



**Dr. V. S. Krishna Govt. Degree
College(A)
Visakhapatnam**



DEPARTMENT OF MATHEMATICS

PROPOSED SYLLABUS FOR MATHEMATICS

IN UNDERGRADUATE DEGREE PROGRAMME

UNDER AUTONOMY

(With effect from 2022-23)

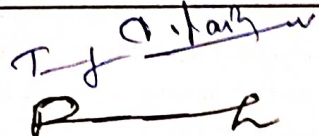
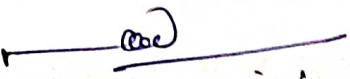
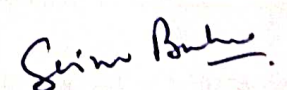
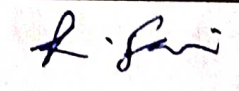
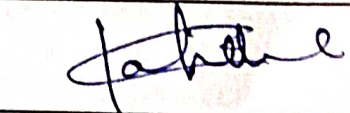
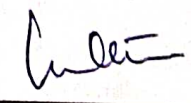
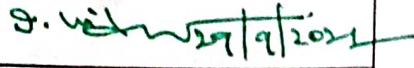
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Dr.V.S.Krishna Govt. Degree College (Autonomous), Visakhapatnam
8th Board of Studies----- September-2022

Subject: Mathematics

Department: Mathematics

In pursuance of conferment of Autonomous status to Dr.V.S.Krishna Govt. Degree College(A), Visakhapatnam by the UGC vide letter No.F22-1/2011(AC) dated 20.07.2011 from Dr. Manju Singh, Joint Secretary, UGC, New Delhi and Proceedings No. C-II (CDC) /Dr.VSK.Govt.College/BOS/2020 dt.03.08.2022 of The Vice-Chancellor, Andhra University, Visakhapatnam, the 8th Board of Studies in **Mathematics** Subject is conducted on 29.09.2022 at 11.00 AM with the following members. The Changes will be implemented from 2022-23 academic year onwards.

MEMBER	NAME& DESIGNATION	SIGNATURE
Head of the Department (Chairman)	Dr. K. Ravibabu	
Faculty Members	Dr. K. Ravibabu Ms. Triveni Domada S. Ram Mohan Rao	
Subject Expert (University Nominee)	Prof. N. Ramakrishna, Dept of Mathematics, Andhra University.	
Subject Experts (from outside the parent university)	Sri. P. Mahalakshmi Naidu, Lecturer in Mathematics, G.D.C, Perumallapuram,E.G., AdikaviNannaya University	
	Sri. R. Ravi Shankar, Lecturer in Mathematics, G.D.C (M), Srikakulam Dr. B. R. Ambedkar University	
Representative Member From Industry / Corporate / Allied Area relating to placement	Sri. Srinu Babu Senior Software Engineering L&T Software Technology Visakhapatnam	
Member from Alumni	Kondru Sai Visakhapatnam	
Coordinator, IQAC	Dr.Ch. Lalitha	
Academic Coordinator and member secretary, Academic Council	Dr. P. Latha	
Principal and Chairperson, Academic Council	Dr.I. Vijayababu	

Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

DEPARTMENT OF MATHEMATICS

BOARD OF STUDIES - MINUTES OF THE MEETING

2022 – 2023

The Board of Studies of the Department of MATHEMATICS met on **29.09.2022 at 11.00AM** under the Chairmanship of Dr. K.Ravibabu and resolved the following:

