 2.3, 2.4, & 2.5 of Text 3)

References

1. Erwin Kreyszig : Advanced Engineering Mathematics, 8th ed., Wiley.
2. H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
3. Shanti Narayan, P.K Mittal – Vector Calculus (S. Chand)
4. Merle C. Potter, J. L. Goldberg, E. F. Aboufadel – Advanced Engineering Mathematics (Oxford)
5. Ghosh, Maity – Vector Analysis (New Central books)
6. Quazi Shoeb Ahamad - Numerical and Statistical Techniques (Ane Books)

Seminar topics

Modeling projectile motion, planetary motion and Satellite, Area, moments and Centre of mass, Masses and Moments in three dimensions, Convergence of Iterations, Speed of Convergence, Algorithms of Iterations.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	5	2	1	-
II	5	3	2	1
III	4	2	2	1
IV	2	1	1	

				1
Total	**16**	**8**	**6**	**3**

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 5)
FIFTH SEMESTER
MM5B01: MATHEMATICAL ANALYSIS

5 hours/week **4 credits**

Text Books:

1. S.C.Malik, Savitha Arora _ Mathematical analysis. RevisedSecond edition.
2. J.W. Brown and Ruel.V.Churchill _ Complex variables and applications, 8th edition. Mc.Graw Hill.

Module I **15 hours**

Intervals. Bounded and unbounded sets, supremum, intimum. Order completeness in R. Archimedian property of real numbers. DEdekinds form of completeness property.

(Sections 2:6, 3, 4.1 ,4.2, 4.3, 4.4 of text 1)

Module II **25 hours**

Neighbourhood of a point. Interior point of a set. Open set. Limit point of a set. Bolzano weierstrass theorem for sets. Closed sets, closure of a set. Dense sets. Countable and uncountable sets.

(Sections : 1.1,1.2,1.3,2,2.1,2.2,3.1,3.2,3.3,3.4,3.5,4 of chapter 2 of text 1)

Module III **30 hours**

Real sequences. The range, bounds of a sequence. Convergence of sequences. Some theorems, limit points of a sequence. Bolzano weierstrass theorem for sequences. Limit interior and superior. Convergent sequences. Cauchy's general principle of convergence. Cauchy's

sequences. Statements of theorem without proof in algebra of sequences. Some important theorems and examples related to them. Monotonic sequences, subsequences.

(Sections : 1.1,to 1.5, 2.to2,3. 4 to5 ,6 ,6.1 ,7,8 9, 9.1 of chapter 3 of text 1)

Module IV

complex numbers **20 hours**

Sums and products. Basic algebraic properties. Further properties. Vectors and moduli. Different representations. Exponential forms. Arguments of products and quotients. Product and powers in exponential form. Foots of complex numbers. Regions in the complex plane.

(Section 1 to 11 of chapter 1 of text 2.)

References:

1. Robert G Bartle and Donald R Sherbert –Introduction to real analysis 3rd edition.Wiley
2. Richard R Goldberg – Methods of real analysis 3rd edition , Oxford and IBM Publishing Co (1964)
3. Shanti Narayan – A Course of mathematical analysis , S Chand and Co Ltd(2004)
4. Elias Zako – Mathematical analysis Vol1, Overseas Press, New Delhi(2006)
5. J. M .Howie – Real Analysis, Springer 2007
6. K.A Ross - Elementary Real Analysis, Springer, Indian Reprint
7. M.R Spiegel – Complex Variables, Schaum's Series

Seminar topics:

Expansion of sin $n\theta$, cos $n\theta$, $\sin^n \theta$

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	2	2	1	-
II	6	2	2	1

III	6	3	2	2
IV	2	1	1	-
Total	16	8	6	3

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 6)
FIFTH SEMESTER
MM5B02: DIFFERENTIAL EQUATIONS

6 hours/week **4 credits**

Introduction:

Since the time of Isaac Newton differential equation have been of fundamental importance in the application of Mathematics to the Physical Science. Lately differential equation gained increasing importance in the Biological and Social Science. In this course we are studying the ordinary differential equation involving one independent and one or more dependent variables. The integrals of ordinary differential equation are plane curves. Also we should study the differential equation involving one dependant and more than one independent variables that are partial differential equation. Such integrals are space curves and surfaces. Partial differential equation can arise in a variety of ways in Geometry, Physics, etc.

