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)

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MAHATHMA GANDHI UNIVERSITY, KOTTAYAM

B.Sc MATHEMATICS PROGRAMME
UNDER
COURSE – CREDIT AND SEMESTER SYSTEM (CCSS UG)
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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/ seme	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 – 1I	4	3
		Complimentary2 Course – 1I	4	3
3	III	English III	5	4
		Sec. Lang./Common course I	5	4
		Mathematics Core Course - 3	5	4
		Complimentary1 Course – 1I	5	4
		Complimentary2 Course – 1I	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

5 hours/week **4 credits**

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

(A quick review) **(20 hrs)**

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

Integration in Vector Fields **(30 hours)**

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

Theory of Equations **(25 hours)**

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 , cos , $\sin^n$

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 αcuts, 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

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**

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

(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
IV	2	2	1	(III or IV)
Total	**16**	**8**	**6**	**3**

MAHATHMA GANDHI UNIVERSITY

COURSE-CREDIT AND SEMESTER SYSTEM (CCSS UG)

MATHEMATICS (OPEN COURSE)

SYLLABUS

(Effective from 2009 admission onwards)

UG PROGRAMME
MATHEMATICS OPEN COURSE
FIFTH SEMESTER
MM5D01: MATHEMATICAL MODELLING

4 hours/week **4 credits**

Prerequests :-

Some knowledge of Trigonometry, Geometry, Ordinary Differential Equations, Probability Distribution, Chi-square test and Programming skills in C.

Objectives:

The objective of the course is to give knowledge of the basic principles of mathematical modelling by analytical methods as well as by simulation using computers. On completion of this course the students will be able to form mathematical models from various areas of life which include :- Industry, Medicine, Physics, Chemistry, Biology, Astronomy etc.

Texts:

[1] Mathematical modelling- J.N.Kapoor, New Age International, 2001 Reprint.
[2] System simulation with digital computer- Narsing Deo, Prentice Hall of India, Sixth printing, 1996.

MODULE-1:

INTRODUCTION **[18 Hrs.]**

Mathematical modelling-what and why? Classification of mathematical models, Characteristics of mathematical models, Mathematical modelling through geometry, algebra, trigonometry & calculus, Limitations of mathematical modelling.
[Chapter-1: Sections 1.1 to 1.9 of book [1]; Page Nos. 1-29]

MODULE-2 :

MODELLING THROUGH FIRST ORDER **[18 Hrs.]**

Linear growth and decay models, Non-linear growth and decay models, Compartment models, Modelling in dynamics and Modelling of geometrical problems.
[Chapter-2: Sections 2.1 to2.6 of book [1]; Page Nos.30 -52.]

MODULE-3 :

SYSTEM SIMULATION **[18 Hrs.]**

Introduction, Examples, Nature of simulation, Simulation of a chemical reactor, Euler and Runge-Kutta integration formulae, Simulation of a water reservoir system, Simulation of a servo system. (Write and execute all the computer programs throughout this course using C)

[Chapter-1: Sections 1.1 to 1.7 & Chapter-2: Sections 2.1 to 2.6 and 2.9 of book [2]; Page Nos. 1-39.]

MODULE-4:

DISCRETE SYSTEM SIMULATION **[18Hrs.]**

Fixed time-step vs. event-to-event model, On simulating randomness, Monte-Carlo computation vs. stochastic simulation, Rudiments of queuing theory, Simulation of a single-server queue.

[Chapter-3: Sections 3.1 to 3.7 and Chapter-4: Sections 4.1 & 4.2 of book [2]; Page Nos. 40-76.]

References

[1] System simulation – Geoffrey Gordon, Prentice Hall of India, Second edition.

[2] Mathematical modeling for industry and engineering- Thomas Svobodny, Prentice Hall.

[3] Mathematical modeling- F.R.Giordano, M.D.Weir&William P.Fox, Third edition.

[4] A practical course in differential and mathematical modeling- Ibragimov N.H, Alga Publications.

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I				
II				
III				
IV				
Total	16	8	6	3

UG PROGRAMME
MATHEMATICS OPEN COURSE
FIFTH SEMESTER
MM5D02: APPLICABLE MATHEMATICS

4 hours/week **4 credits**

The objective of module – 1 & 2 is to prepare students of all streams, particularly those with arts and commerce back ground for their higher studies. A detailed study is not necessary from these modules. All questions asked to be of arts students' standard

Module – 1 **(18 hours)**

Types of numbers, Quadratic equations (Solution of quadratic equations with real roots only), Logarithms – All rules with out proof, Multiplication and division of numbers, Evaluating expressions of the form $x^{p/q}$, x any real number, p & q are integers, Permutations and combinations – simple applications, Trigonometry introduction, Values of trigonometric ratios of 0^0, 30^0, 45^0, 60^0& 90^0, Heights and distances – Simple cases - (application of sinx, cosx, tanx, and their reciprocals only). Two dimensional geometry- Introduction, plotting points and drawing graph of the lines of the form ax + by + c = 0.

Module – 2 **(18 hours)**

Probability – Introduction – Sample spaces and events, Simple examples like tossing coin , tossing die etc.., Differential Calculus - Differentiation – Standard results (derivatives) with out proof, Product rule, Quotient rule and function of function rule), Integral calculus (Integration simple cases, with and with out limits)
No core text book is needed for Modules 1 & 2

The objective of module – 3 & 4 is to prepare students of all streams, particularly those with arts and commerce back ground to approach competitive examinations. Detailed explanation and short cut method for solving problems are to be introduced to students, so that they can acquire better understanding of concepts and problem solving skill. Assignments not less than 20 questions may be given from each topic of these modules. (For University examinations it is to be specified, whether a problem is solved in detail or use some short cut method.)

Module – 3 **(18 hours)**

HCF and LCM of numbers, Fractions, Squares and square roots, cube and cube roots, simplifications, Ratio and Proportion, Percentage, Profit and loss, Simple average (No Weighed average)
(Sections – 2, 3, 5, 6, 7, 9,10,11, 13)

Module – 4 **(18 hours)**

Simple interest, Compound interest, Time and work, Work and wages, (Exclude Pipes and Systems from the core reference), Time and distance, Elementary mensuration – Area and perimeter of polygons, Elementary Algebra, (Simplifications of algebraic expressions)
(Sections - 14, 15, 17, 18, 21, 22, 23)

Core Reference – M. Tyra, & K. Kundan- CONCEPTS OF ARITHMETIC,
BSC PUBLISHING COMPANY PVT.LTD.
C – 37, GANESH NAGAR, PANDAV NAGAR COMPLEX
DELHI - 110092

QUESTION PAPER PTTERN

<table>
<tr><th>Module</th><th>Part A</th><th colspan="2">Part B</th><th colspan="2">Part C</th><th>Part D</th></tr>
<tr><td>I</td><td>3</td><td colspan="2" rowspan="2">2

2</td><td>1</td><td rowspan="2">1(I or II)</td><td>1</td></tr>
<tr><td>II</td><td>3</td><td>1</td><td>1</td></tr>
<tr><td>III</td><td>5</td><td>2</td><td rowspan="2">1

(III or IV)</td><td>1</td><td>1

(III or IV)</td><td>1

(III or IV)</td></tr>
<tr><td>IV</td><td>5</td><td>2</td><td>1</td></tr>
<tr><td>Total</td><td>16</td><td colspan="2">9</td><td colspan="2">6</td><td>3</td></tr>
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UG PROGRAMME

MATHEMATICS OPEN COURSE
FIFTH SEMESTER
MM5D03 : FINANCIAL MATHEMATICS

4 hours/week **4 credits**

Text Book:

Mc Cutch eon and Scot Heinemann, *An introduction to the Mathematics of Finance*, Professional publishing

Module – 1

Theory of interest rates : Rate of interest – Accumulation factors – Force of interest and Stoodley's formula for the force of interest. Basic Compound interest relations: Relationships between s, i, v, and d – The equation of value and yield on a transaction.
Annuity certain: Present values and accumulations – Loan schedule for a level annuity – Continuously payable annuities and varying (increasing and decreasing) annuities.
Nominal rates of interest: Annuities payable p –thly- present values and accumulations- Loan schedule for p-thly annuities.

