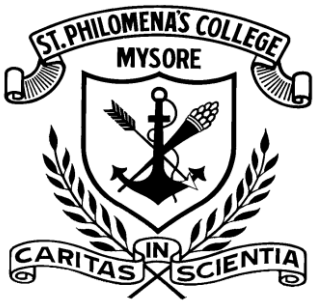

ST.PHILOMENA'S COLLEGE (AUTONOMOUS), MYSURU

(AFFILIATED TO UNIVERSITY OF MYSORE)

REACCREDITED BY NAAC WITH A GRADE

COURSE - BSc

Three-year six semesters Choice Based Credit System (CBCS) and Continuous Assessment & Grading Pattern (CAGP) Under Graduate Programme under Autonomous Structure

Academic year 2018-19 onwards

DEPARTMENT OF MATHEMATICS

ST. PHILOMENA'S COLLEGE (Autonomous), MYSURU-570 015

DEPARTMENT OF MATHEMATICS

CBCS SYLLABUS FOR B.Sc.,

From the Academic Year 2018-19 Onwards

The Scheme of Teaching & Examination

PAPER WISE MARKS DISTRIBUTION

A. Discipline Specific Core (DSC) or Hard Core (HC) Papers.

Semester	Title of the Paper	TYPE	Teaching Hours Per week Theory/ Practical	Credits Theory/ Practical	Exam Duration in Hours Theory/Practical	Max. Marks Theory/Practical		
						Theory/Practical	I A Theory/Practical	Total
I.	Paper-I. Title : Matrices , Basics of Number Theory and Differential Calculus	DSC	03	03	03	50	20	100
	Practical Paper-I	DSC	03	1.5	03	20	10	
II.	Paper-II .Title : Elements of Differential Calculus and Fundamentals of Integral Calculus	DSC	03	03	03	50	20	100
	Practical Paper-II	DSC	03	1.5	03	20	10	
III.	Paper-III .Title : Group Theory, Line and Multiple Integrals	DSC	03	03	03	50	20	100
	Practical Paper-III	DSC	03	1.5	03	20	10	
IV.	Paper-IV. Title : Ordinary Differential Equations	DSC	03	03	03	50	20	100
	Practical Paper-IV	DSC	03	1.5	03	20	10	
V.	Paper-V. Title : Real Sequences, Series and Fourier Series	DSC	03	03	03	70	30	300
	Paper-VI. Title : Rings, Fields and Riemann Integration	DSC	03	03	03	70	30	
	Practical Paper-V.	DSC	02	01	03	35	15	
	Practical Paper-VI.	DSC	02	01	03	35	15	
VI.	Paper-VII .Title: Linear Algebra and Numerical Analysis- I	DSC	03	03	03	70	30	300
	Paper-VIII .Title : Complex Analysis and Numerical Analysis-II	DSC	03	03	03	70	30	
	Practical Paper-VII	DSC	02	01	03	35	15	
	Practical Paper-VIII.	DSC	02	01	03	35	15	
		DSE	02	02	03	30	20	100
		DSE	02	02	03	30	20	
				38		760	340	1100

B. Discipline Specific Elective (DSE) or Soft Core (SC)

						Examination Scheme			
Sl. No	Title of the Paper	TYPE		Teaching week Hours	Credits	Exam Duration in Hours	Theory Max. Marks	I A Max Marks	Total Marks
1.	Elementary Discrete Mathematics	DSE	II to VI	2	2	03	30	20	50
2.	Analytical Geometry	DSE		2	2	03	30	20	50
3.	Integral Transforms	DSE		2	2	03	30	20	50
4.	Theory of Equations	DSE		2	2	03	30	20	50
5.	Differential Geometry	DSE		2	2	03	30	20	50
6.	Indefinite and Improper Integrals	DSE		2	2	03	30	20	50
7.	Advanced Discrete Mathematics	DSE		2	2	03	30	20	50
8.	Elementary Graph Theory	DSE		2	2	03	30	20	50
9.	Partial Differential Equations	DSE		2	2	03	30	20	50
10.	Fundamentals of Metric Spaces	DSE		2	2	03	30	20	50
11.	Probability & Statistics	DSE		2	2	03	30	20	50
12.	Vector Calculus	DSE		2	2	03	30	20	50
13.	Linear Programming	DSE		2	2	03	30	20	50
14.	Basics of Fluid Mechanics	DSE		2	2	03	30	20	50

C. BCA Mathematics Papers

Semester	Title of the Paper	TYPE	Teaching Hours per Week	Credits	Exam Duration in Hours	Max. Marks Theory/Practical		
			Theory/ Practical	Theory/ Practical	Theory/ Practical	Theory/ Practical	I A Theory/ Practical	Total
I	Paper-I. Discrete Mathematics, Trigonometry and Calculus	DSC	03	03	03	70	30	100
II	Paper-II Algebra, Analytical Geometry and Integral Calculus	DSC	03	03	03	70	30	100

Note:

Sl .No	Type	
1.	DSC or HC	Discipline Specific Core (DSC) or Hard Core (HC)
2.	DSE or SC	Discipline Specific Elective (DSE or /Soft Core (SC)

3.	**SEC or OE**	**Skill Enhancement Course (SEC) or Open Elective (OE)**

PREAMBLE

The objective of framing and structuring the syllabus is to offer a sound and solid understanding of Mathematics, which is the queen of all subjects, to undergraduate students of B.Sc. degree course. This programme tries to provide them a broad-based training in Mathematics by opening the avenues of exciting advancements in the field.

Mathematics is a discipline of multiple perspectives. The beauty of Mathematics lies in its simplicity and freedom. The field of Mathematics Education looks into the pertinent gap between Essence of Mathematics and Teaching of Mathematics.

The syllabus strengthens the foundation of Mathematics and the evolution of Mathematics Education. The goal is to make the study of Mathematics, interesting and to encourage the students to delve deep into the study of Mathematics with research mentality. The syllabus is prepared after discussion at length with number of faculty members of the subject from different universities and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

Also, this syllabus helps to set up a mathematical laboratory in the college in order to help the students in the exploration of mathematical concepts through activities and experimentation to enable the teacher to demonstrate, explain and reinforce the abstract mathematical ideas by using concrete objects, models charts, graphs, pictures and posters with the help of FOSS tools on a computer, to hone the mathematical skills among the students.

Further, the syllabus will make them face new challenges in mathematics as per modern requirement, make the learning process student – friendly and provide greater scope for individual participation in the process of learning and becoming autonomous learners.

Finally, this syllabus attempts to foster experimental, problem-oriented and discovery learning of mathematics, to increase the interest and confidence in learning the subject and to eradicate the *Math phobia* through various illustrative examples and experiments based on soft core papers.

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FIRST SEMESTERMATHEMATICS
TITLE: MATRICES, BASICS OF NUMBER THEORY AND DIFFERENTIAL CALCULUS
CLASS DURATION – 03 HOURS PER WEEK48 Hours
Marks-Theory - 50 + Internal Assessment 20= 70

OBJECTIVE: This course aims to provide a first approach to the subject of matrix algebra, which is one of the basic pillars of modern mathematics. This course is concerned with the basics of number theory and to develop working knowledge on calculus.
OUTCOMES: Students will be able to get the analytical and theoretical knowledge about matrices, number theory and differential calculus along with the applications.

Unit 1: **Matrices**

1.1	Rank of a matrix – Elementary row/column operations Invariance of rank under elementary operation	16hrs
1.2	Inverse of a non-singular matrix by elementary operations	
1.3	System of 'm' linear equations in 'n' unknowns	
1.4	Matrices associated with linear equations	
1.5	Trivial and non trivial solutions	
1.6	Criterion for existence of non-trivial solution of homogeneous and non-homogeneous systems	
1.7	Criterion for uniqueness of solutions – Problems.	
1.8	Eigen values and eigenvectors of a square matrix – Properties	
1.9	Diagonalization of a real symmetric matrix	
1.10	Cayley - Hamilton theorem	

Unit 2: **Number theory**

2.1	Division algorithm	16hrs
2.2	The greatest common divisor	
2.3	Euclidean algorithm	
2.4	Diophantine equation	
2.5	the fundamental theorem of arithmetic	
2.6	The Theory of Congruences, Properties of Congruences	
2.7	Binary and Decimal representation of integers	
2.8	Linear Congruences	
2.9	Euler's theorem Fermat's theorem and Wilson's theorem(statements only)-problems.	