Objectives:

After studying this course the students should be able to

- Obtain an integrating factor which may reduce a given differential equation into an exact one and eventually provide its solution.
- Identify and obtain the solution of Clairaut's equation.
- Fine the complementary function and particular integrals of linear differential equation.
- Familiarize the orthogonal trajectory of the system of curves on a given surface.
- Method of solution of the differential equation $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$
- Describe the origin of partial differential equation and distinguish the integrals of first order linear partial differential equation into complete, general and singular integrals.
- Use Lagrange's method for solving the first order linear partial differential equation

Text Books:

1. Shepley L. Ross - Differential Equations, 3rd ed., (Wiley India).
2. Ian Sneddon – Elements of Partial Differential Equation (Tata Mc Graw Hill)

Module I

Ordinary differential equations (25 hrs.)

Exact differential equations and integrating factors (proof of theorem 2.1 excluded) , separable equations and equations reducible to this form,, linear equations and Bernoulli equations, special integrating factors and transformations. Orthogonal and oblique trajectories.

(Sections 2.1 , 2.2, 2.3 , 2.4, 3.1 of Text 1)

Module II (30 hrs.)

Basic theory of linear differential equations. The homogeneous linear equation with constant coefficients. The method of undetermined coefficients, Variation of parameters, The Cauchy – Euler equation.

(Section 4.1 , 4.2 , 4.3, 4.4, 4.5 of Text 1)

Module III (33 hrs.)

Power series solution about an ordinary point, solutions about singular points, the method of Frobenius , Bessel's equation and Bessel Functions, Differential operators and an operator method.

(Section 6.1 , 6.2 , 6.3, 7.1 of Text 1)

Method IV :

Partial Differential equations (20 hrs.)

Surfaces and Curves in three dimensions, solution of equation of the form

$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's method

(Chapter 1 , section 1 and 3 & Chapter 2 Section 1, 2 and 4 of text 2)

Reference: Reference:

1. A.H.Siddiqi & P. Manchanda – A First Course in Differential Equation with Applications (Macmillian)
2. George. F. Simmons – Differential equation with applications and historical notes (Tata Mc Graw Hill)
3. W.E. Boyce & R.C. Diprima - Elementary Differential Equations and boundary value Problems, (Wiley India)
4. S. Balachandra Rao & H. Ranuradha – Differential Equation with Applications and Programs (Universities Press)
5. R. K. Ghosh & K. C. Maity - An Introduction to Differential Equations (New Central Books Agency)
6. B. K. Dutta – Introduction to Partial Differential Equations (New Central Books) .
   Murrary –.Differential Equations. Macmillian
7. E.A. Coddington - An Introduction to Ordinary Differential Equation, PHI.
8. Sankara Rao - Introduction to Partial Differential Equation,2nd edition, PHI.
9. Zafar Ahsan - Differential Equations and their Applications , 2nd edition, PHI

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	4	2	2	1
II	4	2	2	1
III	4	2	1	1*
IV	4	2	1	1*
Total	**16**	**8**	**6**	**3**

* choose one question from either of these modules

BSc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 7)
FIFTH SEMESTER
MM5B03: ABSTRACT ALGEBRA

5 hours/week **4 credits**

Text book :

John B.Fraleigh - A first course in Abstract Algebra (3rd Edition),
(Chapters 1-7 ,11-13 , 23, 24 and 28)

Module 1 **(25 hours)**

Binary operation-Groups,Definition and elementary properties-finite groups and group tables-subsets and sub groups-cyclic sub groups-functions and permutations- groups of permutations-examples.Cycles and Cyclic notations-even and odd permutations-the alternating groups.

Module 2 **(25 hours)**

Cyclic Groups-Elementary Properties-Classification of cyclic groups-Subgroups of finite cyclic groups-Isomorphisms-Definition and elementary properties-How to show that two groups are isomorphic(Not Isomorphic)-Cayle's Theorem-Groups of Cosets--Applications-Criteria for the existence of a coset group-inner automorphisms and normal subgroups-Factor groups-Simple groups

Module 3 **(20 hours)**

Homomorphism-Definition and Elementary Properties-The Fundamental Homomorphism theorem-Applications. Rings,Definition and Basic Properties-Multiplicative questions;Fields-Integral Domains-Divisors of Zero And Cancellation-Integral Domains.

Module 4 **(20 hours)**

Characteristic of a Ring- Quotient Ring and Ideals-Criteria For The Existence of a Coset Ring-Ideals And Quotient Rings.