Module - 2

Discounted cash flow: Net percent values and yields – The comparison two investment projects – The effects of inflation – The yield on a fund and measurement of investment performance. Capital Redemption Policies: Premium calculations- Policy values, Surrnder values, paid-up policy values and policy alterations, Stood ley's logistic model for the force of interest, reinvestment rates.

Module - 3

Valuation of securities: Fixed interest securities – Ordinary shares, prices and yields, perpetuities – Mak ham's formula, optional redemption dates – Effect of the term to redemption on the yield – Real returns and index linked stocks. Capital Gains Tax: Valuing a loan with allowance for capital gains tax - capital tax when the redemption price of the rate of tax is not constant - Finding the yield when there is capital gains tax - optional redemption dates – Offsetting capital losses against capital gains.

Module – 4

Cumulative Sinking Funds (Restricted coverage): The relationships between successive capital repayments – the term of the loan when the redemption price is constant.

Reference:

1. Sheldon M.Ross - *An Introduction to Mathematical Finance*, Cambridge University Press.
2. John C. Hull - *Options, Futures, and other Derivatives*, Prentice Hall of India Pvt Ltd.
3. Salih N. Neftci - *An Introduction to the Mathematics of Financial Derivatives*, Academic press.
4. Robert J Elliot and P Ekkehard Kopp - *Mathematics of Financial Market*, Springer-Verlag, New York Inc.

QUESTON PAPER PATTERN

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

UG PROGRAMME

MATHEMATICS OPEN COURSE
FIFTH SEMESTER
MM5D04 : MATHEMATICAL ECONOMICS

4 hours/week **4 credits**

Text books:

1. H.L. Ahuja : Principles of Micro Economics, 15th Revised Edition, S. Chand
2. Edward T. Dowling: Introduction to Mathematical Economics, Schaum's Outline Series, Third edition, TMH.

Module I :

Demand and Supply Analysis **(20 hrs)**

Utility and demand – the meaning of demand and quantity demanded – the law of demand – demand curve – market demand curve – reasons for the law of demand – slope of a demand curve – shifts in demand – demand function and demand curve – the meaning of supply – supply function – law of supply – slope of a supply curve – shifts in supply – market equilibrium – price elasticity of demand – measurement of price elasticity – arc elasticity of demand – cross elasticity of demand.

(Relevant sections chapters 5 and 7 of Text -1)

Module II:

Cost and Revenue Functions **(20 hrs)**

Cost function: Average and marginal costs, Short run and long run costs, Shapes of average cost curves in the short run and long run and its explanation, Revenue function, Marginal revenue (MR) and Average Revenue (AR) functions, Relation between MR, AR and Elasticity of demand.

(Relevant sections of chapter 19 & 21 of Text - 1)

Module III:

Theory of Consumer Behaviour **(20 hrs)**

Cardinal utility analysis – the Law of diminishing marginal utility – the Law of equi-marginal utility – Indifference curves – Ordinal utility – Indifference map – Marginal rate of substitution – Properties of indifference curves.

(Relevant sections of chapters 9 and 11 of Text -1)

Module IV:

Economic Applications of Derivatives (30 hrs)

Economic Applications of Derivatives. Marginal, average and total concepts optimizing economic functions - Functions of several variables and partial derivatives, Rules of partial differentiation, Second order partial derivatives, Optimization of multivariable functions, Constrained optimization with Lagrange multipliers, Significance of the Lagrange multiplier, Total and partial derivatives – total derivatives.

Marginal productivity, Income determination, multipliers and comparative statics, Income and cross elasticity of demand, Optimization of multivariable function in Economics constrained optimization of multivariable functions in Economics.

(Chapter 4 – Sections 4.7 and 4.8; chapter 5 and chapter 6 sections 6. 1 to 6.5 – of text 2).

References

1. Singh, Parashar, Singh --*Econometrics & Mathematical Economics*, S. Chand & Co. 1997.
2. R.G.D. Allen - Mathematical Analysis for Economists, Macmillan, ELBS.
3. Edward T. Dowling - Introduction to Mathematical Economics, Third edition, Schaum's Outline Series, TMH.
4. Henderson & Quandt - Microeconomic Theory: A Mathematical Approach, 3rd Edition, TMH.
5. Taro Yamane - Mathematics for Economists: An elementary survey. Second Edition, PHI.
6. Srinath Baruah - Basic Mathematics and its Application in Economics, Macmillan.

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	1	1
IV	4	2	2	
Total	**16**	**8**	**6**	**3**

MAHATHMA GANDHI UNIVERSITY

B.Sc. DEGREE PROGRAMME

COURSE-CREDIT AND SEMESTER SYSTEM (CCSS UG)

MATHEMATICS (CHOICE BASED COURSE)

(DURING THE 6TH SEMESTER)

SYLLABUS

(effective from 2009 admission onwards)

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CHOICE BASED COURSE)
SIXTH SEMESTER
MM6D01 : OPERATIONS RESEARCH

4 hours/week **3 credits**

Text Books:

1. K. V Mital and C. Mohan - Optimization Methods in Operations Research and System Analysis (3rd edition) (New Age International)
2. J. K. Sharma : Operation Research Theory and Application (3rd edition)

Introduction :

The programming which involves functions and constraints that are linear is popularly known as Linear Programming. There are various types of Mathematical Programming depends upon the nature and character of the objective function, constraints and decision variable. There may include Integer Programming, Dynamic Programming, Stochastic Programming etc. The present course deals with LPP and its application and the introduction of Queueing theory. These methods are extensively used in various areas of Management, Business, Industry and in several situations. This course is divided into 4 modules and each module is further classified into sections and subsections.

Objectives :

After studying this course, the students should able to

- Define a Euclidean space, a vector space and its basis.
- Write a given LPP in standard form and in a canonical form
- Identify a feasible solution, a basic feasible solution, and an optimal solution using simplex method.
- Identify the Transportation Problem and formulate it as an LPP and hence solve the problem
- Determine that an Assignment problem is a special case of LPP and hence solve by Hungarian method.
- Identify the queueing models.

Module 1

Mathematical Preliminaries **(10 hrs)**

Euclidean Space : Vectors and vector space Linear dependence, dimensions of a vector space, basis.

Convex sets : Open and closed sets in E_n, convex linear combinations, convex sets, intersection of convex sets, convex hull of a set, vertices of a convex set, convex polyhedron, hyper planes, half spaces and polytopes, separating and supporting hyper planes, (All Theorems without proof)

Linear Programming **(10 hrs)**

Introduction, LP in two dimensional space, general LPP, Feasible solution, Basic and basic feasible solution, optimal solution.

Ch. 1 (Section 1 – 5 and 11 – 18 of text 1)

Module 2

Linear Programming Contd. **(20 hrs)**

Simplex method (numerical example) Simplex tableau, Finding the first b.f. s., artificial variables, Degeneracy, simplex multipliers, Duality in LPP, Duality theorems, Application of duality, Dual simplex method.

Ch. 3 (Section 1 – 20 except 16 of text 1)

Module 3

Transportation and Assignment Problems **(17 hrs)**

Introduction, transportation problem, Transportation array, Transportation matrix, triangular basis, finding a basic feasible solution, testing of optimality, loop in a transportation problem, change the basis, Degeneracy, Unbalanced problem, Assignment problem.

Ch. 4 (Section 1 – 11 & 14 of text 1)

Module 4

Queuing Theory **(15 hrs)**

Introduction, Essential features of queuing system, Calling population, Characteristic Queuing Process, Queue discipline, Service Process (or Mechanisms) , Performance measure of Queuing system. Transient- state and Steady – state, Relationship among Performance measure. Probability distribution in Queuing system, Distribution of arrival (Pure Birth Process), Distribution of interarrival times (Exponential process) Distribution of departure (Pure Death Process) Distribution of Service Times.