Unit 3: **Differential Calculus**

3.1	Recapitulation of limits	16hrs
3.2	Continuity and differentiability	
3.3	Derivatives of higher order	
3.4	n^{th}derivatives of the functions: e^{ax} , , $(ax+b)^n$,$\log(ax+b)^n$,$\sin(ax+b)^n\cos(ax+b)^n$, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$– Problems	
3.5	Leibnitz theorem	
3.6	Monotonic functions – Maxima and Minima	
3.7	Concavity Convexity and points of inflection.	
3.8	Polar coordinates – angle between the radius vector and the tangent at a point on a curve	
3.9	Angle of intersection between two curves – Pedal equations	

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PRACTICAL I

Marks: End semester Examination 20 + IA 10 = 30

Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS) tools for computer programs (3 hours/ week per batch of not more than 15 students)**

LIST OF PROBLEMS

1.1. Introduction to Scilab with basic operators.
1.2. Computations with matrices.
1.3. Establishing consistency and solving system of linear equations.
1.4. Introduction to Maxima with basic operators
1.5. Commands for derivatives and n^{th} derivatives.
1.6. Scilab and Maxima commands for plotting functions.
1.7. Plotting of standard Cartesian curves using Scilab /Maxima.
1.8. Plotting of standard Polar curves using Scilab /Maxima.
1.9. Plotting of standard parametric curves using Scilab /Maxima.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics).

Reference Books

1. Serge Lang – First Course in Calculus
2. Lipman Bers – Calculus, Volumes 1 and 2
3. A.R Vashista, Matrices, Krishna Prakashana Mandir, 2003.
4. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
5. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.
6. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc.GrawHill.,2008.
7. Mathematics practical using MAXIMA

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SECOND SEMESTER MATHEMATICS

TITLE: ELEMENTS OF DIFFERENTIAL CALCULUS AND FUNDAMENTALS OF INTEGRAL CALCULUS

CLASS DURATION – 03 HOURS PER WEEK48 Hours

Marks-Theory - 50 + Internal Assessment 20= 70

OBJECTIVE: This course is concerned with basic properties of calculus, which aims to give them a sound knowledge of it.

OUTCOMES: Students will be able to get the analytical knowledge and basic properties of calculus and will apply his knowledge to simplify differential and integral problems.

Unit 1: **Limits and Continuity**

1.1	Real line, Function, real valued function	24 hrs
1.2	Limit of a function – properties and problems	
1.3	Continuity of functions – properties and problems	
1.4	Infimum and supremum of a function	
1.5	Theorems on continuity	
1.6	Intermediate value theorem	
1.7	Differentiability	

1.8 Rolle's theorem, Lagrange's Mean Value theorem
1.9 Cauchy's mean value theorem
1.10 Taylor's theorem (statement only) – Maclaurin's theorem (statement only)
1.11 Taylor's infinite series and power series expansion
1.12 Maclaurin's infinite series – indeterminate forms (L`Hospital rules:0/0, $0 * \infty, 1^{\infty}$)

Unit 2: **Partial Derivatives**

2.1 Partial derivatives ,Functions of two or more variables, 14hrs
2.2 Explicit and implicit functions
2.3 The neighborhood of a point
2.4 Homogeneous functions – Euler's theorem
2.5 chain rule – change of variables
2.6 Directional derivative – Partial derivatives of higher order
2.7 Taylor's theorem for two variables –Derivatives of implicit functions
2.8 Jacobians – Some illustrative examples.

Unit 3: **Integral Calculus**

3.1 Recapitulation of integration, , 10hrs
3.2 Reduction formulae for $\int \sin^n x\, dx, \int \cos^n x\, dx, \int \tan^n x\, dx, \int \cot^n x\, dx$
3.3 Reduction formulae for $\int \sec^n x\, dx, \int x^n \sin x\, dx, \int x^n \cos x\, dx,$ $\int cosec^n x\, dx, \int sin^m x\, cos^n x\, dx,$ with definite limits.

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PRACTICAL II

Marks: End semester Examination 20 + IA 10 = 30

Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS) tools for computer programs (3 hours/ week per batch of not more than 15 students)**

LIST OF PROBLEMS

1.1, Creating a Scilab program (simple examples).
1.2, Creating a Maxima program (simple examples).
1.3, Obtaining partial derivatives of some standard functions
1.4, Verification of Euler's theorem, its extension and Jacobian.
1.5, Evaluation of limits by L'Hospital's rule using Scilab/Maxima.
1.6, Scilab/Maxima programs to illustrate left hand and right hand limits for discontinuous functions.
1.7,Scilab/Maxima programs to illustrate continuity of a function.
1.8,Scilab/Maxima programs to illustrate differentiability of a function.
1.9,Scilab/Maxima programs to verify Rolle's Theorem and Lagrange's theorem.
1.10,Scilab/Maxima programs to verify Cauchy's mean value theorem and finding Taylor's theorem for a given function.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics).

Reference Books:

1. Serge Lang – First Course in Calculus, Springrr-Veilag, Newyork , 1986
2. LipmanBers – Calculus Volumes 1 and 2
3. N Piskanov, Differential and integral Calculus, MIR, Mascow, 1969
4. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
5. Gilbert Strang, Calculus, Wellsley- Cambridge press, Wellsley, 1991

THIRD SEMESTER MATHEMATICS
TITLE: GROUP THEORY, LINE AND MULTIPLE INTEGRALS
CLASS DURATION – 03 HOURS PER WEEK48 Hours
Marks-Theory - 50 + Internal Assessment 20= 70

OBJECTIVE: This course aims in visualizing abstract concepts through groups and gives profound knowledge in integrating functions of several variable along with a line and a plane.
OUTCOMES: After learning this paper Students will be able to get the analytical and basic knowledge, properties of group theory. Also the knowledge to simplify line and multiple integral problems.

Unit 1: **Group Theory** 14 hrs

1.1 Binary operations-problems
1.2 Definition and examples of groups
1.3 Some general properties of Groups
1.4 Group of permutations
1.5 cyclic permutations
1.6 Even and odd permutations
1.7 Powers of an element of a group
1.8 Subgroups
1.9 Cyclic groups - problems and theorems.
1.10 Cosets, Index of a group
1.11 Lagrange's theorem, consequences

Unit 2: **Normal Subgroups**

2.1 Normal Subgroups 14hrs
2.2 Quotient groups – Homomorphism – Isomorphism – Automorphism
2.3 Fundamental theorem of homomorphism

Unit 3: **Line and double Integrals** 20hrs

3.1 Definition of a line integral and basic properties – Examples on evaluation of line integrals -
3.2 Definition of a double integral
3.3 Evaluation of double integrals in regions bounded by given curves
3.4 Changing the order of integration, Change of variables from Cartesian to polar – Surface areas.
3.5 Multiple Integrals
3.6 Definition of a triple integral – Evaluation
3.7 Change of variables (Cylindrical and Spherical) – Volume as a triple integral

PRACTICAL III

Marks: End semester Examination 20 + IA 10 = 30

Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS) tools for computer programs (3 hours/ week per batch of not more than 15 students)**

LIST OF PROBLEMS

1.1. Verifying whether given operator is binary or not.
1.2. To find identity element of a finite group.
1.3. To find inverse element in a finite group.
1.4. Verification of Normality of a given subgroup.
1.5. Examples for finding left and right coset and finding the index of a group.
1.6. Evaluation of the line integral with constant limits.
1.7. Evaluation of the line integral with variable limits.
1.8. Evaluation of the double integral with constant limits.
1.9. Evaluation of the double integral with variable limits.
1.10. Evaluation of the triple integral with constant limits.
1.11. Evaluation of the triple integral with variable limits.
1.12. Scilab/Maxima programs for area and volume.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima

Reference Books:

1. I. N. Herstien – Topics in Algebra, Wiley, New York 1975
2. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
3. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra, AKP classes, Wellesley , 1997
4. J B Fraleigh – A first course in Abstract Algebra, Addison-Wesley, Mass, 1999
5. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
6.. LipmanBers – Calculus Volumes 1 and 2
7. S R Ghorpade, B V Limaye, A course in multivariable calculus and analysis, Springer, 201
8. Claudes, Timotte, Integral Calculus problems
9. O Knill, Multivariable Calculus, Harvard University

NOTE: 18MAT S2 - "Analytical Geometry" is offered as subject elective

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FOURTH SEMESTERMATHEMATICS
TITLE: ORDINARY DIFFRENTIAL EQUATIONS
CLASS DURATION – 03 HOURS PER WEEK48 Hours
Marks-Theory - 50 + Internal Assessment 20= 70

OBJECTIVE: This course aims to provide asound knowledge of solving ordinary differential equations
OUTCOMES: In this course students will get the sound knowledge in solving differential equation through theoretical knowledge.