References :

1. I.N Herstein - Topics in Algebra
2. Joseph A Gullian - A Contemporary Abstract Algebra,Narosa Pub.House .
3. Hillbert – Algebra
4. Artin – Algebra , PHI
5. P.B Bhattacharya , S. K Jain and S. R . Nagpaul – Basic Abstract Algebra , 2nd edition, Cambridge University Press
6. Durbin – Modern Algebra , An introduction , 5th edition , Wiley
7. Chatterjee - Abstract Algebra , 2nd edition, PHI
8. M. K. Sen, S. Ghosh - Topics in Abstract Algebra (University Press)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	4	2	2	1
II	4	2	2	1
III	4	2	1	1
IV	4	2	1	
Total	**16**	**8**	**6**	**3**

BSc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 8)
FIFTH SEMESTER
MM5B04 : FUZZY MATHEMATICS

5 hours/week **4 credits**

Text Book:

George J. Klir and BoYuan, - *Fuzzy Sets and Fuzzy Logic Theory and Applications'*, Prentice Hall of India Private Limited New Delhi, 2000.

Module - I **(20 Hrs)**

Introduction , Crisp Sets: An Overview ,Fuzzy Sets: Basic Types ,Fuzzy Sets: Basic concepts. Additional properties of α cuts, Representation of fuzzy sets, Extension principle of fuzzy sets.
(Chapter 1 – 1.1, 1.2, 1.3 and 1.4 and Chapter 2– 2.1 , 2.2 , 2.3)

Module - II

Operations on Fuzzy Sets: **(30 Hrs)**
Types of Operations , Fuzzy complements , Fuzzy intersections: t – norms , Fuzzy Unions: t – conorms , Combinations of operations .(Theorems 3.7 , 3.8 ,3.11 ,3.13, 3.16 and 3.18 statement only)
(Chapter 3 – 3.1, 3.2, 3.3, 3.4, 3.5)

Module - III
Fuzzy Arithmetic **(20 Hrs)**
Fuzzy numbers , Arithmetic operations on Intervals , Arithmetic operations on Fuzzy numbers. (Exclude the proof of Theorem 4.2) Lattice of fuzzy numbers, Fuzzy equations
Chapter 4 – 4.1, 4.3, 4.4, 4.5 , 4.6)

Module - IV

Fuzzy Logic **(20 Hrs)**
Classical Logic: An Overview , Multivalued Logics , Fuzzy propositions , Fuzzy quantifiers ,Linguistic Hedges, Inference from Conditional Fuzzy propositions ,
Chapter 8 – 8.1, 8.2, 8.3, 8.4, 8.5 and 8.6 only)

Reference:

1. Klir, G. J and T. Folger, *Fuzzy Sets, Uncertainty and Information*, Prentice Hall of India Private Limited New Delhi, (1988)
2. H.J Zimmermann, *Fuzzy Set Theory- and its Applications*, Allied Publishers, 1996.
3. Dubois, D and H. Prade , *Fuzzy Sets and System: Theory and Applications*, Academic Press, New York, 1988
4. Abraham Kandel, *Fuzzy Mathematical Techniques with Applications*, Addison – Wesley Publishing Company 1986

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	4	2	1	0
II	4	2	2	1
III	4	2	1	1
IV	4	2	2	1
Total	**16**	**8**	**6**	**3**

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE 9)
SIXTH SEMESTER
MM6B01: REAL ANALYSIS

5 hours/week **4 credits**

Text book:

S.C.Malik and Savitha Arora - mathematical Analysis, 2nd Edition.

Module I :

Infinite Series **20 hours**

A necessary condition for convergence. Cauchy`s general principle of convergence for a series. Positive term series. A necessary condition for convergence of positive term series. Geometric series. The comparison series $\sum\frac{1}{n^p}$ comparison test for positive term series without proof. Cauchy`s root test DALEMBERTÈS RATIO test. Raabe's test. Gauss`s test. Series with arbitrary terms. Alternating series. Absolute convergence
(Section 1.1 to 1.4,2 ,2.1 to 2.3,3,4,5,6,9,10,10.1,10.2 of chapter 4 of Text 1)

Module II :

Continuous functions **25 hours**

Continuous function (a quick review). Continuity at a point, continuity in an interval. Discontinuous functions. Theorems on continuity. Functions continuous on closed intervals. Uniform continuity.
(Section 2.1 to 2.4 ,3,4 of chapter 5 of Text 1)

Module III :