Ch. 16 (Section 16.1 – 16.4 of text 2)

Reference:

1. Operation Research by Kanti Swarup, P. K. Gupta and Man Mohan - (Sultan Chand and Sons)
2. Problems in Operations Research by Gupta P. K. and Hira D. S. - (S. Chand)
3. Operations Research by Ravindran A., Philip D. T. and Solberg J. J. - (John Wiley and Sons)
4. B. K. Mishra , B. Sharma – Optimization Linear Programming (Ane Books)
5. Mokhtar S. Bazaraa, J. J. Jarvis, H.D. Sherali – Linear Programming and Network Flows (Wiley India)

QUESTON PAPER PATTERN

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

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CHOICE BASED COURSE)
SIXTH SEMESTER
MM6D02: PROGRAMMING IN C

4 hours/week **3 credits**

Text book:

E. Balagurusamy - Programming in ANSI C, fourth edition, The Tata Mc Graw - Hill publishing Company,
Chapters 2 to 9

Module I **(25 hrs)**

Constants Variables and Data Types

Introduction, Character set, C Tokens, Key words and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Declaration of Storage Class, Assigning Values to Variables, Defining Symbolic Constants, Declaring a Variable as Constant, Declaring a Variable as Volatile, Over flow and Under flow of Data,

Operators and Expressions.

Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Some Computational Problems, Type Conversions in Expressions, Operator Precedence and Associativity, Mathematical Functions

Managing In Put and Out Put Operations.

Introduction, Reading a Character, Writing a Character, Formatted In put, Formatted Out put
(Chapters 2 , 3 , 4)

Module II **(15 hrs)**

Decision Making and Branching

Introduction, Decision Making with IF Statement, Simple IF Statement, The IF……Else Statement, Nesting of IF……Else Statement, The Else…….IF Ladder, The switch Statement, The **?:** Operator The GOTO Statement

Decision Making and Looping

Introduction, The WHILE Statement, The DO Statement, The FOR Statement, Jumps in LOOPS, Concise Test Expressions
(Chapters 5 and 6)

Module III **(15 hrs)**

Arrays

Introduction, One Dimensional Arrays, Declaration of One Dimensional Arrays, Initialization of One Dimensional Arrays, Two Dimensional Arrays, Initialization of Two Dimensional Arrays, Multidimensional Arrays, Dynamic Arrays, More about Arrays.

Character Arrays and Strings

Introduction, Declaring and Initializing String Variables, Reading Strings from Terminal, Writing Strings to Screens. Arithmetic Operations on Characters, Putting Strings together, Comparison of two Strings, String Handling Functions. Table of Strings, Other Features of Strings

Module IV **(17 hrs)**

User Defined Functions.

Introduction, Need for User Defined Functions, A Multi Function Programme, Elements of User Defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, No Arguments and No Return Values, Arguments but No Return Values, Arguments with return Values, No Arguments but Returns a Value, Functions That Return Multiple Values, Nesting of Functions, Recursions, Passing Arrays to Functions, Passing Strings to Functions, The scope, Visibility and Life Time of Variables, Multi File Programmes

(Chapters 7 ,8 and 9)

Reference:

1. V. Rajaraman - Computer Programming in C, Prentice Hall of India, Pvt Ltd

2. Byron S Gottried - Theory and Problems of Programming with C, (Schaums) Tata Mc Graw – Hill.

3. Yashwanth P Kanethkar - Let us C, BPB Publications,.

QUESTON PAPER PATTERN

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

B.Sc. DEGREE PROGRAMME

MATHEMATICS (CHOICE BASED COURSE)
SIXTH SEMESTER
MM6D03 : TOPOLOGY

4 hours/week **3 credits**

Text book:

James R Munkres -Topology - Second Edition,
PEARSON PRENTICE HALL, An imprint of Pearson Education
(First Impression, 2006)

Module – 1 **(17 Hours)**

Topological Spaces, Basis for a Topology,
The product Topology on X x Y, The Subspace Topology.

Module – 2 **(33 Hours)**

Closed sets and Limit Points, Continuous functions,
The Metric Topology

Module – 3 **(12 Hours)**

Connected Spaces, Connected subspaces in the Real Line

Module – 4 **(10 Hours)**

Compact Spaces

Chapter – 2
Sections 12, 13, 15, 16, 17, 18, 20
Chapter - 3
Sections 23,24, 26

Reference :

Introduction to Topology and Modern Analysis – G. F. Simmons

QUESTION PAPER PATTERN

<table>
<tr><td>Module</td><td>Part A</td><td>Part B</td><td colspan="2">Part C</td><td>Part D</td></tr>
<tr><td>I</td><td>4</td><td>2</td><td colspan="2">1</td><td rowspan="2">1
(I or II)</td></tr>
<tr><td>II</td><td>5</td><td>2</td><td>2</td><td rowspan="2">1
(II or III)</td></tr>
<tr><td>III</td><td>4</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td>IV</td><td>3</td><td>2</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>Total</td><td>16</td><td>8</td><td colspan="2">6</td><td>3</td></tr>
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B.Sc. DEGREE PROGRAMME

MATHEMATICS (CHOICE BASED COURSE)
SIXTH SEMESTER
MM6D04 : THEORY OF COMPUTATION

4 hours/week **3 credits**

Text book:

K.L.P. Mishra and N.Chandrasekaran - *Theory of Computer Science, Automata, Languages and Computation* (Third Edition) , Prentice- Hall of India Pvt. Ltd, New Delhi

Module 1 **(22 Hrs)**

The Theory of Automata: Definition of Automaton – Description of Finite Automaton – Transition Systems – Properties of Transition Functions – Acceptability of a String by a Finite Automaton – Nondeterministic Finite State Machines – The Equivalence of DFA and NDFSA. Examples.

Module – 2 **(15 Hrs)**

Formal Languages: Basic Definitions – Definition of a Grammar – Derivations and Language Generated by a Grammar – Examples

Module – 3 **(15 Hrs)**

Chomsky Classification of Languages – Languages and their relation – Operation on Languages – Languages and Automata - Examples

Module – 4 **(20 Hrs)**

Regular expressions – Identities for Regular Expressions – Finite Automata and Regular Expressions – Transition system Containing Λ- moves- NDFAs with Λ- moves and Regular Expressions – Conversion of Nondeterministic Systems to Deterministic Systems – Algebraic Method Using Arden's Theorem - Construction of Finite Automata Equivalent to a Regular Expression – Equivalence of Two Finite Automata – Equivalence of Two Regular Expressions. Examples

Chapters – 3, 3.1- 3.7, 4.1, 4.2, 4.3, 4.6, 5.1 and 5.2 (Proof of theorems 5.1, 5.2, 5.3 and 5.4 are omitted)

Reference:

1. John E. Hopcroft, Jefrey D. Ullman - *Introduction to Automata Theory Languages, and Computation*, Narosa Publishing House 1999
2. Peter Linz - *An Introduction to Formal Languages and Automata* (second edition) Narosa Publishing House 1997.

QUESTON PAPER PATTERN

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

MAHATHMA GANDHI UNIVERSITY

B.Sc. DEGREE PROGRAMME

COURSE-CREDIT AND SEMESTER SYSTEM (CCSS UG)

MATHEMATICS
(COMPLEMENTARY COURSES)

SYLLABUS

(effective from 2009 admission onwards)

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.