- 1) To adopt Revised Choice Based Credit System as per the Staff Councils proceedings commencing from the academic year 2022 – 2023 for Semester I, II, III, IV, V and VI of B.Sc. students.
- 2) To approve/ ratification and introduce the newly framed syllabus (modified and approved by the BOS) for Semester I, II, III, IV, V and VI course in Mathematics. The newly framed syllabus is oriented in such a fashion that it caters to the needs of the students and to meet the present-day job employability and to develop professionalism in the field of Mathematics.
- 3) To ratify and introduce the semester mode pattern of examinations for Semester I, II, III, IV, V and VI students (M.P.C., M.P.Cs, M.C.IC & M.S.Cs. groups). Further it is approved/ ratified syllabus, blue print and the model question papers submitted by the concerned faculty members for Semester I, II, III, IV, V and VI.
- 4) To approve/ ratify new employable and skill-based programs from 2022-23. To adopt NAAC norms by introducing quality circles among student community.
- 5) To approve /ratify life skill courses, skill development courses for the 1st and 2nd year students (B.A., B.Com. and B.Sc.) and mathematics minors for Phy. (hons.), Chem. (hons.).
- 6) To approve/ ratify for 25 internal marks as a part of Continuous Internal Assessment for core courses and allocation of marks as per Table-I
- 7) To approve/ ratify question paper blue print, model question papers for 75 external marks and allocation of marks and the pattern of the paper as per Table-II
- 8) To approve/ ratify minimum pass percentage of semester end theory examinations as 40% of 25 internal + 75 external=100
- 9) To approve / ratify practical examinations for each core courses for semester I , II, III, IV, V and allocation of marks Table-IIA
- 10) To approve/ ratify Internship-I as community services project for 1st year students at the end of sem-II w.e.f. 2022-23 as per NEP-2020 and allocation of marks as per Table-III.
- 11) To approve/ ratify Internship-II, two months training program for 2nd year students at the end of IV-semester w.e.f. 2022-23 as per NEP-2020 and allocation of marks as per Table-IV.
- 12) To approve Internship-III, six months On Job Training program for 3rd year students (after IV-semester) as VI-semester w.e.f. 2022-23 as per NEP-2020 and allocation of marks as per Table-V.
- 13) To approve / ratify value-added certificate course for the academic year 2022-23 and allocation of marks and the pattern of the paper as per Table-VI.

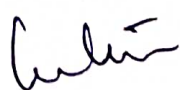
- 14) To approve/ ratify blue print and the model question papers for 50 external marks for life skill and skill development courses and allocation of marks and the pattern of the paper as per Table-VII.
- 15) To approve and ratify list of examiners as per Table-VIII.
- 16) To implement pedagogical strategies to enrich teaching and learning process and to implement Blended learning teaching process.
- 17) To approve suggestions for students' seminars, workshops and student-centered activities.
- 18) To approve suggestions for research and extension activities or start-up.
- 19) To encourage students to take up independent research projects at their level by providing facilities.
- 20) To adopt NAAC norms by introducing quality circles among student communities.
- 21) To develop infrastructure facilities in the department and implement guidelines of the academic council.
- 22) To take up ICT mode of teaching and evolve techniques that are easily understanding by the students and conduct remedial coaching to the below average students.
- 23) To encourage students to join JKC to equip with communication skills and improve their personality development.
- 24) To encourage students to participate in the community development activities such as Haritha Krishna Eco Club, NCC and NSS.

Signed and approved by


Prof. N. Ramakrishna,
Subject Expert
(University Nominee)


Sri. P. Mahalakshmi Naidu,
Subject Experts
(from outside the parent
university)


Sri. R. Ravi Shankar
Subject Experts
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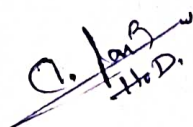

H.D.

Table-I: Allocation of Internal Marks as a part of Continuous Internal Assessment methods:

w.e.f. 2022-23			
Assessment	Marks for each Mid examination	Time	Pass Mark
Assignments(at least one assignment from each unit) *The weightage of marks, for the assignments should be awarded after completion of all the assignments which are finished before the mid examinations are commenced.	10	50min	The marks obtained by a student for 100 marks in both mid examination is to be scale down to 25 marks. Minimum Pass marks 9*
Projects/Seminars/PPT/Quizzes/Field trips ..etc	10	NA	
External Activities like clean & green, NCC,NSS and attendance Attendance should be also be taken into account for awarding the total of 5 marks. The award of marks should be completed before conduct of the mid examination commenced.	10	NA	
Internal examination pattern for both Mid1 and Mid2 : Section-A Answer any two out of five $2 \times 5 = 10$ Section-B Answer any five out of seven $5 \times 2 = 10$ ** One mid examination may be conducted through online mode**	20	1 hour	
Total	50		

Table-II: Allocation of External Marks for semester end theory examinations:

Duration of the exam	3 hrs
Maximum marks	75 marks
Minimum pass marks	27*
Paper pattern	Section A for 25 marks: In Section A , answer any 5 questions out of 8 , each carry 5 marks. (5X5=25) Section B for 50 marks: In section B, answer all 5 questions(there will be an internal choice), each question carry 10 marks

Table-IIA: Allocation of Practical marks:

Category	Marks
Record	20
Problem solving	60
Viva-voce	20
Maximum marks	100
Minimum pass marks	50*

Table-III: Allocation of Internship-I (Community Service Project) Marks:

Category	Marks
Project log book	20
Implementation	30
Project Report	25
Project Presentation	25
Total marks	100
Minimum pass marks	50*

Table-IV: Allocation of Internship-II Marks:

Category	Marks
Implementation	50
Project Report	25
Project Presentation	25
Total marks	100
Minimum pass marks	50*

Table-V: Allocation of Internship-III Marks:

Category	Marks
Implementation	50
Project Report	25
Project Presentation	25
Internal Viva Voce at industry oblique company	50
External Viva Voce at college	50
Total marks	200
Minimum pass marks	100*

Table-VI: Allocation of Add-On course Marks:

Duration	One and half hrs
Maximum marks	50
Minimum pass marks	25*
Examination pattern	Answer any five questions out of eight questions, each question carry 10 marks 5X10=50 marks

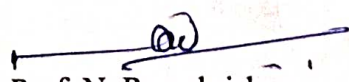
Table-VII: Allocation of external marks for life skill and skill development courses:

Duration	One and half hrs
Maximum marks	50 marks
Minimum marks	25*
Examination pattern	Answer any five questions out of eight questions, each question carry 10 marks 5X10=50 marks

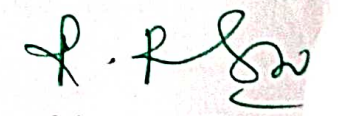
Table-VIII : List of examiners

Sl.No	Name of the examiner	Designation	Place of working
01	ArunaKumari Sadasivuni	Lecturer in Mathematics	GDC(M),Srikakulam
02	Ronanki Ravisankar	Lecturer in Mathematics	GDC(M),Srikakulam
03	Mrs.Y Prasanthi	Lecturer in Mathematics	GDC(W)(A),Srikakulam
04	Duryodhana Dalai	Lecturer in Mathematics	GDC,Ichapuram
05	Chappa .Raghavendra Naidu	Lecturer in Mathematics	GDC,Palakonda
06	L VenkataRamana	Lecturer in Mathematics	GDC,Rajam
07	Dr.SanapalaLakshmanarao	Lecturer in Mathematics	GDC,Tekkali
08	Chappa Naidu	Lecturer in Mathematics	GDC,Veeraghattam
09	P.Mangamma	Lecturer in Mathematics	GDC (W),Marripalem
10	K.V.S.Nagalakshmi	Lecturer in Mathematics	GDC (W),Visakhapatnam
11	Dr.K.VenkataVidyasagar	Lecturer in Mathematics	GDC,Bheemunipatnam
12	AlakaKrishnaRao	Lecturer in Mathematics	GDC,Chodavaram
13	MVRamakrishna	Lecturer in Mathematics	GDC,Sabbavaram
14	ChVijayaKumar	Lecturer in Mathematics	GDC,Yellamanchili

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Dr.V.S.Krishna Govt. Degree College (Autonomous), Visakhapatnam
8th Board of Studies----- September-2022
Department: Mathematics
Courses Structure

Courses	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem- VI
Life Skills	1 (02)	1 (02)	2 (04)			*****
Skill Development	1 (02)	2 (04)	1 (02)			*****
Language – 1	C-1 (04)	C-2 (04)	C-3 (04)			*****
Language – 2	C-1 (04)	C-2 (04)	C-3 (04)			*****
Domain Sub -1	C-1 (06)	C-2 (06)	C-3 (06)	C-4 (06)	SEC-1(06)	*****
				C-5 (06)	SEC-2 (06)	*****
Domain Sub -2	C-1 (06)	C-2 (06)	C-3 (06)	C-4(06) C-5(06)	SEC-1(06) SEC-2 (06)	*****
Domain Sub -3	C-1 (06)	C-2 (06)	C-3 (06)	C-4(06) C-5(06)	SEC-1(06) SEC-2 (06)	*****
Community Service Project	*****	CSP	*****	*****	*****	*****
Internship I	*****	*****	*****	Training programme	*****	*****
Internship II	*****	*****	*****	*****	*****	On Job Training

* Figures in parenthesis are hours per week of Core Courses of Science. In respect of Arts and Commerce Courses, the hours per week for Core Courses will be 5.