Riemann Integration **30 hours**

Definitions and existence of the integral. Inequalities of integrals. Refinement of partitions of integrability. Integrability of the sum of integrable functions. The integrals as the limit of a sum. Some applications. Some integrable functions. Integration and differentiation. The fundamental theorem of calculus.
(Section 1 to 9 of chapter 9 of Text 1)

Module IV :

Uniform Convergence **15 hours**

Point wise convergence. Uniform convergence on an interval. Cauchy`s criterion for uniform convergence. A test for uniform convergence of sequences. Test for uniform convergence of series. Weierstrass`s M-test, Abel`s test. Statement of Dirichelet`s test without proof.
(Section 1 to 3.2 of Text 1)

References:

3. Robert G Bartle and Donald R Sherbert–Introduction to real analysis 3rd edition.
4. Shanti Narayan and P.k Mital – A Course of mathematical analysis , S Chand and Co Ltd(2004)
5. J. V Deshpande – Mathematical analysis and Applications
6. Chatterjee - Real analysis , PHI
7. Royden - Real analysis ,3rd edition, PHI
8. R. A. Gordon - Real Analysis 2nd Edn. (Pearson)
9. Nanda, Saxena – Real Analysis (Allied)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	6	3	2	1
II	4	2	1	1
III	3	2	2	1
IV	3	1	1	-
Total	16	8	6	3

B.Sc DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 10)
SIXTH SEMESTER
MM6B02: COMPLEX ANALYSIS

5 hours/week **4 credits**

Aims:

The course aims:

- To explain the fundamental ideas of Analytic functions
- To discuss basic methods of complex integration
- To introduce elementary complex functions
- To discuss power series expansion of analytic functions

Brief Description of the course:

This course introduces the concepts analytic function, elementary complex functions, and their properties, basic methods of complex integration and its applications in contour integration.

Learning outcome:

On completion of this course, the students will be able to

- Conceive the concept of analytic functions and will be familiar with the elementary complex functions and their properties
- familiar with the theory and techniques of complex integration
- familiar with the theory and application of the power series expansion of analytic functions

Text book:

James Ward Brown& Ruel. V. Churchill- Complex variables and applications (8^{th} edition)

Module 1 **(30 hours)**

Analytic functions

Functions of a complex variable-limits-theorems on limits-continuity-derivatives-differentiation formulas-Cauchy-Riemann equations-sufficient condition for differentiability-analytic functions examples-harmonic functions.

Elementary functions

Exponential function –logarithmic function –complex exponents –trigonometric functions- hyperbolic functions- inverse trigonometric and hyperbolic functions.

Module 2 **(25 hours)**

Integrals

Derivatives of functions –definite integrals of functions –contours –contour integrals –some examples –upper bounds for moduli of contour integrals –ant derivates –Cauchy-Goursat theorem (without proof)- simply and multiply connected domains- Cauchy's integral formula- an extension of Cauchy's integral formula- Liouville's theorem and fundamental theorem of algebra- maximum modulus principle.

Module 3 **(15 hours)**

Series

Convergence of sequences and series -Taylor's series -proof of Taylor's theorem-examples- Laurent's series(without proof)-examples.

Module 4 **(20 hours)**

Residues and poles

Isolated singular points –residues –Cauchy's residue theorem –three types of isolated singular points-residues at poles-examples –evaluation of improper integrals-example –improper integrals from Fourier analysis –Jordan's lemma (statement only) –definite integrals involving sines and cosines.

.

Chapter2-sections12,15,16,18to22,24,25,26.
Chapter3-sections29,30,33to36.
Chapter4-sections37to41,43,44,46,48to54.
Chapter5-sections55to60&62.
Chapter6-sections68to74(except71).
Chapter7-sections78to81&85.

Reference:

1. Lars V.Ahlfors - Complex Analysis – An Introduction to the Theory of Analytic Functions of one Complex Variables (4th edition), (McGRAW-HILL)
2. Shanti Narayan - Theory of functions of a complex variable
3. Kasana - Complex Variables: Theory and Applications , 2nd edition

B.Sc DEGREE PROGRAMME

MATHEMATICS (CORE COURSE 11)
SIXTH SEMESTER
MM6B03: DISCRETE MATHEMATICS

5 hours/week **4 credits**

Text books:

1. John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers
2. David M Burton - Elementary Number Theory 6th Edition TMH
3. Vijay K. Khanna - Lattices and Boolean Algebras- First Concepts, Vikas Publishing House Pvt Ltd.