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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

Integral Calculus: **(15 hrs)**

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

Application of Integrals **(20 hrs)**

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

Multiple Integrals **(17 hrs)**

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 **(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

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

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

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

Analytic Geometry **(25 hrs)**

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)

5 hours/week **4 credits**

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

Special Functions **(25 hrs)**

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

Partial Differential Equations **(15 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)

Module III

Numerical Analysis **(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 **(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 B.Sc Electronics / Computer Science)
FIRST SEMESTER

MEC1C01: Vector Analysis, Differential Equation, Fourier series and Integral Transform

4 hours/week **4 credits**

Aim of the course:

To achieve a thorough knowledge of Vector Calculus, Co-ordinate system, Differential equation, Fourier series and Integral Transform

Text Book:

1. Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.
2. B S Grewal - Higher Engineering Mathematics, Khanna Publishers

Module I **(25 Hours)**

Vector Analysis:

A quick Review of the basic concepts (Sections 8.4, 8.5, 8.6 of text 1),
Gradient of a scalar field; Directional Derivative, Divergence of a vector field, Curl of a Vector Field. (Sections 8.9, 8.10, 8.11 of Text 1).
A quick Review of Line Integrals, Surface Integrals, and Triple Integrals, (sections 9.1 and 9.6 of text 1)
Green's Theorem in the Plane, Divergence theorem of Gauss and Stoke's theorem (without proofs).
(Sections 9.4, 9.7, 9.9, of Text 1)

Co-ordinate System:

Cartesian, Spherical and Cylindrical co-ordinate systems and transformations. Forms of the Gradient, Divergence, Curl and Laplace an operators in the co-ordinate systems

(As in Text 2)

Module II **(22 hours)**

Ordinary Differential Equations:

Exact differential equations, homogenous, non-homogeneous, linear and Bernoulli's equations. Linear Differential equation of second order with constant coefficients. Simultaneous equations with constant coefficients

Partial Differential Equations:

Laplace's equation, Poisson equation and wave equation.

(Relevant sections of Text 2)

Module III **(15 Hours)**

Fourier Series:

Periodic functions, trigonometric series, Fourier series , Functions of any period, Even and odd functions, Half range expansions,

(Sections 10.1, 10.2, 10.3, 10.4, Text 1)

Module IV **(10 Hours)**

Integral Transform:

Laplace Transform, inverse Laplace Transform, Linearity, shifting, Transforms of derivatives and integrals Solution of differential equations by Laplace Transform

(Sections 5.1 and 5.2 of text 1)

References:

1. George B. Thomas and Ross L. Finney - Calculus and Analytical Geometry (9^{th} Edition) – Addison wesley
2. A.H. siddiqi, P. Manchanda - A First Course in Differential Equations with Application (Macmillian)
3. G. F. Simmons - Differential equation with applications and historical notes (Tata Mc Graw Hill)

4. Ian Sneddon - Elements of Partial Differential Equation – Ian Sneddon (Tata Mc Graw Hill)

QUESTON PAPER PATTERN

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

* choose one question from either of these modules

B.Sc. DEGREE PROGRAMME
MATHEMATICS (Complementary Course To B.Sc Electronics / Computer Science)
SECOND SEMESTER
MEC2C01 : LINEAR ALGEBRA AND GRAPH THEORY

4 hours/week **4 credits**

Aim of the course: To equip the student with a thorough knowledge on Vector spaces, Linear Algebra and Graph Theory

Text Books:

1. S. Kumaresan -- Linear Algebra, A Geometric Approach, Prentice Hall of India, New Delhi,1999.
2. Seymour Lipschutz. Marc Lars Lipson - Schaum's Outlines Linear Algebra (Series - Schaum's Outlines
3. C. R. Foulds: Graph Theory Applications, Narosa Publishing House, 1994.

Module I

Vector spaces: Definition and examples, Linear Independence basis, Orthonormal Basis, Linear transformation, Matrix via Linear Transformation

Module II

Symmetric, Skew symmetric, Hermitian and Skew Hermitian matrices, Adjoint and Inverse of a matrix, Orthogonal and Unitary matrices, Rank of a matrix, Elementary transformations of a matrix, reduction to normal and echelon form.

Module III

Consistency and solution of System of linear equations, characteristic equation of a matrix, Eigen values, Eigen vectors, Cayley Hamilton theorems, Nature of Characteristic roots of diagonal, Hermitian, Skew –Hermitian and unitary matrices.

Module IV

Graph theory terminology, Paths and Circuits, Representation of Graphs, Path Matrix, Adjacency matrix, Adjacency matrix.

Exterior paths and circuits, Hamiltonian paths and Circuits, Spanning tress, Minimum spanning trees.

Reference Books:

1. I. N. Herstain – Topics in Algebra
2. Narsingh Deo – Graph Theory with Applications to Engineering and Computer Science
3. Santi Narayan - Matrices

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I				
II				
III				
IV				
Total	16	8	6	3

B.Sc. DEGREE PROGRAMME
MATHEMATICS (Complementary Course to B.Sc Electronics / Computer Science)
THIRD SEMESTER
MEC3C01 : NUMERICAL METHODS

4 hours/week **4 credits**

Aim of the Course: To equip the student with the computer based numerical and statistical methods.

Text Books:

1. E. Balagurusamy – Treatment as in Numerical methods, Tata McGraw Hill.
2. P. Kandasamy K.Thilagavathy and K.Gunavathy – Numerical, S.Chand and Company Ltd

Module – 1 **(21 Hrs)**

Approximations and errors in computing – significant digits – Inherent errors – Numerical errors – Truncation errors – Modelling errors – Blunders – Absolute and Relative errors.

Error Propagation - conditioning and Stability – Convergence of an iterative process – Error estimation – Minimizing the total error.

Roots of non – Linear equations – methods of solution – Iterative methods – Starting and stopping an iterative process. – Bisection Method – Convergence of bisection method – False position method – convergence – Newton – Raphson method – convergence – Limitations - Secant Method – convergence.

Module – II **(15 Hrs)**

Solutions to simultaneous linear equations – Existence of solution – Solution by elimination – Basic Gauss Elimination Method – Gauss Elimination with Pivoting - Guass Jordan method – Triangular Factorization Methods – Matrix Inversion method.

Iterative solutions of Linear Equations - Gauss Jocobi Iteration method – Gauss - Seidal iterative method – Method of Relaxation – convergence of iteration methods.

Module – III **(12 Hrs)**

Curve Fitting: Interpolation – Polynomial forms – Linear Interpolation – Lagrange Interpolation polynomial – Newton Interpolation polynomial – Divided difference table – Interpolation with equidistant points – Forward and Backward difference table

Curve Fitting: Regression – Fitting Linear equations – Least squares regression – Fitting Transcendental Equations – Fitting a polynomial function

Module – IV **(24 Hrs)**

Numerical Differentiation – Differentiating Continuous functions – Forward and central difference quotient – Error Analysis – Differentiating Tabulated functions - Higher – order derivatives.

Numerical Integration – Newton – Cotes methods – Trapezoidal Rule – Error analysis – Composite Trapezoidal rule - Simpsons 1/3 rule – Error analysis – Composite Simpsons 1/3 rule – Error analysis – Simpsons 3/8 rule – Boole's rule

Numerical Solution of Ordinary Differential equations – Taylor Series method – Picard's method – Euler's Method – Accuracy of Euler's method – Polygon method – Runge –Kutta Methods.

Reference Books:

1. M.K.Venkataraman– Numerical methods in Science and Engineering , National Publishing company 1990 edition.
2. M.K Jain, R.K Iyengar, R.K Jain " Numerical Methods for Scientific and Engineering Computation". Wiley Eastern Ltd, New Delhi-1997.
3. V. Rajaraman – Computer Oriented Numerical Methods , PHI Pub.