Unit 1: **Differential Equations** 24hrs

1.1 Recapitulation **of** Definition, examples of differential equations.
1.2 Formation of differential equations by elimination of arbitrary constants
1.3 Differential equations of first order- separation of variables
1.4 Homogeneous differential equations and reducible to homogeneous
1.5 Exact differential equations, reducible to exact.

1.6 Linear differential equations. The general solution of a linear equation
1.7 Integrating factors by inspection. The determination of integrating factors
1.8 Bernoulli's equation. Equations solvable for p
1.9 Equations solvable for x
1.10 Equations solvable for y.

Unit 2: **Linear differential equations with constant coefficients** 10hrs

2.1 Ordinary Linear differential equations with constant coefficients
2.2 Complementary function – particular integral
2.3 Cauchy – Euler differential equations

Unit 3: **Linear differential equations with variable coefficients** 14hrs

3.1 To find a solution when a part of complementary function is given.
3.2 Changing the independent variable method
3.3 Changing the dependent variable method
3.4 By method of variation of parameters
3.5 Exact equations method
3.6 Total differential equations – Necessary and sufficient condition for the equation Pdx + Qdy +Rdz = 0 to be exact (proof only for the necessary part)
3.7 Simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

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PRACTICAL IV

Marks: End semester Examination 20 + IA 10 = 30

Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS) tools for computer programs (3 hours/ week per batch of not more than 15 students)**

LIST OF PROBLEMS

1.1. Finding complementary function of second order ordinary differential equations with constant coefficient.
1.2. Finding particular integral of second order ordinary differential equations with constant coefficient.
1.3. Solutions to the problems on total differential equations.
1.4.Solutions to the problems on simultaneous differential equations.
1.5. Solution of Differential equation using Scilab/Maxima and plotting the solution-I.
1.6. Solution of Differential equation using Scilab/Maxima and plotting the solution-II.
1.7. Solution of Differential equation using Scilab/Maxima and plotting the solution-III.
1.8. Solution of Differential equations using Scilab/Maxima and Plotting the solution-IV

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.

Reference Books:

1. G. Stephonson – An introduction to Partial Differential Equations.
2. B. S. Grewal – Higher Engineering Mathematics
3. E. Kreyszig – Advanced Engineering Mathematics
4. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
5. D. A Murray – Introductory Course in Differential Equations.
6. G. P. Simmons – Differential Equations
7. F. Ayres – Differential Equations (Schaum Series**)**
8**.** Martin Brown – Application of Differential Equations.

NOTE:

18MAT S3 "Theory of Equations" is offered as subject elective.

FIFTH SEMESTERMATHEMATICS
TITLE: REAL SEQUENCES, SERIES AND FOURIER SERIES
CLASS DURATION – 03 HOURS PER WEEK48 Hours
Marks-Theory - 70 + Internal Assessment 30= 100

OBJECTIVE: This course is concerned with the fundamentals of mathematical analysis which makes the students to understand the concept of sequence, their convergence, series, alternate series, Fourier series and its application

OUTCOMES: This course helps to get complete knowledge of sequences, series of real numbers and the elements of analysis

Unit 1: **Real Sequences** 18 hrs

1.1 Sequence of real numbers – Bounded and unbounded sequences
1.2 Infimum and supremum of a sequence
1.3 Limit of a sequence – Sum, product and quotient of limits
1.4 Standard theorems on limits – Convergent , divergent and oscillatory sequences
1.5 Standard properties –Monotonic sequences and their properties
1.6 Cauchy's general principle of convergence.

Unit 2: **Infinite Series** 16 hrs

2.1 Infinite series of real numbers – Convergence – divergence and oscillation of series
2.2 Properties of convergence
2.3 Positive term series – Geometric series – p series
2.4 Comparison tests – D'Alembert's ratio test – Raabe's test – Cauchy's root test

Unit 3: **Fourier series** 14 hrs

3.1 Introduction – Periodic functions
3.2 Fourier series and Euler formulae (statement only)
3.3 Even and odd functions – Half range series – Change of interval.

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PRACTICAL V
Marks: End semester Examination 35 + IA 15 = 50
Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS)**
tools for computer programs (3 hours/ week per batch of not more than 15 students)

LIST OF PROBLEMS

1.1. Illustration of convergent, divergent and oscillatory sequences using Scilab/Maxima.
1.2. Using Cauchy's criterion to determine convergence of a sequence (simple examples).
1.3. Illustration of convergent, divergent and oscillatory series using Scilab/Maxima.
1.4. Scilab/Maxima programs to find the sum of the series and its radius of convergence.
1.5.D'Alembert'sratio test, Raabe's test.
1.6. To plot periodic functions with period 2π and 2L.
1.7. To find full range trigonometric Fourier series of some simple functions with period 2π and 2L.
1.8. Plotting of functions in half-range and including their even and odd extensions.
1.9. To find the half-range sine and cosine series of simple functions.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.

Reference Books:

1. S.C Malik –Real Analysis

3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Ageinternational (P) Ltd., 1992

4. Richard R Goldberg, Methods of Real Analysis, Indian ed.

5. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis

6. E.Kreyszig- Advanced Engineering Mathematics, Wiely India Pvt. Ltd.

7. Raisinghania M. D.,Laplace and Fourier Transforms S. Chand publications.

NOTE:

18MAT S4 "Integral transform" is offered as subject elective.

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FIFTH SEMESTER MATHEMATICS
TITLE: RINGS, FIELDS AND RIEMANN INTEGRATION
CLASS DURATION – 03 HOURS PER WEEK48 Hour
Marks-Theory - 70 + Internal Assessment 30= 100

OBJECTIVE: This course is concerned with the ring theory and a field extension to develop computational skill in abstract algebra which makes student to have a good mathematical maturity and enables to build mathematical thinking and skill.

OUTCOMES: This course helps to get a mathematical maturity in rings, fields and Riemann integral.

Unit 1:**Rings** 14 hrs

1.1 Rings ,Examples – Integral Domains
1.2 Division rings – Fields – Subrings
1.3 Subfields – Characteristic of a ring
1.4 Ordered integral domain –Embedding ring
1.5 The field of quotients
1.6 Ideals – Algebra of Ideals – Principal ideal ring.
1.7 Divisibility in an integral domain
1.8 Units and Associates – prime Elements – Polynomial rings

Unit 2: **Fields** 14 hrs

2.1 Divisibility – Irreducible polynomials
2.2 Division Algorithm – Greatest Common Divisors
2.3 Euclidean Algorithm –Unique factorization theorem
2.4 Kernel of a ring homomorphism
2.5 Fundamental theorem of homomorphism
2.6 Maximal ideals – Prime ideals – Properties
2.7 Eisenstien's Criterion of irreducibility.

Unit 3: **Riemann integral** 20 hrs

3.1 The Riemann integral
3.2 Upper and lower sums – Criterion for integrability
3.3 Integrability of continuous functions and monotonic functions
3.4 Fundamental theorem of Calculus
3.5 Change of variables – Integration by parts
3.6 First and second mean value theorems of integral calculus

PRACTICAL VI
Marks: End semester Examination 35 + IA 15 = 50
Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS)**
tools for computer programs (3 hours/ week per batch of not more than 15 students)

LIST OF PROBLEMS

1.1. Examples on different types of rings.
1.2. Examples on integral domains and fields.
1.3. Examples on subrings, ideals and subrings which are not ideals.
1.4. Homomorphism and isomorphism of rings- illustrative examples.
1.5. Solving polynomial equations using Scilab/Maxima.
1.6. Finding GCD of polynomials and expressing it in terms of the polynomials
1.7. Finding units and associates
1.8. Riemann integrability

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.