Module I :

Graph Theory **(40Hrs)**

An introduction to graph. Definition of a Graph, Graphs as models, More definitions, Vertex Degrees, Sub graphs, Paths and cycles The matrix representation of graphs (definition & example only)
(Section 1.1 to 1.7 of text 1)

Trees and connectivity. Definitions and Simple properties, Bridges, Spanning trees, Cut vertices and connectivity.
(Section 2.1, 2.2, 2.3 & 2.6 of text 1)

Module 2 **(20 Hrs)**

Euler Tours and Hamiltonian Cycles .Euler's Tours, The Chinese postman problem .Hamiltonian graphs, The travelling salesman problem, Matching and Augmenting paths, Hall`s Marriage Theorem-statement only, The personnel Assignment problem, The optimal Assignment problem (Section 3.1(algorithm deleted) 3.2(algorithm deleted), 3.3, 3.4 (algorithm deleted))
Matching
(Section 4.1,4.2 4.3(algorithm deleted),4.4 (algorithm deleted) of text 1

Module 3:

Introduction to Cryptography **(15 Hrs)**

From Caesar Cipher to Public key Cryptography, the Knapsack Cryptosystem

4. B. Choudhary - The Elements of Complex Variables.

5. A. David Wunsch – Complex Analysis with Applications (Pearson)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	7	3	2	0
II	5	2	2	1
III	1	1	1	1
IV	3	2	1	1
Total	**16**	**8**	**6**	**3**

(Section 10.1, 10.2 only of text 2)

Module 4:

Poset and Lattices **(15 Hrs)**

Diagramatical Representation of a Poset, Isomorphisms, Duality, Product of two Posets, Lattices, Semilattices, Complete Lattices, Sublattices.
(Chapter 2 of text 3)

Reference:

1. Douglas B West Peter Grossman - Introduction to Graph Theory
2. W.D.Wallis - A Biginner's Guide to Discrete Mathematics, Springer
3. R. Balakrishnan, K. Ranganathan - A textbook of Graph Theory, Springer International Edition
4. S.Arumugham, S. Ramachandran - Invitation to Graph Theory, Scitech. Peter Grossman,
5. J.K Sharma - : Discrete Mathematics(2^{nd} edition), (Macmillion)
6. S. A. Choudam –A First Course in Graph Theory (Macmillian)
7. Theory (Macmillian)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	6	3	2	1
II	5	2	2	1
III	2	1	1	-
IV	3	2	1	1
Total	16	8	6	3

B.Sc DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
SIXTH SEMESTER
MM6B04: LINEAR ALGEBRA AND METRIC SPACES

5 hours/week **4 credits**

Text Book :

1. Richard Bronson, Gabriel B. Costa - Linear Algebra An Introduction (Second Edition), Academic Press 2009, an imprint of Elsevier.
2. G. F. Simmons -- Introduction to Topology and Modern analysis (Tata Mc Graw Hill)

Module 1 **(25 hours)**

Vector spaces: Vectors, Subspace, Linear Independence, Basis and Dimension, Row Space of a Matrix.
(Chapter – 2 Sections 2.1, 2.2, 2.3, 2.4, 2.5 of text 1)

Module 2

(30 hours)

Linear Transformations: Functions, Linear Transformations, Matrix Representations, Change of Basis, Properties of Linear Transformations.

(Chapter –3 Sections 3.1, 3.2, 3.3, 3.4, 3.5 of text 1)

Module 3

(15 hours)

Metric Spaces – Definition and Examples, Open sets, Closed Sets. , Cantor set

(Chapters: - 2,Sections 9, 10,11 of text 2)

Module 4 **(20 hours)**

Convergence, Completeness, Continuous Mapping (Baire's Theorem included)

(Chapter: -2 ,Sections 12, 13)

Reference:

1 I. N. Herstein – Topics in Algebra , Wiley India

2 Harvey E. Rose - Linear Algebra, A Pure Mathematical Approach, Springer

3 Devi Prasad, - Elementary Linear Algebra, Narosa Publishing House

4 K. P. Gupta – Linear Algebra, Pragathi Prakashan

5 Promode Kumar Saikia – Linear Algebra, Pearson

6 Derek J. S. Robinson – A Course in Linear Algebra with Applications, Allied.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	5	2	2	1
II	5	2	2	1
III	4	2	1	1 (III or IV)
IV	2	2	1	
Total	16	8	6	3

B.Sc. DEGREE PROGRAMME

MATHEMATICS
(COMPLEMENTARY COURSE TO
PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY)
FIRST SEMESTER

MP1C01: Differential Calculus and Trigonometry

4 hours/week **3 credits**

Text Books: -

1. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.
2. S.L. Loney – Plane Trigonometry Part – II, AITBS Publishers India, 2009.