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**

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO STATISTICS)
FIRST SEMESTER
MS1C01: Differential Calculus, Logic & Boolean algebra

4 hours/week **3 credits**

Text Books: -

1. Thomas and Finney: Calculus and Analytic Geometry, 9th Edition (Addison –Wesley)

2. Schaum's outline series - Discrete mathematics, second edition

3.N.P.Bali,Dr.N.Ch.NarayanaIyengar-Engineeringmathematics-Laxmi Publications

Module 1
Differential Calculus: **(22 hrs)**
A quick review of limits of function, rules for finding limits, Derivative of a function, differentiation rules, rate of change, Derivatives of trigonometric functions, chain rule ,Implicit differentiation and rational exponents. Indeterminate forms.L'hospital's rule.
(Sections 1.1, 1.2, 1.3, 2.1, 2.2, 2.3 ,.6.6 of text 1)

Module II
Partial Derivatives: **(20hrs)**
Functions of several variables (Definition and simple examples only), Partial derivatives, Euler's theorem on homogeneous functions, Maxima and minima of functions of two variables, LaGrange's multipliers, Jacobians
(chapter 5, relevant portions of text 3)

Module III
Application of derivatives **(10hrs)**
Extreme values of a function Rolle's Theorem, Mean Value Theorem,(with out proof) First derivative test for local extreme values (Sections 3.1, 3.2, 3.3 of Text 1)

Module 1V Logic and Boolean Algebra **(20 hrs)**
Proposition, compound propositions, basic logical operations, Propositions and truth

tables, Logical equivalence, Algebra of propositions, Conditional and biconditional, Arguments, Propositional functions, Quantifiers
(sections 4.1 to 4.12 of text 2)

Boolean Algebra:

Definitions, theorems, duality, switching circuit
(sections 15.1, 15.2, 15.3, 15.4, 15.10 of Text 2)

Reference Books :

1. Shanty Narayan : Differential Calculus (S Chan)
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. Murray R Spiegel, Advanced Calculus, Schaum's Outline series
5. Robert.R.Stoll-Set theory And Logic (Eurasia Publishers,N.Delhi)
6. B.S.Vatssa-Discrete Mathematics-Third edition

QUESTON PAPER PATTERN

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

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO STATISTICS)
SECOND SEMESTER
MS2C01: Integral Calculus, Fourier Series

4 hours/week **3 credits**

Text Books: -

1. Thomas and Finney : Calculus and Analytic Geometry, 9th Edition (Addison –Wesley)
2. N.P.Bali, Dr.N.Ch.Narayana Iyengar- Engineering mathematics, Laxmi Publications
3. Erwin Kreyszig: Advanced Engineering Mathematics, Eighth Edition, Wiley, India.

Module I

Integral Calculus: (22hrs)

A quick review of indefinite integrals as anti derivatives (sections 4.1& 4.3 of the Text1) Integration by substitution, Integration by parts, Partial fractions, Reduction formula

(sections 7.2, 7.3, 7.4 of the Text 1)

Riemann sums and Definite integrals; properties areas and the Mean value theorem. The Fundamental theorem. Improper integrals, Test for convergence and divergence .
(Section 4.5, 4.6, 4.7 , 7.6 of the Text1).

Module II

Application of Integrals (20hrs)

Application of Integrals: Areas between curves, Volumes of Solids of Revolution (Disk method only), Lengths of plane curves. Areas of surfaces of revolution
(Section 5.1, 5.2, 5.3, 5.5, 5.6 of the text 1),

Module III

Multiple Integrals (15 hrs)

Double Integrals, Evaluation of double Integrals, Changing order of integration, Triple integrals in rectangular co-ordinates, Area by double integration.
(As in Sections 6.1,6.2,6.4,6.5,6.7 of Text 2)

Module IV

Fourier Series (15 hrs)

Fourier Series : Periodic Functions, Trigonometric Series, Fourier Series, Even and Odd functions, Half-range Expansions.
(Sections 10.1, 10.2, 10.4,10.5 of Text 3 – Excluding Proofs).

Reference Books:

1. Shanti Narayan , P .K . Mittal : Integral Calculus (S. Chand & Company)
2. P.P.G Dyke : An introduction to Laplace Transforms and Fourier Series (Springer 2005)

QUESTON PAPER PATTERN

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

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO STATISTICS)
THIRD SEMESTER
MS3C01: Vector Calculus, Differential equations , Laplace Transform

5 hours/week **4 credits**

Textbook:

1. Erwin Kreyszig- Advanced Engineering Mathematics, Eighth Edition, Wiley, India.
2. Murray : Differential Equations (Macmillan)
3. N.P.Bali, Dr.N.Ch.Narayana Iyengar-Engineering mathematics - Laxmi Publications

Module I

Vector Differential Calculus **(20hrs)**

A quick Review of vector algebra, Inner product and vector product in R^2 and R^3. Vector and scalar functions and Fields, Derivatives, Curves, Tangents, Arc Length, Velocity and acceleration, Gradient of a scalar field; Directional Derivative, Divergence of a vector field, Curl of a Vector Field.
(Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.9, 8.10, 8.11 of Text 1).

Module II

Vector Integral Calculus **(25 hrs)**

Line Integrals, Independence of path, Green's Theorem in the Plane (without proof), surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence theorem of Gauss and Stoke's theorem (without proofs).
(Sections 9.1, 9.2, 9.4, 9.5, 9.6, 9.7, 9.9, 9.10 of Text 1)

Module III

Ordinary differential equations **(35 Hrs)**

First order Equations (a quick review)
Exact equations, Clairaut's equation, second order linear equations with constant coefficients R.H.S being one of the forms e^{ax}, Cos ax, Sin ax, x^n or product of any two of them. Simultaneous equations with constant coefficients
(Chapter 11, 13 of text 3)

Module IV

Laplace Transform **(10 Hrs)**

Laplace Transforms .Inverse Laplace Transform, Linearity of Laplace Transform.

(chapter 18 of text 3, relevant portions)

Reference Books:

1. Shanti Narayan , P .K . Mittal :Vector Calculus (S. Chand & Company)
2. Harry F. Davis & Arthur David Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
3. Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, Asian Student edition.
4. A. M Siddique, P Manchanada : A first Course in Differential Equations
5. Zill Dennis G.&Michael R Cullen,-- Advanced Engineering Mathematics,Narosa Publishers,third edition

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QUESTON PAPER PATTERN

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

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO STATISTICS)
FOURTH SEMESTER
MS4C01: Abstract algebra, Linear Algebra, Theory of Equations, Special functions

5 hours/week **4 credits**

Text Books:

1. John B Fraleigh - A first course in Abstract Algebra(7th Edition)Pearson Education
2. Erwin Kreyszig - Advanced Engineering Mathematics, 8th Edition, Wiley, India
3. N.P.Bali, Dr.N.Ch.Narayana Iyengar.-Text book on Engineering mathematics,Laxmi publications

Module I
Abstract algebra **(20hrs)**

Groups, definitions and examples. Elementary properties, finite groups and sub groups. Cyclic groups elementary properties.. Rings and fields definitions.
(Section 1.4, 1.5, 1.6, 2.8, 3.13, 4.18, 6.30 of text 1)

Module II
Linear Algebra **(35 hrs)**

A quick review of the fundamental concepts of matrices, Hermitian,Skew- Hermitian and unitary matrices, Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Row Canonical form, Normal form. Systems of Linear equations: Homogeneous and Non Homogeneous Equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem (statement only) and simple applications. Vector space, Definitions and elementary properties. Linear independence and dependence, base, dimension. Linear combination of vectors. Spanning set. Subspace.
(relevant sections of Text 2)

Module III

Theory of Equations **(20 hrs)**

Statement of Fundamental theorem of Algebra. Relation between roots and coefficients, Transformation of equations. Reciprocal equations. Cardon's method. Descarte's method. (chapter 2 of text 3)

Module IV

Special functions **(15 hrs)**

Beta and Gamma functions, Reduction formula for gamma .Relation between beta and gamma functions. Problems related to these functions

(Chapter 15 of text 3)

Reference Books:

1. I.N.Herstien-Topics in Algebra
2. K.V.Mittal-Optimisation methods in operations research and system analysis
3. Kenneth Hoffman, Ray Kunze-Linear Algebra (second edition) prentice-Hall India
4. Thunter – An elementary treatise on the Theory of Equations with examples