** SEC1 and SEC-2 in Sem-V are C-6 and C-7 respectively.

LIST OF LIFE SKILL COURSES

Semester	No. of Courses	Choices	Preferred Teaching Dept.
II	01	Elementary Statistics	Statistics/Mathematics
III	02	Analytical Skills	Mathematics/Statistics

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.**B.A./B.Sc. MATHEMATICS****REVISED SYLLABUS FOR CORE COURSES
CBCS/ SEMESTER SYSTEM****(w.e.f. 2022-23)****CORE COURSES STRUCTURE****(Sem-I to Sem-VI)**

Semester	Course	Subject	Hrs.	Credits	IA	ES	Total
I	Course –I	Differential Equations & Differential Equations Problem Solving Sessions	6	5	25	75	100
II	Course –II	Three dimensional analytical Solid geometry & Three dimensional analytical Solid Geometry Problem Solving Sessions	6	5	25	75	100
	LSC	Elementary Statistics	2	2		50	50
	Internship-I	Community Service Project (after completion of II-Semester)	100 (Total Hrs. for doing CSP)	4			100
III	Course –III	Abstract Algebra & Abstract Algebra Problem Solving Sessions	6	5	25	75	100
	LSC	Analytical Skills	2	2		50	50
IV	Course –IV	Real Analysis & Real Analysis Problem Solving Sessions	6	5	25	75	100
	Course –V	Linear Algebra & Linear Algebra Problem Solving Sessions	6	5	25	75	100

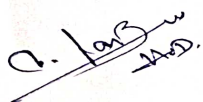
	Internship-II	Training Programme	Two months	4			100
V-Skill Enhancement Course	Course –VI-A	Numerical Methods	6	5	25	75	100
	Course –VII-A	Mathematical Special Functions	6	5	25	75	100
	OR						
	Course –VI-B	Multiple Integrals and Applications of Vector Calculus	6	5	25	75	100
	Course –VII-B	Integral Transforms with applications	6	5	25	75	100
	OR						
	Course –VI-C	Partial Differential Equations and Fourier Series	6	5	25	75	100
	Course –VII-C	Number Theory	6	5	25	75	100
VI	Internship-III	On Job Training		4			100
	Add on Course	Basic Statistics for Data Analysis	60 (Total)	2		50	50

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HOD.

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

B.A./B.Sc. MATHEMATICS

(w.e.f. 2022-23)

Aim and objectives of UG program in Subject:

Aim: The aim of introducing Mathematics as a course in Under Graduate is to encourage and enable students to:

- i) Develop interest towards inductive and deductive reasoning in problem solving.
- ii) Apply mathematical methods to solve physical/chemical problems.
- iii) Develop the skills and knowledge to pursue higher studies in mathematics.

Objectives: At the end of the programme Student will be able to

- i) Understand the concepts from five courses of mathematics
(Abstract algebra, Differential Equations, Solid Geometry, Linear Algebra , Real analysis, Vector calculus)
- ii) Apply mathematical techniques or problem solving.

Learning outcomes: (in consonance with the Bloom's Taxonomy):

After successful completion of the programme, the student will be able to

1. Distinguish among linear and nonlinear ordinary differential equations.
2. Expound upon the concept of Riemann Integration.
3. Demonstrate a group and group properties with examples.
4. Describe the rings, integral domains and fields with examples .
5. Solve Eigen values and Eigen vectors.
6. Evaluate Line, Surface and Volume Integrals using Divergence, Green's and Stroke's Theorems.
7. Apply various numerical techniques to solve the physical/chemical problems.
8. Solve linear and nonlinear system of equations (numerical methods).
9. Understand the role of computation as a tool in real world problem solving.
10. Apply Laplace and Fourier Transforms to find solutions of Initial and Boundary Value problems (heat equation and wave equation).

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

COURSE-I

CBCS/ SEMESTER SYSTEM

B.A./B.Sc. MATHEMATICS

(w.e.f. 2022-23)

DIFFERENTIAL EQUATIONS

SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Solve linear differential equations
2. Conversion of non-exact equations to exact differential equations by using integrating factors.
3. Know the methods of finding solutions of differential equations of the first order but not of the first degree.
4. Solve higher-order linear differential equations, both homogeneous and non-homogeneous with constant coefficients.
5. Understand the concept and apply appropriate methods for solving differential equations.

Course Syllabus:

MODULE – I (12 Hours)

Differential Equations of first order and first degree:

Method of variable separable, Homogeneous differential equations, Exact differential equations; Integrating factors; Change of variables and Linear Differential Equations; Differential equations reducible to linear form;.