Module 1

Differential Calculus:
Rates of change and limits, calculating limits using the limit laws, the precise definition of a limit, one sided limits and limits at infinity, derivative of a function, differentiation rules, the derivative as a rate of change, derivatives of trigonometric functions, the chain rule and parametric equations, implicit differentiation.

(22 hrs)

(Sections 2.1 – 2.4, 3.1 – 3.6 of Text 1)

Module II

Applications of Derivatives: **(15 hrs)**
Extreme values of functions, The Mean Value Theorem, Monotonic functions and the first derivative test.

(Sections 4.1 - 4.3 of Text 1)

Module III

Partial Derivatives: **(15 hrs)**

Functions of several variables (Definition only), Partial derivatives, The Chain Rule (Sections 14.3 - 14.4 of Text 1)

Module 1V

Trigonometry **(20hrs)**

Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$, $\sin^n \theta$, $\cos^n \theta$, $\sin^n \theta \cos^m \theta$ Circular and hyperbolic functions, inverse circular and hyperbolic function. Separation into real and imaginary parts. Summation of infinite series based on C + iS method. (Geometric, Binomial, Exponential, Logarithmic and Trigonometric series)

(Relevant Sections in Chapter 3 – 5 and Chapter 8of Text 2)

Reference Books :

1. Shanti Narayan : Differential Calculus (S Chand)
2. George B. Thomas Jr. and Ross L. Finney : Calculus, LPE, Ninth edition, Pearson Education.
3. S.S. Sastry, Engineering Mathematics, Volume 1, 4th Edition PHI.
4. Muray R Spiegel, Advanced Calculus, Schaum's Outline series.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	5	2	2	1*
II	5	2	2	1*
III	4	2	1	1
IV	2	2	1	1
Total	16	8	6	3

* choose one question from either of these modules

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO
PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY)
SECOND SEMESTER

MP2C01: Integral Calculus and Matrices

4 hours/week **3 credits**

Text Books: -

1. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.
2. Frank Ayres Jr : Matrices, Schaum's Outline Series, TMH Edition.

Module I

(15 hrs)

Integral Calculus:

A quick review of indefinite integral as anti derivative. The Definite integral. The fundamental theorem of Calculus

(Section 5.3 and 5.4 of Text -1).

Module II

(20 hrs)

Application of Integrals

Substitution and area between curves, Volumes by slicing and rotation about an axis (disc method only), Lengths of plane curves, Areas of surfaces of revolution and the theorem of Pappus (excluding theorem of Pappus)

(Section 5.6, 6.1, 6.3, 6.5 of Text - 1),

Module III

(17 hrs)

Multiple Integrals

Double Integrals, area of bounded region in plane only, Double Integrals in Polar form, Triple integrals in rectangular co-ordinates, Volume of a region in space (As in Sections 15.1, 15.2, 15.3, 15.4 of Text - 1)

Module IV

Matrices (20hrs)

Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only.

Systems of Linear equations: System of non homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem (statement only) and simple applications

(Text 2, Chapters – 5, 10, 19, 23).

Reference Books :

1. Shanti Narayan , P .K . Mittal :Integral Calculus (S. Chand & Company)
2. Shanthi Narayanan & P.K. Mittal, A Text Book of Matrices, S. Chand.
3. David W. Lewis - Matrix Theory (Allied)

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	5	2	1	1*
II	4	2	2	1*
III	3	2	2	1
IV	4	2	1	1
Total	16	8	6	3

* choose one question from either of these modules

B.Sc. DEGREE PROGRAMME

MATHEMATICS (COMPLEMENTARY COURSE TO PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY) THIRD SEMESTER

MP3C01: Vector Calculus , Differential Equations and Analytic Geometry

(Applicable from 2011 admission on wards)

5 hours/week **4 credits**

Text :-

1. A. H Siddiqi , P Manchanada : A first Course in Differential Equations with Applications (Macmillan India Ltd 2006)
2. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.