QUESTON PAPER PATTERN

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

MODEL - II

CORE MATHEMATICS

Course - 1 Foundation of Mathematics

Course - 2 Trigonometry , Analytic geometry & Matrices

Course - 3 Calculus

Course - 4 Vector Calculus , Theory of Equations & Numerical Methods

Course - 5 Mathematical Analysis

Course - 6 Differential Equations

Course - 7 Abstract Algebra

Course - 8 Open course

Course - 9 Real analysis

Course - 10 Complex Analysis

Course - 11 Discrete Mathematics

Course - 12 Linear Algebra and Metric Spaces

COMPLEMENTARY SUBJECTS

OPERATIONS RESEARCH

Course - 1 Linear Programming

Course - 2 Duality & Transportation Problem

Course - 3 Queueing Theory

Course - 4 Non – Linear Programming

VOCATIONAL SUBJECT

COMPUTER SCIENCE

Course - 1 Computer Fundamentals

Course - 2 Operating Systems

Course - 3 Object Oriented Programming in C++

Course - 4 Computer Lab in C++

Course - 5 Database Management System

Course - 6 Computer Lab using Database System

Course - 7 Lab in C++ in Numerical Methods

Course - 8 Project & Viva

SEMESTERS - PAPERS

Sl: No	Semester	Papers	Hours	Credits	Total
1	I	English	5	3	18
		Second Language	5	3	
		Mathematics Course - 1	4	4	
		Operations Research Course - 1	6	4	
		Computer Science Course - 1	5	4	
2	II	English	5	3	18
		Second Language	5	3	
		Mathematics Course - 2	4	4	
		Operations Research Course - 2	6	4	
		Computer Science Course - 2	5	4	

3	III	English Mathematics Course - 3 Operations Research Course - 3 Computer Science Course – 3 Computer Science Course - 4	5 5 5 5 5	3 4 4 4 4	19
4	IV	English Mathematics Course - 4 Operations Research Course - 4 Computer Science Course - 5 Computer Science Course - 6	5 5 5 5 5	3 4 4 4 4	19
5	V	Mathematics Course - 5 Mathematics Course - 6 Mathematics Course - 7 Mathematics Course - 8 Computer Science Course - 7	5 5 5 5 5	4 4 4 4 4	20
6	VI	Mathematics Course - 9 Mathematics Course - 10 Mathematics Course - 11 Mathematics Course - 12 Computer Science Course - 8	5 5 5 5 5	4 4 4 4 4	20
		On the Job Trg		3	6
		Viva		3	
		Total	150		120

MODEL -II
Complementary Component:
Operations Research

SEMESTER – I

Course 1: Linear Programming

(108 hours)

Text Book:

K.V.Mital and C.Mohan : Optimization methods in Operations Research and system Analysis (New Age International publishers)

Chapter - 1, 2, 3(Sections 1 to 16)

Module I (18 hours)

Euclidean Space:

Vectors and Vector spaces , linear dependence, dimension of a vector space , base, Euclidean space, Norm of a vector.

Module II (25 hours)

Linear Algebraic Equations:

General form, particular Case When A is non singular, consistent system of equations, linearly independent consistent equations, and homogeneous equations

Module III (30 hours)

Convex sets:

Open and Closed sets in En, Convex linear combinations, convex sets, Intersection of convex sets, convex hull of a set, vertices or extreme points of a convex sets, convex polyhedron, hyperplanes, halfspaces and polytopes separating and supporting hyperplanes, Vertices of a closed bounded Convex sets, Summary, Quadratic forms, extreme of functions, partial derivatives, radiant vector, Taylor series, Directional derivatives, directions of steepest descent, local and global extrema, limitations of method of differential calculus, unconstraint extrema, constraint extrema, implicit function theorem, method of Lag ranges multipliers, convex functions, general problem of mathematical programming

Module IV (35 hours)

Linear programming:

Introduction, L.P in two dimensions, general L.P problem, Feasible solutions, Basic solutions, Basic Feasible solutions, optimal solutions, Summary simplex method, Canonical forms, Simplex method (Numerical Example) simplex table finding the first basic feasible solution, Artificial variables, Degeneracy, simplex myultipliers, Revised simplex method.

Reference Text:

J.K.Sharma :O.R Theory and Applications (Macmillan India Ltd.)

Question Paper Pattern:

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

MODEL -II
Complementary Component:
Operations Research

SEMESTER – II

Course 2: Duality, Transportation & Assignment Problems

(108 hours)

Text Book:

K.V.Mital & C.Mohan: Optimization Methods in Operations Research and System Analysis(New Age International Publishers)
Chapter - 3 (Sections 17 – 22) & Chapter – 4

Module I (30 hours)

Linear Programming:

Duality in L.P.Problems, Duality Theorems, Application of duality, Dual Simplex Method, Summary of Simplex Methods, Applications of L.P.

Module II (30 hours)

Transportation Problems:

Introduction, Transportation Problems, Transportation Arrays, Transportation matrix, Triangular basis finding a basis feasible solution. Testing for Optimality.

Module III (25 hours)

Loop in Transportation, Array changing the basis, Degeneracy, Unbalanced Problem, Transportation with Transshipment, Caterer problem.

Module IV (23 hours)

Assignment Problems:

Assignment Problems, Generalized transportation problem, Summary of Transportation Algorithms.

Reference:

J.K.Sharma :Operations Research Theory and Applications (Macmillan Indian Ltd)

Question 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	0
IV	4	2	1	1
Total	**16**	**8**	**6**	**3**

MODEL -II
Complementary Component: Operations Research

SEMESTER – III

Course 3: Queueing Theory

(90 hrs)

Text Book:

1. K.V.Mital & C.Mohan :Optimization Methods in Operations Research and System Analysis (New Age International Private Limited)
   Chapter 12
2. J.K.Sharma :Operations Research Theory and Applications (Macmillan)
   Chapter 13 (Section 1 -6) ; Chapter 16 (Sections 1-6)

Module I (25 hours)

Theory of Games:

Introduction, Matrix games, problem of game theory, Minimax theorem, Saddle Point, Strategies and Pay off. Theorems of Matrix Games, graphical solutions, Notion of Dominance, Rectangular game as an LP problem.

Module II (20 hours)

Project Management: PERT & CPM

Introduction, Basic Difference between PERT & CPM, Significance of using PERT/CPM phases of Project Management, Project Planning Phase, Scheduling Phase, Project control Phase PERT/CPM.

Module III (25 hours)

Network Components and Precedence Relationships, Rules of AOA Network Construction Errora and Dummies in Network, critical path analysis, Forward Pass Method, Backward pass method, Float(slack) of an activity and Event Critical Path, Project Scheduling with Uncertain Activity Times, Estimation of Project Completion Time.

Module IV (30 hours)

Queuing Theory:

Introduction, Essential features of a Queueing system, Calling Populations Characteristics Queueing Process, Queue Discipline, Service Process, Performance Measures of a Queueing system, Transient – state and steady – state, Relationships among performance Measures, Probability distributions Queueing systems, Distributions of Arrivals (Exponential Process),

Distribution of Departure (pure Death Process), Distribution of Service Times Classification of Queueing Models, Solution of Queueing Models, Single serves Queueing Models.

Model I; {(M/M/1): (∞ / FCFS)}
Model II; {(M/M/1): (∞ / SIRO)}
Model III; { (M/M/1) : (N/FCFS)}

Exponential Service – Finite Queue.

Reference:

Operations Research – Kanti Swarup – P.K.Gupta and Man Mohan (Sultan Chand & Sons)

Question Paper Pattern:

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

MODEL -II
Complementary Component:
Operations Research

SEMESTER – IV

Course 4: Non – Linear Programming

(90 hrs)

Text Book:

K.V.Mital & C.Mohan :Optimization Methods in Operations Research and System Analysis –(3rd Edition (New Age International Private Limited)
Chapter 6 & 8.

Module I (15 hours)

Integer Programming:

Introduction, ILP in two-dimensional space, General ILP and MILP problems, Examples of section 2 continued.

Module II (30 hours)

Cutting planes, Examples, Remarks on Cutting plane methods, Branch and Bound Method – Examples, Branch and bound method – General Description, The 0 – 1 variables.

Module III (20 hours)

Kuhn-Tucker Theory and Non Linear Programming:

Introduction, Lagrangian Function, Saddle Point, Relation Between saddle point of F(X,Y) and Minimal point of f(x).

Module IV (25 hours)

Kuhn-Tucker conditions, Primal and dual problems, Quadratic Programming, Separable programming.