Reference Books:

I. N. Herstien – Topics in Algebra.
2. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
3. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2
4. J B Fraleigh – A first course in Abstract Algebra.
5. S.C Mallik – Real Analysis.
6. Leadership project – Bombay university- Text book of mathematical analysis
7. S. S. Bali – Real analysis

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SIXTH SEMESTER MATHEMATICS
TITLE: LINEAR ALGEBRA AND NUMERICAL ANALYSIS-I
CLASS DURATION – 03 HOURS PER WEEK48 Hours
Marks-Theory - 70 + Internal Assessment 30= 100

OBJECTIVE: The main objective is to introduce basic notions in linear algebra that are often used in mathematics and other sciences. It develops the basic ideas of vector spaces. Students will learn numerical techniques and error approximation

OUTCOMES: This course aims to provide a first approach to the linear algebra, which is one of the basic pillars of algebra and gives analytical and logical knowledge in solving applied problems in the concerned area

Unit 1: **Vector Spaces** 14 hrs

1.1 Vector Spaces – Introduction – Examples
1.2 Vector subspaces – Criterion for a subset to be a subspace – Algebra of Subspaces
1.3 Linear Combination – Linear Span
1.4 Linear dependence and linear Independence of vectors

Unit 2: **Basis of a Vector Space** 14 hrs

2.1 Theorems on linear dependence and linear independence
2.2 Basis of a vector space
2.3 Dimension of a vector space — Some properties
2.4 Quotient spaces
2.5 Homomorphism of vector spaces

2.6 Isomorphism of vector spaces – Direct Sums

Unit 3: **Errors Analysis and Transcendental and Polynomial Equations** 20 hrs

3.1 Measures of Errors: Relative, absolute and percentage errors.
3.2 Types of errors: Inherent error, Round-off error and Truncation error.
3.3 Concept of simple and multiple roots. Iterative methods, error tolerance.
3.4 Use of intermediate value theorem.
3.5 Numerical solutions of Algebraic, transcendental equations and simultaneous equations.
3.6 Bisection method– iteration method.
3.7 Gauss elimination method, Gauss-Siedel method.
3.8 Gauss-Jacobi method.

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PRACTICAL VII
Marks: End semester Examination 35 + IA 15 = 50
Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS)**
tools for computer programs (3 hours/ week per batch of not more than 15 students)

LIST OF PROBLEMS

1.1. Expressing a vector as a linear combination of given set of vectors.
1.2. Examples on linear dependence and independence of vectors.
1.3. Examples on basis and Dimension
1.4. Program for bisection method.
1.5. Program for method of false position.
1.6. Program for Newton-Raphson method.
1.7. Program for Gauss elimination method.
1.8. Program for Gauss-Siedel method.
1.9. Program for Gauss-Jacobi method.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of Scilab/maxima.

Reference Books:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. Saymour Lipschitz – Theory and Problems of Linear Algebra.
6. B.S Grewal – Higher engineering mathematics.
7. Murray R Spiegel – Theory and problems of vector calculus.

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SIXTH SEMESTER MATHEMATICS
TITLE: COMPLEX ANALYSIS AND NUMERICAL ANALYSIS-II
CLASS DURATION – 03 HOURS PER WEEK48 Hours
Marks-Theory - 70 + Internal Assessment 30= 100

OBJECTIVE: This course is aimed to provide an introduction with the exploration of the algebraic, geometric and topological structures of the complex number field. Application of numerical techniques in various fields.

OUTCOMES: Students will be able to understand theoretical, analytical approach in solving the problems in complex variables and gives the profound knowledge in finding the roots of the polynomial .

Unit 1	**Functions of a Complex Variable**	
1.1	Equation to a circle and a straight line in complex form.	
1.2	Limit of a function.	
1.3	Continuity and differentiability.	
1.4	Analytic functions – Singular points.	
1.5	Cauchy-Riemann equations in Cartesian and polar forms.	14 hrs
1.6	Necessary and sufficient condition for function to be analytic.	
1.7	Harmonic functions – Real and Imaginary parts of an analytic function are harmonic.	
1.8	Construction of analytic function i) Milne Thomson Method – ii) using the concept of Harmonic function.	
Unit 2	**Complex Integration**	
2.1	The complex Line integral – Examples and Properties.	
2.2	Proof of Cauchy's Integral theorem using Green's Theorem.	
2.3	Direct consequences of Cauchy's theorem.	
2.4	The cauchy's integral formula for the function and the derivatives.	14 hrs
2.5	Applications to the evaluations of simple line integrals.	
2.6	Cauchy's Inequality – Liouville's theorem.	
2.7	Fundamental theorem of Algebra.	
Unit 3	**Finite differences.**	
3.1	Forward and backward differences.	
3.2	Shift operator – Interpolation.	
3.3	Newton – Gregory forward and backward interpolation formulae.	
3.4	Lagrange's interpolation Formula.	
3.5	Numerical solutions of first order linear differential equations– Euler – CauchyMethod.	20 hrs
3.6	Euler's modified method.	
3.7	Runge -Kutta fourth order method – Picard's method.	
3.8	Numerical integrationGeneral quadrature formula – Trapezoidal Rule.	
3.9	Simpson's 1/3 rule – Simpson's 3/8 th rule, Weddle's rule.	

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PRACTICAL VIII

Marks: End semester Examination 35 + IA 15 = 50

Mathematics practical with Free and **o**pen **S**ource **S**oftware **(FOSS) tools for computer programs (3 hours/ week per batch of not more than 15 students)**

LIST OF PROBLEMS

1.1. Some problems on Cauchy-Riemann equations (polar form).
1.2. Implementation of Milne-Thomson method of constructing analytic functions(simple examples).
1.3. Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
1.4. Verifying real and imaginary parts of an analytic function being harmonic (in polar coordinates).
1.5. Examples connected with Cauchy's integral theorem.
1.6. Programs on Interpolations with equal intervals.
1.7. Programs on Interpolations with unequal intervals.
1.8. Solving ordinary differential equation by modified Euler's method.
1.9. Solving ordinary differential equation by Runge-Kutta method of 4^{th} order.
1.10. Programs on Simpson's 1/3 rule.
1.11. Programs on Simpson's 3/8 rule.

.**Note:** The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in Place of scilab/maxima.

Reference Books:

1. L. V. Ahlfors – Complex Analysis
2. Bruce P. Palica – Introduction to the Theory of Function of a Complex Variable
3. Serge Lang – Complex Analysis
4. S. Ponnuswamy – Foundations of Complex Analysis
5. R. P. Boas – Invitation to Complex Analysis.
6. R V Churchil& J W Brown, Complex Variables and Applications, 5th ed.:McGraw Hill Companies., 1989.
7. A R Vashista, Complex Analysis, Krishna PrakashanaMandir, 2012.
8. B. D Gupta – Numerical Analysis
9. H. C Saxena – Finite Difference and Numerical Ana;ysis
10. B. S. Grewal – Numerical Methods for Scientists and Engineers
11. E. Ksreyszig – Advanced Engineering Mathematics.
12. M K Jain, S R K Iyengar, and R K Jain, Numerical Methods for Scientific and Engineering Computation, 4_{th} ed. New Delhi, India: New Age International, 2012.
13. S SSastry, Introductory methods of Numerical Analysis, Prentice Hall of India,2012.

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FIRST BCA-MATHEMATICS

TITLE: DISCRETE MATHEMATICS, TRIGONOMETRY AND CALCULUS.

CLASS DURATION – 03 HOURS PER WEEK48 Hours

Marks-Theory - 70 + Internal Assessment 30= 100

OBJECTIVE: This course is aimed to provide an introduction to the set theory, mathematical logic, trigonometry, and calculus.

OUTCOMES: At the end of this coursestudents can understand basicproperties, working rules of the set theory, logic, and calculus.

Unit 1	**Basics of set theory**	
1.1	Notations, Inclusions and equality of sets, the power set	**10hrs**
1.2	Operation on sets, Venn diagram, set identities	
1.3	Order pairs and n-tuples	

1.4	Cartesian product. Relation and ordering-properties of binary relations in a set	
1.5	Relation matrix and the graph of a relation	
1.6	Equivalence relations, compatibility relations	
1.7	Composition of binary relation.	
Unit 2	**Mathematical Logic**	
2.1	Statements and notation	
2.2	Connectives, negation, conjunction, disjunction,	
2.3	Statement formulas and truth tables	
2.4	Logical capabilities of programming languages,	**10hrs**
2.5	Conditional and bi-conditional, well formed formulas	
2.6	Tautologies, equivalence of formulas	
2.7	Duality law and tautological implication.	
Unit 3	**Trigonometry.**	
3.1	Radian measure of an angle ,trigonometric functions	
3.2	Heights and distances	**14 hrs**
3.3	Allied angles, addition and product formula	
3.4	Multiple and sub-multiple angle	
Unit 4	**Calculus.**	
4.1	Limits and continuity-Definitions, basic properties with examples and problems thereon.	
4.2	Differentiation –sum rule, product rule, quotient rule, chain rule	**14hrs**
4.3	Logarithmic differentiation.	
4.4	Differentiation of implicit functions and differentiation of parametric equations.	