MODULE – II (12 Hours)

Orthogonal Trajectories

Differential Equations of first order but not of the first degree:

Equations solvable for p ; Equations solvable for y ; Equations solvable for x ; Equations that do not contain x (or y); Equations homogeneous in x and y ; Equations of the first degree in x and y – Clairaut's Equation.

MODULE – III (12 Hours)

Higher order linear differential equations-I:

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators

General solutions of $f(D)y = 0$

General solution of $f(D)y = Q$, when Q is a function of x , $\frac{1}{f(D)}$ is expressed as partial fractions

P.I. of $f(D)y = Q$ when $Q = be^{ax}$

P.I. of $f(D)y = Q$ when Q is $b \cdot \sin ax$ or $b \cdot \cos ax$

MODULE – IV (12 Hours)

Higher order linear differential equations-II:

Solution of the non-homogeneous linear differential equations with constant coefficients

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax}V$, where V is a function of x .

P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x .

P.I. of $f(D)y = Q$ when $Q = x^mV$, where V is a function of x .

MODULE –V (12 Hours)

Higher order linear differential equations-III :

Method of variation of parameters; Linear differential Equations with non-constant coefficients; The Cauchy-Euler Equation, Legendre's linear equations, miscellaneous differential equations.

Introduction of partial differential equations :

Partial Differential Equations, classification of first order partial differential equations,

Rule I, derivation of a partial differential equations by the elimination of arbitrary constants

2. Rule II, derivation of a partial differential equation by the elimination of arbitrary function ϕ from the equations $\phi(u, v) = 0$ where u and v are functions of x, y and z .

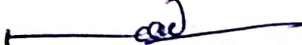
Co-Curricular Activities (15 Hours)

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving

Reference Books:

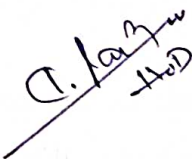
1. A text book of Mathematics for B.A./B.Sc., Vol 1, by N. Krishna Murthy & others, published by S.Chand& Company, NewDelhi
2. Ordinary and Partial Differential Equations by Dr. M.D.Raisinghania, published by S. Chand & Company, NewDelhi.
3. Differential Equations with applications and programs – S. BalachandraRao& HR Anuradha-UniversitiesPress.
4. Differential Equations and Their Applications by ZafarAhsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Secondedition.

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Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.
COURSE-II

CBCS/ SEMESTER SYSTEM
(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS
THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY
Syllabus (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Get the knowledge of planes.
2. Basic idea of lines, sphere and cones.
3. Understand the properties of planes, lines, spheres and cones.
4. Express the problems geometrically and then to get the solution.

Course Syllabus:

MODULE – I (12 Hours)

The Plane :

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

MODULE – II (12 hrs)

The Line :

Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line.

MODULE – III (12 hrs)

The Sphere :

Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes;

MODULE – IV (12 hrs)

The Sphere and Cones :

Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres; Simplified form of the equation of two spheres.

Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone;

MODULE – V (12 hrs)

Cones:

Enveloping cone of a sphere; right circular cone: equation of the right circular cone with a given vertex, axis and semi vertical angle: Condition that a cone may have three mutually perpendicular generators; intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex.

The Cylinder:

Definition of a cylinder, Equation to the Cylinder whose generators intersect a given conic and parallel to a given line, Enveloping Cylinder of a sphere.

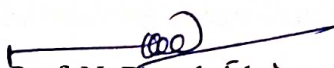
Co-Curricular Activities(15 Hours)

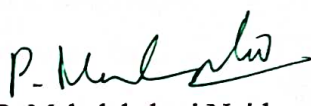
Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and its applications/ Problem Solving.

Reference Books :

1. A text book of Mathematics for BA/B.Sc Vol 1, by V Krishna Murthy & Others, published by S. Chand & Company, New Delhi.
2. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
3. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.
4. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.
5. Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

Signed and approved by


Prof. N. Ramakrishna,
Subject Expert
(University Nominee)


Sri. P. Mahalakshmi Naidu,
Subject Experts
(from outside the parent
university)


Sri. R. Ravi Shankar
Subject Experts
(from outside the parent
university)


A. Raju

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

COURSE-III

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

ABSTRACT ALGEBRA

SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Acquire the basic knowledge and structure of groups, subgroups and cyclic groups.
2. Get the significance of the notation of a normal subgroups
3. Get the behavior of permutations and operations on them
4. Study the homomorphisms and isomorphisms with applications
5. Understand the ring theory concepts with the help of knowledge in group theory and to prove the theorems.
6. Understand the applications of ring theory in various fields

Course Syllabus:

MODULE – I (12 Hours)

GROUPS :

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

MODULE – II (12 Hours)

SUBGROUPS :

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition- examples-criterion for a complex to be a subgroup.Criterion for the product of two subgroups to be a subgroup-Union and Intersection of subgroups.