Module I

Vector valued Functions (2 hrs) **(15 hrs)**

Vector Functions, Arc length and unit Tangent vector T, Curvature and unit Normal Vector N, Torsion and unit Binormal vector B, Directional Derivatives and Gradient Vectors.

(**Sections** 13.1, 13.3, 13.4, 13.5 and 14.5 of text 2)

Module II (2 hrs)

Integration in Vector Fields **(25 hrs)**

Line Integrals, Vector fields and Work, Circulation and Flux, Path independence, Potential Function and Conservation Fields, Green's theorem in Plane (Statement and problems only), Surface area and Surface integral, Parameterised Surface, Stoke's theorem(Statement and Problems only), the Divergence theorem and a Unified theory (Statement and simple problems only).

(Sections 16.1 to 16.8 of text 2)

Module III (3 hrs)

Ordinary differential equations **(25 Hrs)**

Exact Differential Equation, Linear Equations , Solutions by Substitutions, Equations of first order and not of first degree , First order equations of higher Degree solvable for p , Equations

3

solvable for y, Equations solvable for x, Equations of first degree in x and y - Lagrange's and Clairaut's Equation

(sections 2.1 , 2.2 , 2.3 , 2.4 , 3.1 , 3.2 , 3.3 , 3.4 , 3.5 of text 1)

Module IV

(3 hrs)

Analytic Geometry **(25 hrs)** (3)

Conic sections and Quadratic equations, Classifying Conic Sections by Eccentricity, Conics and Parametric equations, The Cycloid, polar co-ordinates, Conic Sections in Polar coordinates. (Sections 10.1, 10.2, 10.4, 10.5, 10.8 of Text 2)

(exclude the pedal Method and Newtorian Method)

Reference Books :

1. Shanti Narayan , P .K . Mittal :Vector Calculus (S. Chand & Company)
2. P.P.G Dyke : An introduction to Laplace Transfoorms and Fourier Serices (Springer 2005)
3. Harry F. Davis & Arthur David Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
4. Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, Asian Student edition.
5. Merle C. Potter – Advanced Engineering Mathematics , Oxford University Press.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	4	2	1	...
II	4	2	2	1
III	4	2	1	1
IV	4	2	2	1
Total	16	8	6	3

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO PHYSICS/CHEMISTRY/PETROCHEMICALS/GEOLOGY)
FOURTH SEMESTER

MP4C01: Fourier Series , Differential Equations, Numerical Analysis and Abstract Algebra

(Applicable from 2011 admission on wards)

4 credits

5 hours/week

1. Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.
2. Ian Sneddon – Elements of Partial Differential Equation (Tata Mc Graw Hill)
3. S.S . Sastry : Introductory methods of Numerical Analysis ,4th edition (Prentice Hall)
4. John B Fraleigh - A first course in Abstract Algebra (7th Edition) Pearson Education

Module I

(25 hrs)

Special Functions (3hr)

Fourier Series : Periodic Functions, Trigonometric Series, Functions of any period p = 2L Fourier Series, Even and Odd functions, Half-range Expansions.

Legendre Polynomials – A brief introduction to power series and power series method solving Differential equations. Legendre equation and Legendre Polynomials , Rodrigues' Formula, Bessel's Equation .Bessel's Functions

(Sections 10.1, 10.2, 10.3, 10.4, 4.1, 4.3 , 4.5 of Text 1 – Excluding Proofs).

Module II (2hr)

(15 Hrs)

Partial Differential Equations

Surfaces and Curves in three dimensions, solution of equation of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's method

(Chapter 1 , section 1 and 3 & Chapter 2 Section 1, 2 and 4 of text 2)

Module III

Numerical Analysis (3hr) **(25 Hrs)**

(Use of Non Programmable Scientific Calculator is Permitted)

Absolute , relative and percentage errors. A general error formula . Error in a series Approximation. Bisection Method , Methods of false position , Iteration Method , Acceleration of convergence: Aitken's Δ^2 Process, Newton Raphson Method, the quotient – Difference method .

(section 1.3, 1.4, 1.5 , 2.1 , 2.2 , 2.3 , 2.4, 2.5 and 2.11 of Text 3)

Module IV

Abstract algebra (2hr) **(25 hrs)**

Groups, Subgroups, Cyclic groups, Groups of Permutations and Homomorphisms, Rings and Fields , Vector Spaces.