Reference Books:

1. Discrete Mathematics by G K Ranganath
2.Discrete Mathematics by Chandrashekar Rao
3. Discrete Mathematics and its application by Kenneth H Rosen
4. Text book of Discrete Mathematics by Swapan Kumar Sarkar
5. Discrete Mathematics by Chakravarti Kumar

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SECOND BCA-MATHEMATICS
TITLE: ALGEBRA, ANALYTICAL GEOMETRY AND INTEGRAL CALCULUS.
CLASS DURATION – 03 HOURS PER WEEK. 48 Hours
Marks-Theory - 70 + Internal Assessment 30= 100

OBJECTIVE: This course is aimed to provide a basic knowledge about integral calculus, fundamentals of graph theory with basics of algebra.
OUTCOMES: At the end of this course students can apply his skill in solving the problems of integral calculus and he can apply his analytical knowledge solving graph theory and algebra problems.

Unit 1	**Basics of Algebra.**	
1.1	Introduction.	
1.2	Partial fraction, logarithms	**10 hrs**
1.3	Mathematical induction, binomial theorem	
1.4	Matrices and determinants	
Unit 2	**Graph Theory.**	**10hrs**

2.1 Basics definitions, paths, connectivity
2.2 Matrix representation of graphs-
2.3 Adjacency matrix, Incidence matrix, cycle matrix.
2.4 Trees- definitions, types of trees and distance concepts.

Unit 3 **Analytical Geometry.**

3.1 Points- section formula, distance formulae, area of a triangle in point form.
3.2 Straight lines-slope of a line, parallel and perpendicular lines, deferent forms of lines **14 hrs**
3.3 Circle-Equation of a circle with center as origin
3.4 Equation of a circle with center as other than origin, general equation of a circle
3.5 Tangent to the circle and length of the tangents.

Unit 4 **Integral Calculus**

4.1 Introductions, Indefinite integrals, integration by parts
4.2 integration by method of substitution, integration by using partial fraction
4.3 Evaluation of
$\int \frac{1}{a^2+x^2}\,dx$, $\int \frac{1}{a^2-x^2}\,dx$, $\int \frac{1}{x^2-a^2}\,dx$, $\int \frac{1}{\sqrt{a^2-x^2}}\,dx$, $\int \frac{1}{\sqrt{a^2+x^2}}\,dx$, $\int \frac{1}{\sqrt{x^2-a^2}}\,dx$.

4.4 Integrals of the form $\int \frac{dx}{ax^2+bx+c}$, $\int \frac{(px+q)dx}{ax^2+bx+c}$, $\int \frac{dx}{\sqrt{ax^2+bx+c}}$, $\int \frac{(px+q)dx}{\sqrt{ax^2+bx+c}}$. **14hrs**

4.5 Integrals of the form $\int \frac{dx}{a+b\cos x}$, $\int \frac{dx}{a+b\sin x}$, $\int \frac{dx}{a\cos x+b\sin x+c}$, $(p\cos x+q\sin x)dx a\cos x+b\sin x+c$.

4.6 Introductions to definite integrals.

Reference Books:

1. PU Text books prescribed by NCERT
2. A text book of Mathematics by G K Ranghanath
3. Analytical Geometry by Shanthi Narayan
4. Graph Theory by V R Kulli
5. Graph Theory by S Arumugam
6. Integral Calculus by Shanthi Narayan

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SOFT CORE / DISCIPLINE SPECIFIC ELECTIVE (DSE)

TITLE: ELEMENTARY DISCRETEMATHEMATICS
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: The objective of this course is to explain the fundamental ideas of sets, functions and logical operators

OUTCOME: Students will be able to get the fundamentals of set theory, functions and logical reasoning and syllogism through quantifiers

Unit 1 **Sets and Relations**

1.1 Cartesian product of two and more sets, relations
1.2 Difference and Symmetric difference of two sets **10 hrs**
1.3 Set identities, Generalized union and intersections

1.4 Product set, Relations (Directed graph of relations on set is omitted).
1.5 Composition of relations, Types of relations,Partitions.
1.6 Equivalence relations with example of congruence modulo relation,
1.7 Partial ordering relations, n-ary relations
1.8 Functions Identity function, constant functions
1.9 Product (composition) of functions,theorems on one-one and onto functions,
1.10 Mathematical functions, Recursively defined functions

Unit 2 **Logic**

2.1 Introduction, propositions, truth table.
2.2 Negation, conjunction andDisjunction.
2.3 Implications, bi-conditional propositions.
2.4 Converse, contra positive and inverse propositions and precedence of logical operators **10hrs**
2.5 Propositional equivalence: Logical equivalences.
2.6 Predicates and quantifiers: Introduction
2.7 Binding variables and NegationsBasics definitions, paths, connectivity

Suggested Project:

Fundamental theorem of Algebra: A polynomial equation of degree n>1 has n and only n roots, relation between roots and coefficients, symmetric functions of the roots.

Reference Books:

1. Elements of Discrete Mathematics 3rdedition by C.L. Liu, Tata Macgraw Hill,Publishers(2008).
2Discrete Mathematics by swapankumarSarkar,S.Chand publication
3. Discrete Mathematical Structures with Applications to Computer Scienceby J.P. Trembley and R.
Manohar, TataMagrawHill Publishers.
4. Discrete Mathematics for Computer Scientists by J. K. Truss, Pearson Education Asia.

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TITLE: ANALYTICAL GEOMETRY
(To be offered in II semester).
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course will give a glimpse of two and three dimensional figures and to analyze their properties in depth.

OUTCOME: This course helps the students to gain the analytical, geometrical knowledge in two, and three dimensional geometry.

Unit 1 **Analytic Geometry of two Variables.**

1.1 General Equation of Second Degree. Equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$
1.2 Transformation of Co-ordinates
1.3 Change of Origin and Rotation of Axes
1.4 To show that the general second degree equation represents. **18 hrs**
(a)Ellipse if $h^2 < ab$ (b) Parabola if $h^2 = ab$ (c) Hyperbola if $h^2 > ab$.
(d) Circle if $a = b$ & $h = 0$ and (e) Rectangular Hyperbola if $a + b = 0$
(f) Two straight lines if $\Delta = 0$
(g) Two parallel straight lines if $\Delta = 0$ &$h^2 = ab$ and where $\Delta = \begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$

Unit 2 **Conic sections.**

2.1 Standard equations of conics using focus-directrix property

2.2 Parametric equations of standard conics

2.3 Tangent at a point (x_1, y_1). Tangents in terms of slope **14hrs**

2.4 Tangent in terms of parametric co-ordinations.

2.5 Condition of tangency. Properties of i) Parabola ii) Ellipse and iii) Hyperbola.

Suggested Projects:

1 Geometrical Models (2 and 3 dimensionals) 2 Conic section..

Reference Books:

1.S. L. Loney; The Elements of Co-ordinate Geometry part I Cartesian Coordinates; subject publications
1990.
2.P.K.Jain, Khalil Ahmed: Textbook of Analytical Geometry of three Dimensions, second edition, Wiley,
Eastern Limited, 1991.
3.M.L. Khanna: Solid Geometry; Jai Prakash Nath and Co.1988.
4.TomApostal**, Calculus Vol. I** , Second Edition, Wiley Students Edition , India, 2012

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TITLE: ADVANCED DISCRETE MATHEMATICS.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course gives the idea ofbasic concepts of partial ordered , lattice.
OUTCOME: At the end of the this course student can understand the fundamentals of Lattice theory and its properties

Unit 1 **Lattice Theory:**

1.1 Partially Ordered sets & Lattice Theory**:** Definition and examples of partiallyordered sets **12 hrs**

1.2 Lattices: Set theoretic & Algebraic definitions, Examples for lattices

1.3 Duality principle, Sub-lattices & Convex sub-lattices.

Unit 2 **Properties Of Lattice Theory:**

2.1 Ideals of lattices,

2.2 Complements & Relative complements

2.3 Homomorphism & Isomorphism **20 hrs**

2.4 Distributive and Modular lattices

2.5 Characterization of distributive and modular lattices in terms of sub-lattices.

Suggested Projects:

1. Domination theory
2. Directed Graphs

Reference Books:

1. Elements of Discrete Mathematics 3rdedition by C.L. Liu, Tata Macgraw Hill,Publishers(2008).
2. Introduction to Lattice Theory by Gabor Szasz, Academic Press, NewYork and London, 1963.
3. Discrete Mathematical Structures with Applications to Computer Scienceby J.P. Trembley and R. Manohar, TataMagrawHill Publishers.
4. Discrete Mathematics for Computer Scientists by J. K. Truss, PearsonEducation Asia.