Text Book:

Optimization Methods in Operations Research and System Analysis –(3rd Edition) K.V.Mital & C.Mohan (New Age International Private Limited) Chapter 6 & 8.

Reference:

Operations Research Theory and Applications – J.K.Sharma (Macmillan)

Question Paper Pattern:

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

MODEL -II
Vocational Subject - Computer Science

SEMESTER – I

Course 1: Computer Fundamentals

(90 hours)

Text Book:

Pradeep K.Sinha, Priti Sinha : Foundations of computing

Module I (25hours)

Fundamentals of computers and computer Arithmetic:

Characteristics Evolution of computer, Computer Generations, Computer Types, Computer Applications:

Number systems, converting from one Number system to Another, Binary Arithmetic's, fixed and Floating Points, Numbers, Computer Codes.

(Chapter 1 & 3 of the text)

Module II (20 hours)

Hardware Components:

Basic Anatomy of Computers, Bit/Byte/Word – Memory Units _ Arithmetic Logic Unit – Control Unit – Input – Output Devices – Secondary Storage Devices.

(Chapter 2 & 8 of the text)

Module III (20hours)

Software Components:

Types of Software – Introduction to Higher Level Languages – Compilers – Assemblers – interpreters – System Utilities – Stages in Development of Software – Flowchart Symbols – Examples – Introduction to Application Packages.

(Chapter 10 & 12 of the text)

Module IV (25hours)

Introduction to Computer Networks:

Uses – Physical Communication Media – Network Types – Network Topologies – Communication Protocols.

Introduction to Internet

(Chapter 17 & 18 of the text)

Reference:

1. Subramanian N: Introduction to Computers
2. Tremblay and Bunt : Introduction to Computers
3. Tanenbaum : Computer Networks

Question Paper Pattern:

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

MODEL -II

Vocational Subject - Computer Science

SEMESTER – II

Course 2: **Introduction to Operating System & OS as Resource Manager**

(90 hours)

Text Book:

Tanenbaum: Modern Operating Systems

Module I (20 hours)

Operating System Concepts &OS as Resource Manager.

(Chapter 1 of the text)

Module II (25 hours)

Processor management – Job scheduling in single user, Multiprogramming and time – Sharing Environment.

(Chapter 2 of the text)

Module III (25 hours)

Device Management – Sharable – Non Sharable – Spooling.

Memory Management – Allocation – Paging- Virtual Storage.

(Chapter 3 & 4 of the text)

Module IV (20 hours)

Information Management – File Structures.

Introduction to Windows

(Chapter 6 & 11 of the text)

Reference:

1. Godbole - Operating Systems
2. Mastering Windows.

Question Paper Pattern:

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

MODEL -II

Vocational Subject - Computer Science

SEMESTER – III

Course 3: Object Oriented Programming with C++

(90 hours)

Text Book:

Balagurusamy : Object Oriented Programming with C++

Module I (15 hours)

Introduction:

Object – Oriented Development – modeling – object modeling techniques – benefits of Object – Oriented Programming – Object –Oriented Languages.

(Chapter 1 of the text)

Module II (25 hours)

Programming with C++

Classes and Objects – Functions in C++, Operator Overloading Friend Functions

(Chapter 2 & 4 & 7 of the text)

Module III (25 hours)

Inheritance :

Introduction – Single Inheritance – Multilevel Inheritance – Multiple Inheritances – Examples.
Polymorphism - Introduction – Pointers – Virtual functions.

(Chapter 5 & 9 of the text)

Module IV (25 hours)

Working with files:

Opening and closing the file – other file operations
Exception handlers.
Templates - Introduction – class templates – function templates.

(Chapter 11 & 12 & 13 of the text)

Reference:

1. James Rumbaugh : Object Oriented Modelling and Design
2. Barkakati : Object Oriented Programming with C++

Question Paper Pattern:

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

MODEL -II

Vocational Subject - Computer Science

SEMESTER – IV

Course 4: **Computer Lab in C++**

(90 hours)

Computer Lab in C++ (At least 20 Numbers of Programs)

(Practical Examination 3 hrs)

MODEL -II

Vocational Subject - Computer Science

SEMESTER – V

Course 5: Database Management Systems

(90 hours)

Text Books:

Abraham Silberschatz, Henry K. Korth, S, Sudarshan - Data Base System Concepts , McGraw Hill.

Module I (20 hours)

Introduction - Purpose – Data model – Data base languages.

Entity – Relationship model – Basic concepts – Design issues – ER diagram weak entity sets.

(Chapter 1 & 6 of the text)

Module II (25 hours)

Relation model – Structure of relational databases – The relational algebra modification of database – Views.

SQL – Basic structures –Queries – Programming using SQL

(Chapter 2 & 3 of the text)

Module III (25 hours)

Object – Oriented data base, Object – Oriented data model, Object – oriented languages.

File structures – File organization – Organization of records in files – Data dictionary storage – Storage structure for object – Oriented database – Indexing & Hashing – Basic concepts – B+ - Tree Index file – Hashing functions

(Chapter 9 & 11 & 12 of the text)

Module IV (20 hours)

Query processing – Overview – Section of operation – Sorting

Database architecture – Different type of systems – Network types.

(Chapter 13 & 20 of the text)

Reference:

1. R. Elmarsi, S. B. Navathe : Fundamentals of database system , Addison Wesley
2. Ullman : Principles of database systems

Question Paper Pattern:

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

Vocational Subject - Computer Science

SEMESTER – V

Course 6 : Computer Lab in Database

(90 hours)

Computer Lab using Database System (At least 20 Numbers of Programmes)
(Practical Examination 3 hrs)

MODEL -II

Vocational Subject - Computer Science

SEMESTER – VI

Course 7 : Lab in C++ in Numerical Methods

(90 hours)

Programming in C++ & Numerical Methods (At least 20 Numbers of Programmes)

(Practical Examination 3 hrs)

Course 8 : Project

(90 hours)

Project and Viva

B.Sc. DEGREE PROGRAMME
(COMPLEMENTARY COURSE)
MATHEMATICS
FIRST SEMESTER
MP1C01: Differential Calculus and Trigonometry

5 hours/week **4 credits**

Text Books: -

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

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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.

(26 hrs)

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

Module II

Applications of Derivatives: **(20 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: **(20 hrs)**
Functions of several variables (Definition only), Partial derivatives, The Chain Rule

(Sections 14.3 - 14.4 of Text 1)

Module 1V

Trigonometry **(24hrs)**

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 :

3. Shanti Narayan : Differential Calculus (S Chand)

4. 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
(COMPLEMENTARY COURSE)
MATHEMATICS
SECOND SEMESTER

MP2C01: Integral Calculus and Matrices

5 hours/week **4 credits**

Text Books: -

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

Module I

Integral Calculus: **(13 hrs)**

The Definite integral. The fundamental theorem of Calculus (Section 5.3 and 5.4 of Text -1).

Module II

Application of Integrals **(25 hrs)**

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

Multiple Integrals **(22hrs)**

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 **(30 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 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**

B.Sc. DEGREE PROGRAMME
(COMPLEMENTARY COURSE TO MODEL M-II)
MATHEMATICS
THIRD SEMESTER

MP3C01: Vector Calculus, Fourier Series and Analytic Geometry

5 hours/week **4 credits**

Text :-

2. Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.

2. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.

Module I

Vector Differential Calculus **(25 hrs)**

A quick Review of vector algebra, Inner product and vector product in R^2 and R^3. Vector and scalar functions and Fields, Derivatives, Curves, Tangents, Arc Length, Velocity and acceleration, Gradient of a scalar field; Directional Derivative, Divergence of a vector field, Curl of a Vector Field.
(Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.9, 8.10, 8.11 of Text 1).

Module II

Vector Integral Calculus **(20 hrs)**

Line Integrals, Line Integrals Independence of path, Green's Theorem in the Plane (without proof), surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence theorem of Gauss and Stokes's theorem (without proofs).
(Sections 9.1, 9.2, 9.4, 9.5, 9.6, 9.7, 9.9 of Text 1)

Module III

Special Functions **(20 hrs)**

Fourier Series : Periodic Functions, Trigonometric Series, 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, 10.4 , 4.1, 4.3 , 4.5 of Text 1 – Excluding Proofs).