(Section 1.4, 1.5, 1.6, 2.8, 3.13, 4.18, 6.30 of text 4)

Reference :

1. Stephen Andrilli, David Hecker - Elementary Linear Algebra ,Academic Press
2. Surjeet Singh, Qazi Zameeruddin - Modern Algebra Eighth Esition Vikas Pub. House
3. R. K. Ghosh, K. C. Maity – An Introduction to Differential Equations, New Central Books
4. Shepley L. Ross – Differential Equation , Wiley India
5. Srimanta Pal – Numerical Methods, Oxford University Press
6. Qazi Shoeb Ahamad, Zubir Khan – Numerical and Statistical Techniques, Ane Books

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	4	2	2	1
II	4	2	1	1*
III	4	2	2	1
IV	4	2	1	1*
Total	**16**	**8**	**6**	**3**

* Choose one question from either of these modules

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO ECONOMICS)
FIRST SEMESTER

ME1C01: Graphing functions, Equations and Linear Algebra

6hours/week **4 credits**

Text Books:-

1. Edward T Dowing : Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)

MODULE-I

Review
Exponents, polynomials, factoring, fractions, radicals, order of mathematical operations.

Equations and Graphs
Equations, Cartesian Co-ordinate system, linear equations and graphs slopes intercepts. The slope intercept form. Determining the equation of a straight line. Applications of line equations in business and economics.

MODULE-II

Functions
Concepts and definitions- graphing functions. The algebra of functions. Applications of linear functions for business and economics.

Solving quadratic equations
Facilitating non linear graphing. Application of non linear functions in business and economics.

System of equations
Introduction, graphical solutions. Supply-demand analysis. Break-even analysis. Elimination and substitution methods. IS-LM analysis. Economic and mathematical modeling. Implicit functions and inverse functions.

MODULE-III

Linear (or Matrix) Algebra
Introduction. Definition and terms. Addition and subtraction of matrices. Scalar multiplication. Vector multiplication. Multiplication of matrices. Matrix expression of a system of linear

equations. Augmented matrix. Row operation. Gaussian method of solving linear equations. Solving linear equations with.

Matrix algebra

Determinants and linear independence. Third order determinants. Cramer's rule for solving linear equations. Inverse matrices. Gaussian method of finding an inverse matrix. Solving linear equations with an inverse matrix. Business and Economic applications. Special determinants.

MODULE-IV

Linear programming : using graphs:

Use of graphs. Maximisation using graphs. The extreme point theorem. Minimisation using graphs.

Reference Books :

1. Taro Yaman : Mathematical Economics

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	4	2	1	...
II	4	2	1	...
III	4	2	2	2
IV	4	2	2	1
Total	16	8	6	3

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO ECONOMICS)
SECOND SEMESTER

ME2C01: Calculus, Exponential and Logarithmic Functions

6hours/week **4 credits**

Text Books:-

1. Edward T Dowing : Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)

Module – 1

Differential calculus

The derivative and the rules of differentiation: limits, continuity. The slope of curvilinear function. The derivative, differentiability and continuity. Derivative notation. Rules of differentiation. Higher order derivatives. Implicit functions. Differential calculus. Uses of derivatives. Increasing decreasing functions. Concavity and convexity. Relative extrema. Inflection points. Curve sketching. Optimisation of functions. The successive derivative test. Marginal concepts in economics. Optimising economic functions of business. Relation among total, marginal and average functions.

Module – 1I

Exponential and logarithmic functions

Exponential functions. Logarithmic functions properties of exponents and logarithms. Natural exponential and logarithmic functions. Solving natural exponential and logarithmic functions. Logarithmic transformation of non linear functions. Derivatives of natural exponential and logarithmic functions. Interest compounding. Estimating growth rates from data points.

Module – 1II

Integral calculus:

Integration rules for indefinite integrals. Area under a curve. The definite integral. The fundamental theorems of calculus. Properties of definite integrals. Area between curves. Integration by substitution. Integration by parts. Present value of cash flow consumer's and producers surplus.

Module – 1V

Calculus of Multivariable functions:

Functions of several independent variables. Partial derivatives. Rules of partial differentiation . Second – order partial derivatives. Optimization of multivariable functions. Constrained optimization with Lagrange Multipliers. Income determination Multipliers. Optimization of multivariable functions in business and economics constrained optimization of multivariable economic functions. Constrained optimization of Cobb Douglas production functions.

Reference Books :

1. Taro Yaman : Mathematical Economics

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I	4	2	2	1
II	4	2	2	....
III	4	2	1	1
IV	4	2	1	1
Total	16	8	6	3