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TITLE: DIFFERENTIAL GEOMETRY.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course imparts an in-depth analysis of curves, surfaces and analysis of several variable functions.

OUTCOME: This course helps in understanding basic knowledge about asymptotes, multiple points and this course helps the student to trace the curves.

Unit 1	**Asymptotes**	
1.1	Introduction, Definitions	
1.2	Conditions for infinite roots of a given equation	
1.3	Asymptotes of algebraic curve, simple methods of finding the asymptotes	**12 hrs**
1.4	Asymptotes parallel to coordinate axis	
1.5	Miscellaneous methods of finding asymptotes of algebraic curves.	
Unit 2	**Multiple Points,**	
2.1	Introduction, Classification of double points,.	
2.2	Conditions for double point to exist and their classification,	
2.3	Species of cusps, Methods for finding the Species of cusps.	**20 hrs**
2.4	Tracing of Cartesian curve, polar curve and parametric curve.	
2.5	Characterization of distributive and modular lattices in terms of sub-lattices.	

Suggested Projects:

1. Arc length of the Catenary curves
2. SerretFrenet Formulae,
3. Conformal map of stereographic projection.

Reference Books:

1. Mittal and Agarwal, Differential Geometry, , Krishna Prakashan Media [P] Ltd. 27th edition (1999), 11, Shivaji Road, Meerut – 1 (U.P.)
2. J. A. Thorpe, Introduction to Differential Geometry, Springer Verlag.
3. I. M. Singer and J. A. Thorpe, Lecture notes on elementary Topology and Geometry, Springer Verlag 1967.
4. B. O. Neill, Elementary Differential Geometry, Academic Press, 1966.
5. S. Sternberg, Lectures on Differential Geometry of Curves and Surfaces, Prentice – hall 1976.
6. D. Laugwitz, Differential and Riemannian Geometry, Academic Press, 1965.
7. R. S. Millman, and G. D. Parker, Elements of Differential Geometry Springer Verlag.
8. T. J. Willmor, An Introduction to Differential and Riemannian Geometry, Oxford University Press 1965.
9. H. S. Dhami, Differential Calculus, New Age International Publication.

TITLE: INDEFINITE AND IMPROPER INTEGRALS.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course will provide a glimpse of integration of function which could not be integrated by Riemann integrations .i.e, those functions which are unbounded and those functions whose domain is unbounded.
OUTCOME: This course helps students to solve indefinite, improper forms of an integrals

Unit 1 **Introduction to indefinite integrals.**

1.1 Continuity of $F(x) = \int_a^x f(t)dt$ where, $f \in R[a, b]$,
1.2 Fundamental theorem of calculus
1.3 Mean value theorem, **12 hrs**
1.4 Integration by parts, Leibnitz rule
1.5 Miscellaneous methods of finding asymptotes of algebraic curves.

Unit 2 **Improper integrals**

2.1 Improper integrals- type 1 and type 2,.
2.2 Absolute convergence of improper integrals
2.3 Comparison tests, Abel's and Dirichlet's tests (without proof) **20 hrs**
2.4 □□and□□functions and their properties, relationshipbetween□□and□□functions.
2.5 Functions of bounded variations.total variation, decomposition theorem

Suggested Projects:

1. Arc length of the Catenary curves
2. SerretFrenet Formulae,
3. Conformal map of stereographic projection.

Suggested Projects:

1. Convergence of improper integrals, applications of comparison tests, Abel's and Dirichlet's tests, and functions.
2.Double integrals, iterated integrals, applications to compute average value, area, moment, center of mass.
3.Applications of complete elliptic integral.

Reference Books:

(1) R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964.
(2) Ajit Kumar, S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.
(3) T. Apostol, Calculus Vol.2, , John Wiley.
(4) J. Stewart, Calculus, Brooke/Cole Publishing Co, 1994.
(5) J. E. Marsden, A. J. Tromba and A. Weinstein, Basic multivariable calculus.
(6) Bartle and Sherbet, Real analysis.

TITLE: THEORY OF EQUATIONS
(To be offered in IV Semester)
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course is introduce solid base for theory of equations and find the roots of the cubic equations.

OUTCOMES: This course helps in improving the basic knowledge about the theory of equations and gives thestrength in solving the equations.

Unit 1 **Equations and its roots.**

1.1 Euclid's algorithm – Polynomials with integral coefficients
1.2 Remainder theorem – Factor theorem – Fundamental theorem of algebra(statement only) **16 hrs**
1.3 Irrational and complex roots occurring in conjugate pairs

Unit 2 **Cubic and reciprocal equations**

2.1 Relation between roots and coefficients of a polynomial equation – symmetric functions
2.2 Conditions for double point to exist and their classification,
2.3 transformation – Reciprocal equations – Descartes' rule of signs – multiple roots **16 hrs**
2.4 solving cubic equations by Cardon's method –
2.5 solving quartic equations by Descarte's Method

Suggested Projects:

1 Roots of Polynomial through Graphs
2. Fundamental theorem of algebra
3.Ferrari method of solving Bi-Quadratic equation
4. Subjects motivated from theory of equations. Eg: Numerical methods

Reference Books:

1. Higher algebra by S.Barnad and J M Child
2.Elementary Number Theory By David M burton.

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TITLE: LINEAR PROGRAMMING.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

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OBJECTIVE: This course is application oriented which will help the students to appreciate the beauty of interdependent nature of mathematics.

OUTCOME: After studying this course students can easily solve many of the practical problems by using linear programming problem .

Unit 1 **Linear Programming Problem-I**

1.1 Convex Set, Extreme points of a convex set
1.2 Convex combination **16 hrs**
1.3 Convex hull, Convex polyhedron
1.4 Fundamental theorem of linear programming

Unit 2 **Linear Programming Problem-II**

2.1 Definition, Formulation of linear programming of problems (LPP)

2.2 Graphical solution of linear programming problems,

2.3 General formulation of LP problems **16 hrs**

2.4 Standard form and matrix form of LP problems.

2.5 Canonical stack forms for Linear Programming- Problems

Suggested Projects:

1. Duality in Linear Programming and Dual Simplex Method
2. Transportation and Assignment Problem:
3. Network- Flow Problems

Reference Books:

1. Operation Research by KantiSwaroop, P.K. Gupta and Manmohan

2. G. Hadley, Linear Programming, Narosa Publishing house, 1995.

3. Linear Programming and its Applications by James K Strayer,Narosa Publishing House,Springer

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TITLE: PARTIAL DIFFERNTIAL EQUATIONS

(To be offered in IV Semester)
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course is concerned with the basics of partial differential equations which makes the student to understand the topic from grass root level.

OUTCOME: At the end of this course student will learn the various methods of solving partial differential equation.

Unit 1 **Introduction to Partial Differential Equations**

1.1 Basic concepts

1.2 Formation of a partial differential equations by elimination of arbitrary constants and functions **20 hrs**

1.3 – Solution of partial differential equations – Solution by Direct integration,

1.4 Solving Lagrange's linear equations of the form Pp + Qq = R- problems

Unit 2 First order non-linear partial differential equations

2.1 Standard types of first order non-linear partial differential equations – Charpit's method

2.2 Homogenous linear equations with constant coefficient **12 hrs**

2.3 Rules for finding the complementary function

2.4 Rules for finding the particular integral.

Suggested Projects:

1 Applications of Partial Differential Equations

TITLE: FUNDAMENTALS OF METRIC SPACES.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course acts as a catalyst to the vast branch of mathematics i.e, topology and gives profound base for it.
OUTCOME: At the end of this course students can gain the basic knowledge about topology

Unit 1	**Metric space**	
1.1	Definition and examples of metric spaces	
1.2	Open ball and open sets, closed set as complement of an open set.	**16hrs**
1.3	Properties of closed sets and open sets.	
1.4	Limit points of a set, closure of a set, dense sets.	
Unit 2	**Point set topology**	
2.1	Subspace of a metric space	
2.2	Convergence of a sequence in a metric space, Cauchy sequences	
2.3	Continuous functions from a metric space X to a metric space Y (ε-δ definition) their characterization in terms of open sets, closed sets	**16hrs**
2.4	Closure and convergent sequences	

Suggested Projects:
1. Define at-least 4 metric on $\mathbb{R}$ and R^2 and write their visualization of open balls.
2. Relations Between metric space and topological space
3. Relations Between metric space and Hausdorff space

Reference Books:

1. E.T.Copson : Metric spaces, Cambridge University Press
2. P.K. Jain and K. Ahmad : Metric spaces, Narosa Publishing House.
3. S. Kumaresan : Topology of Metric Spaces Narosa Publication House.