Module IV

Analytic Geometry **(25 hrs)**

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)

Reference Books :

6. Shanti Narayan , P .K . Mittal :Vector Calculus (S. Chand & Company)

7. P.P.G Dyke : An introduction to Laplace Transfoorms and Fourier Serices (Springer 2005)

8. Harry F. Davis & Arthur David Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.

9. Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, Asian Student edition.

10. Merle C. Potter – Advanced Engineering Mathematics , Oxford University Press.

QUESTON PAPER PATTERN

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

B.Sc. DEGREE PROGRAMME
MATHEMATICS (COMPLEMENTARY COURSE TO MODEL -II)

FOURTH SEMESTER

MP4C01: Differential Equations, Abstract Algebra, Numerical Analysis

5 hours/week **4 credits**

4. A. H Siddiqi , P Manchanada : A first Course in Differential Equations with Applications(Macmillan India Ltd 2006)
5. Ian Sneddon – Elements of Partial Differential Equation (Tata Mc Graw Hill)
6. 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

Ordinary differential equations **(25 Hrs)**

Separable Variables , 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 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 II

Partial Differential Equations **(15 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)

Module III
Numerical Analysis **(30 Hrs)**

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 **(20hrs)**

Groups, Subgroups, Cyclic groups, Groups of Permutations, Homeomorphisms, Rings and Fields , Vector Spaces.
(Section 1.4, 1.5, 1.6, 2.8, 3.13, 4.18, 6.30 of text 4)

Reference :

7. Stephen Andrilli, David Hecker - Elementary Linear Algebra ,Academic Press
8. R. K. Ghosh, K. C. Maity – An Introduction to Differential Equations, New Central Books
9. Shepley L. Ross – Differential Equation , Wiley India
10. Srimanta Pal – Numerical Methods, Oxford University Press
11. 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

BCA DEGREE PROGRAMME

MATHEMATICS

FIRST SEMESTER

M1C01 : MATRICES , CALCULUS AND LAPLACE TRANSFORMS

4 hrs/week **4 credits**

Text Book:

1. Matrices, Frank Ayres JR Schaum's Outline Series, TMH Edition
2. Thomas and Finney - Calculus and analytical geometry (Addison-Wesley)
3. Dr. B. S. Grewal – Higher Engineering Mathematics

MODULE I : Matrices (17 hrs)

A quick review of the fundamental concepts, Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of a Non-Singular Matrix, Canonical form, Normal form. Systems of Linear equations: Homogeneous and Non Homogeneous Equations, Characteristic equation of a matrix. (Relevant sections of Text 1).

(proof of all the theorems are to be excluded.)

MODULE I I : Differential Calculus: (20hrs)

A quick review of limits of function, rules for finding limits, extensions of limit concepts, derivative of a function, differentiation rules, chain rule, rate of change and simple applications of the rules. Extreme values of a function Rolle's Theorem, Mean Value Theorem.
(Sections 1.1, 1.2, 1.3, 2.1, 2.2, 2.3 , 3.1, 3.2 of Text 2)

MODULE III : Partial Differential Equations (15 hrs)

Introduction, formulation of Partial Differential Equation by elimination of arbitrary constants and by elimination of arbitrary function. Solution of first order equations using Lagrange's method.

(relevant sections of Text 3)

MODULE IV : Laplace Transforms **(20 hrs)**

Definitions- transforms of elementary functions, properties of Laplace transforms, inverse transforms- convolution theorem (no proof). (relevant sections of Text 3).

Reference Books:

1. S.K . Stein – Calculus and analytic Geometry , (McGraw Hill)
2. Zubair Khan, Shadab Ahmad Khan - Mathematics – 1 and

   Mathematics – II (Ane Books)
3. Shanti Narayan - Matrices (S. Chand & Company)
4. N.P.Bali, Dr.N.Ch.Narayana Iyengar-Engineering mathematics - Laxmi Publications
5. Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.

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	-
IV	4	2	1	1
Total	**16**	**8**	**6**	**3**

BCA DEGREE PROGRAMME

MATHEMATICS

SECOND SEMESTER

M2C01 : DISCRETE MATHEMATICS

4 hrs/week **4 credits**

Text Books :

1. Petergray – Logic, Algebra and databases (chapter 3), Affiliated East West press pvt Ltd.
2. Robert J mcEliece, Robert B Ash and Carol Ash – Introduction to discrete mathematics (chapter 1,2 and 4) , Mc.Graw Hill.

MODULE I : Preliminaries **(17 hrs)**

Basic set Theory, terminology and notation, Venn diagrams, truth table and proof. Functions and relations, partial orderings and equivalence relations, mathematical induction. An application of Hamming codes.

MODULE II : Combinatorics (15 hrs)

The theory counting. The multiplication rule, ordered sample and permutations, unordered samples without repetition, permutations involving indistinguishable objects, multinomial co-efficient, unordered samples with repetition, permutation involving indistinguishable objects.

MODULE III : Propositional Calculus **(15 hrs)**

Proposition, compound proposition, truth table for basic operators, connectives, theorems from Boolean algebra, De-Morgan's law, normal forms, rules of inference, chain rule and modusponens, chains of inference, tautology, proof by adopting a premise. Reductio- ad-absurdum, proof by resolution.

MODULE IV : Graphs and Algorithms **(25 hrs)**

Leonhard Euler and the seven bridges of Konigsberg, trees and spanning trees, minimal spanning trees, binary trees and tree searching. Planar graphs and Euler's theorem, the shortest path problem, Dijkstras Algorithm, two "all-pairs" Algorithm, Floyd's Algorithm and Marshal's Algorithm.

Reference Books:

1. S. Lipschutz : Set Theory and related topics (Second Edition), Schaum Outline Series, Tata McGraw-Hill Publishing Company, New Delhi.
2. R.G..Stoll - Set Theory and Logic
3. P.R. Halmos - Naive Set Theory, Springer
4. John Clark & Derek Allen Holton - A first book at graph theory (Allied Publishers)
5. Douglas B west – Introduction to Graph Theory , Pearson Education

QUESTON PAPER PATTERN

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

BCA DEGREE PROGRAMME

MATHEMATICS

FOURTH SEMESTER

M4C01 : OPERATIONS RESEARCH

4 hrs/week **4 credits**

Text Book:

Belly E Gillet – Introduction to Operations Research (A Computer Oriented Arithmetic Approach) (Tata Mc. Graw Hill)

MODULE I : Basics of O.R. (10hrs)

The nature and uses of O.R- mach concepts and approaches of O.R- models in O.R.

MODULE II : Linear programming problems (25 hrs)

Mathematical formulation of a L.P.P. General linear programming problems, solution of a L.P.P, graphical method for solving a L.P.P.

Simplex Method: Stack and surplus variables- reduction of any feasible solution to a basic feasible solution. Unbounded solution. Optimality conditions- artificial variable techniques- Big M method.

MODULE III : Transportation & assignment Problems (20 hrs)

Transportation model- solution by simplex method- north west corner rule, lowest cost entry method, vogel method, MODI method, degeneracy, assignment problems.

MODULE IV: Game Theory (17 hrs)

Two persons zero sum games, pure and mixed strategy with saddle point, solution of pure strategy games, solution of mixed strategy problems by arithmetic method. Principle of dominance.

Reference Books:

1. V.K Kapoor – Operations Research
2. Kanti Swarup , P.K Gupta and Man Mohan – Operations Research, Sultan Chand & Sons
3. K.V Mital and C. Mohan – Optimization Methods in Operations Research and System Analysis
4. J. K Sharma – Operations Research Theory and Applications , Macmillan
5. B. N. Mishra, B. K. Mishra – Optimization Linear Programming Ane Books

QUESTON PAPER PATTERN

Module	Part A	Part B	Part C	Part D
I				
II				
III				
IV				
Total	16	8	6	3