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TITLE: INTEGRAL TRANSFORMS.
(To be offered in V Semester)
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: To learn the theoretical approach of the subject**.**
OUTCOME: Students will be able to apply the theoretical knowledge in practical skill.

Unit 1	**Laplace transforms.**	
1.1	Definition of - Integral Transform	
1.2	Laplace Transform Linearity, Property, Piecewise continuous Functions,	
1.3	Existence of Laplace Transform,	
1.4	Functions of Exponential order, and of Class A.	**20 hrs**
1.5	Analysis of Laplace transforms	
1.6	Laplace Transform of Integrals,	
1.7	Multiplication by t, Multiplication by tn	
1.8	Division by t. Laplace transform of Bessel Function	

1.9 Laplace Transform of Error Function

1.10 Laplace Transform of Sine and cosine integrals

Unit 2 Fourier transforms

2.1 The Fourier integral –different forms of Fourier integrals-problems

2.2 Complex Fourier problems-inverse transforms

2.3 Self reciprocal-basic properties of Fourier transforms

2.4 Linear change of scale, shifting

2.5 Modulation –transforms of derivatives and the derivative of the transform problems there on

2.6 Fourier sine and cosine transforms.

12 hrs

Suggested Projects:

1. Application of integral transforms in electrical engineering.

Reference Books:

1. B.S Grewal – Higher engineering mathematics.
2. E. Ksreyszig – Advanced Engineering Mathematics

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TITLE: ELEMENTARY GRAPH THEORY.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course gives the idea ofbasic concepts of Graph Theory, Operation on graphs, and the relations between the graph theory and Matrix theory.

OUTCOME: After studding this course student can apply the graph operations on given graphs and can get the applications of graph theory in other branches of mathematics and other area like computer science, chemistry, physics.

Unit 1 **Basics**

1.1 Graph ,finite, Infinite graphs

1.2 Incidence and degree , Isolated vertex, Pendent Vertex

1.3 Null graph, Isomorphism, Sub-graphs, Walks, Paths, Circuits

1.4 Connected and disconnected graphs, Components,

20 hrs

Unit 2 Graph operations

2.1 Operation on graphs, Hamiltonian paths

2.2 Circuits, Trees and some properties of trees

2.3 Rooted and binary tree, Spanning tree and fundamental circuits.

2.4 Matrix Representation of Graphs

20 hrs

Reference Books:

1.F. Harary – Graph Theory, Addition Wesley Reading Mass, 1969.

2.N. Deo – Graph Theory With Applications to Engineering and Computer Science, Prentice Hall of India, 1987.

3.K. R. Parthasarathy – Basic Graph Theory, Tata McGraw-Hill, New Delhi, 1994.

G. Chartand and L. Lesniak – Graphs and Diagraphs, Qwadsworth and Brooks, 2nd Ed.,

4.Clark and D. A. Holton – A First Look at Graph Theory, Allied publishers.
5.D. B. West – Introduction to Graph Theory, Pearson Education Inc., 2001, 2nd Ed.,

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TITLE: PROBABILITY & STATISTICS.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course is concerned with the Foundations of mathematics which makes the students to understand the analytical approach, concept of statistics and gives an idea about probability.
OUTCOME: At the end of this course students can solve many of the real life problems.

Unit 1	**INTRODUCTION TO STATISTICS**	
1.1	Statistical concepts-definitions and explanation of commonly used statistical terms	
1.2	Scales of measurements with examples	
1.3	Organization of data - Classification and tabulation (univariate and bi-variate tables), frequency distribution (univariate and bi variate)	**16hrs**
1.4	Diagrammatic representations - Line diagram, simple bar diagram, multiple bar diagram, component bar diagram, percentage component bar diagram, pie diagram	
1.5	Graphical representations - Histogram, frequency curve, frequency polygon, ogives, scatter plot	
Unit 2	**MEASURES OF CENTRAL TENDENCY**	
2.1	**Introduction** - definitions, various measures of averages, merits and demerits, applications	
2.2	Mean -Arithmetic mean, weighted arithmetic mean	**16 hrs**
2.3	Combined arithmetic mean, corrected arithmetic mean	
2.4	Geometric mean, harmonic mean.	
2.5	Partition Values - Median, quartiles, deciles, percentiles. (Along with their graphical computation	
2.6	Mode - Using formula and by grouping method (along with their graphical computation)	
2.7	Rooted and binary tree	
2.8	Spanning tree and fundamental circuits	

Suggested Projects:

1. Applications of the Chi-square Distribution-Tests of Goodness Fit-Contingences Tables.
2. Binomial and Poisson Distribution-
3. Normal Distribution and its properties.
4. Lindberg-levy Central Limit Theorem.
5. Applications of Baye`s theorem

TITLE: VECTOR CALCULUS.
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course is framed to help students to mathematize real world problems using vectors and by learning about their property.
OUTCOME: At the end of this course students can have the knowledge of operations of scalar, vector product and properties of it.

Unit 1	**Basics**	
1.1	Scalar and vector product of three vectors,	
1.2	Product of four vectors. Reciprocal vectors.	**12 hrs**
1.3	Vector differentiation Scalar Valued point functions	
1.4	Vector valued point functions	
1.5	Derivative along a curve, directional derivatives	
Unit 2	**Properties and Applications**	
2.1	Orthogonal curvilinear coordinates	
2.2	Conditions for orthogonality fundamental tired of mutually orthogonal unit vectors.	**20 hrs**
2.3	Gradient, divergence	
2.4	curl and laplacian operators in terms of orthogonal curvilinear coordinates ,cylindrical coordinates spherical coordinates,	
2.5	Vector integration, line integral, surface integral, volume integral	
2.6	Theorem of Gauss, Green, Stokes (statements only) and problems there on	
2.7	Rooted and binary tree	
2.8	Spanning tree and fundamental circuits	

Suggested Projects:

1. Gradient of a scalar point function,
2. Laplacian operator

Reference Books:

1.Murrary R. Spiegal : Theory and Problems of Advanced Calculus, Schaum Publication

2.Murrary R. Spiegal : Vector Analysis, SchaumPublisghing Company, New York.

3.N. Saran and S.N. NIgam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.

4.ShantiNarayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

TITLE:BASICS OF FLUID MECHANICS
CLASS DURATION – 02 HOURS PER WEEK32 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: The course on fluid mechanics is devised to introduce fundamental aspects of fluid flow behaviour.

OUTCOME: At the end of this course students can able to understand stress-strain relationship in fluids, classify their behavior and also establish force balance in static systems.

Unit 1	**Basics**	
1.1	Recollection of vector analysis	
1.2	Introduction to fluid mechanics:-- General description, isotropy	
1.3	Basic properties of fluid, viscous and non-viscous fluids, viscosity	**12 hrs**
1.4	Newtonian and non-Newtonian fluids, real and ideal fluids	
1.5	Types of flows (Laminar, turbulent, steady, unsteady, uniform, non-uniform, rotational, irrotational, barotropic flows [Definitions].)	
Unit 2	**Motion of Fluids**	
2.1	Kinematics of fluids in motion	
2.2	Methods of describing fluid motion (Lagrangian method, Eulerian method	
2.3	Velocity of a fluid particle, material, local and convective derivatives	**20 hrs**
2.4	Acceleration of fluid particle(in Cartesian coordinates)	
2.5	Significance of equation of continuity	
2.6	Derivation of equation of continuity (by Euler's method, Lagrangian method).	
2.7	Stream line, path line, stream lines, velocity potential, vorticity vector, vortex line	
2.8	Rotational and irrotational motion	

Suggested Projects:

1. Motion in two-dimensions
2. General theory of irrotational motion
3. Motion of cylinders
4. Vortex motion
5. Bernoulli's equation.
6. Pressure equation
7. Bernoulli's theorm

Reference Books:

1. M. D. Raisinghania, Fluid dynamics, S. Chand, 2014

OPEN ELECTIVE MATHEMATICS – 18MAT-OE1
TITLE: QUANTITATIVE APTITUDE
CLASS DURATION – 03 HOURS PER WEEK36 Hours
Marks-Theory - 30 + Internal Assessment 20= 50

OBJECTIVE: This course helps the students to imbibe quantitative techniques in competitive field.
OUTCOME: At the end of this course students can analyze and can solve tricky problems

Unit 1	**Numbers**	
1.1	Types of numbers,, ,	
1.2	Unit digits	**12 hrs**
1.3	HCF and LCM	
1.4	Shortcut methods for calculation, Square and cube roots, average	
Unit 2	**Percentage and Work efficiency**	
2.1	Percentage	
2.2	Profit and loss	
2.3	Ratio and proportion	
2.4	Time and work,	**20 hrs**
2.5	Pipes and cisterns– problems	
Unit 3	**Simple , Compound Interest and Syllogism**	
3.1	Simple ,Compound interest	
3.2	Boats and streams	
3.3	Calendar, mensuration	
3.4	syllogism-problems	

Reference Books:

1. Quantitative Aptitude- R.S Agarwal-
2. Quantitative Aptitude for CAT- Arun Sharma

Websites for reference:
www.bankersadda.com
www.sscadda.com
www.mathisfun.com
www.learnersplanet.com

Useful web links for students:

1. http://www.cs.columbia.edu/~zeph/3203s04/lectures.html
2. http://home.scarlet.be/math/matr.htm
3. http://www.themathpage.com/
4. http://www.abstractmath.org/
5. http://ocw.mit.edu/courses/mathematics/
6. http://planetmath.org/encyclopedia/TopicsOnCalculus.html
7. http://mathworld.wolfram.com/
8. http://www.univie.ac.at/future.media/moe/galerie.html
9. http://www.mathcs.org/
10. http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm
11. http://math.fullerton.edu/mathews/numerical.html
12. http://www.onesmartclick.com/engineering/numerical-methods.html

13. http://www.math.gatech.edu/~harrell/calc/
14. http://tutorial.math.lamar.edu/classes/de/de.aspx
15. http://www.sosmath.com/diffeq/diffeq.html
16. http://www.analyzemath.com/calculus/Differential_Equations/applications.html
17. http://www.math.gatech.edu/~harrell/calc/
18. http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm
19. http://www.fourier-series.com/
20. http://www.princeton.edu/~rvdb
21. http://www.zweigmedia.com/RealWorld/Summary4.html
22. http://www.math.unl.edu/~webnotes/contents/chapters.htm
23. http://www-groups.mcs.st-andrews.ac.uk/~john/analysis/index.html
24. http://web01.shu.edu/projects/reals/index.html

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QUESTION PAPER BLUE PRINT

Ist Semester . B. Sc (DSC)
Matrices, Basics of Number Theory and Differential Calculus

Time:3 hours **Total Marks:60**

Part-A

1. **Answer any FIVE out of SEVEN questions** **5*2=10**
   - **Unit 1: a-b**
   - **Unit 2: c-d**
   - **Unit 3: e-g**

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

- **Unit 1: 2-6**
- **Unit 2: 7-10**
- **Unit 3: 11-15**

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II Semester B. Sc (DSC)
Elements of Differential Calculus and Fundamentals of Integral Calculus

Time:3 hours **Total Marks:60**

Part-A

1. **Answer any FIVE out of SEVEN questions** **5*2=10**
   - **Unit 1: a-c**
   - **Unit 2: d-e**
   - **Unit 3: f-g**

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

- **Unit 1: 2-6**
- **Unit 2: 7-11**
- **Unit 3: 12-15**

III Semester B. Sc (DSC)
Group Theory, Line and Multiple Integrals

Time:3 hours **Total Marks:60**

Part-A

1. **Answer any FIVE out of SEVEN questions** **5*2=10**

Unit 1: a-b
Unit 2: c-d
Unit 3: e-g

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

Unit 1: 2-6
Unit 2: 7-10
Unit 3: 11-15

*****

IV Semester B. Sc (DSC)
Ordinary Differential Equations

Time:3 hours **Total Marks:60**

Part-A

1. **Answer any FIVE out of SEVEN questions** **5*2=10**

Unit 1: a-c
Unit 2: d-e
Unit 3: f-g

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

Unit 1: 2-8
Unit 2: 9-11
Unit 3: 12-15

****

V Semester B. Sc (DSC)
Real Sequence, Series and Fourier Series

Time:3 hours **Total Marks:70**

Part-A

1. **Answer any TEN out of TWELVE questions** **10*2=20**

Unit 1: a-e
Unit 2: f-i
Unit 3: j-l

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

Unit 1: 2-6
Unit 2: 7-11
Unit 3: 12-15

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V Semester B. Sc (DSC)
Rings, Fields and Riemann Integration

Time:3 hours **Total Marks:70**

Part-A

1. **Answer any TEN out of TWELVE questions** **10*2=20**

Unit 1: a-e
Unit 2: f-i
Unit 3: j-l

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

Unit 1: 2-6
Unit 2: 7-11
Unit 3: 12-15

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VI Semester B. Sc (DSC)
Linear Algebra and Numerical Analysis I

Time:3 hours **Total Marks:70**

Part-A

1. **Answer any TEN out of TWELVE questions** **10*2=20**

Unit 1: a-d
Unit 2: e-h
Unit 3: i-l

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

Unit 1: 2-5
Unit 2: 6-9
Unit 3: 10-15

****

VI Semester B. Sc (DSC)
Complex Analysis and Numerical Analysis II

Time:3 hours **Total Marks:70**

Part-A

1. **Answer any TEN out of TWELVE questions** **10*2=20**

Unit 1: a-d
Unit 2: e-h
Unit 3: i-l

Part-B

Answer any TEN out of FOURTEEN questions **10*5=50**

Unit 1: 2-5
Unit 2: 6-10
Unit 3: 11-15

QUESTION PAPER BLUE PRINT FOR B. Sc, SOFTCORE

Time: 90 min **Marks:30 marks**

Part-A

Answer any FIVE out of SIXquestions **5x2=10**		
Question number	**Marks Allotted**	**Corresponding units**
A	2	Unit-1
B	2	Unit-1
C	2	Unit-1
d	2	Unit-2
e	2	Unit-2
f	2	Unit-2

Part-B

Answer any FOUR out of SIX questions 4x5=20		
Question number	**Marks Allotted**	**Corresponding units**
1	5	Unit-1
2	5	Unit-1
3	5	Unit-2
4	5	Unit-2
5	5	Project work
6	5	Project work

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QUESTION PAPER BLUE PRINT FOR B. Sc, OPEN ELECTIVE

Time:90mins **Marks:50**

Part-A

1. **Answer any TEN out of TWELVE questions** **10x2=20**

Unit 1 : a-d
Unit 2 : e-h
Unit 3 :i-l

Part –B

2. **Answer any SIX out of NINE questions**

Unit 1 : a-c **6x5=30**
Unit 2 : d-f
Unit 3 : g-i

QUESTION PAPER BLUE PRINT FOR B. C. A, HARDCORE

Part-A

Answer any ten out of twelve questions 10x2=20		
Question number	**Marks Allotted**	**Corresponding units**
a	2	Unit-1
b	2	Unit-1
c	2	Unit-1
d	2	Unit-2
e	2	Unit-2
f	2	Unit-2
g	2	Unit-3
h	2	Unit-3
I	2	Unit-3
J	2	Unit-4
K	2	Unit-4
l	2	Unit-4

Part-B

Answer any six out of eight questions 6x5=30		
Question number	**Marks Allotted**	**Corresponding units**
1	5	Unit-1
2	5	Unit-1
3	5	Unit-2
4	5	Unit-2
5	5	Unit-3
6	5	Unit-3
7	5	Unit-4
8	5	Unit-4

Part-C

Answer any six out of eight questions 6x5=30		
Question number	**Marks Allotted**	**Corresponding units**
1	5	Unit-1
2	5	Unit-1
3	5	Unit-2
4	5	Unit-2
5	5	Unit-3
6	5	Unit-3
7	5	Unit-4
8	5	Unit-4