Co-sets and Lagrange's Theorem :

Cosets Definition – properties of Cosets-Index of a subgroups of a finite groups-Lagrange's Theorem.

MODULE –III (12 Hours)

NORMAL SUBGROUPS :

Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group –quotient group – criteria for the existence of a quotient group.

HOMOMORPHISM :

Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

MODULE – IV (12 Hours)

PERMUTATIONS

AND CYCLIC GROUPS :

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups :-Definition of cyclic group – elementary properties – classification of cyclic groups.

MODULE – V (12 Hours)

RINGS :

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings, Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field. Sub Rings, Ideals.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Group theory and its applications / Problem Solving.

Reference Books :

1. A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, published by S.Chand& Company, New Delhi.
2. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishinghouse.
3. Modern Algebra by M.L.Khanna.
4. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan.

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A. Jayaram

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

COURSE-IV

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

REAL ANALYSIS

SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to

1. Get clear idea about the real numbers and real valued functions
2. Obtain the skills of analyzing the concepts and applying appropriate methods for testing convergence of a sequence/series.
3. Test the continuity and differentiability and Riemann integration of a function
4. Know the geometrical interpretation of mean value theorems.

Course Syllabus:

MODULE – I (12 Hours)

REAL NUMBERS :

The algebraic and order properties of $\mathbb{R}$, Absolute value and Real line, Completeness property of $\mathbb{R}$, Applications of supremum property; limit points and interior points, open sets, closed sets, intervals. (No question is to be set from this portion).

Real Sequences:

Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence. The Cauchy's criterion, properly divergent sequences, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit Point of Sequence, Subsequences and the Bolzano-weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence theorem.

MODULE –II (12 Hours)

INFINITE SERIES :

Series: Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

1. Limit comparison test
2. Geometric Series
3. P-test
4. Cauchy's n^{th} root test or root test.
5. D'Alembert's Test or Ratio Test.
6. Raabe's test
7. Alternating Series – Leibnitz Test.

Absolute convergence and conditional convergence.

MODULE – III (12 Hours)

CONTINUITY :

Limits : Real valued Functions, Boundedness of a function, Limits of functions. Some extensions of the limit concept, Infinite Limits. Limits at infinity. (No question is to be set from this portion).

Continuous functions : Continuous functions, Combinations of continuous functions, Continuous Functions on intervals, uniform continuity.

MODULE – IV (12 Hours)

DIFFERENTIATION AND MEAN VALUE THEOREMS :

The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

MODULE – V (12 Hours)

RIEMANN INTEGRATION :

Riemann Integral, Riemann integral functions, Darboux theorem. Necessary and sufficient condition for R – integrability, Properties of integrable functions, Fundamental theorem of integral calculus, integral as the limit of a sum, Mean value Theorems.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Real Analysis and its applications / Problem Solving.

Reference Books:

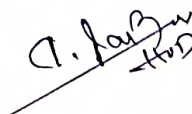
1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, published by John Wiley.
2. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.
3. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd., New Delhi.

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A. Jayaram
HOD

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.
COURSE-V
CBCS/ SEMESTER SYSTEM
(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS
LINEAR ALGEBRA
SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Understand the concepts of vector spaces, subspaces, bases, dimension and their properties
2. Understand the concepts of linear transformations and their properties
3. Apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods
4. Learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course Syllabus:

MODULE – I (12 Hours)

Vector Spaces-I:

Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebra of subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

MODULE –II (12 Hours)

Vector Spaces-II:

Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space, Dimension of a subspace, Quotient space and Dimension of Quotient space.

MODULE –III (12 Hours)

Linear Transformations:

Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Algebra of Linear Operators, Matrix of a linear transformation, Range and null space of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

MODULE –IV (12 Hours)

Matrix :

Matrices, Elementary Properties of Matrices, Inverse Matrices, Rank of Matrix, echelon form and normal form, Linear Equations, Characteristic equations, Characteristic Values & Vectors of square matrix, Cayley – Hamilton Theorem, Diagonalization.

MODULE –V (12 Hours)

Inner product space :

Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle Inequality, Parallelogram law, Orthogonality, Orthonormal set, complete orthonormal set, Gram – Schmidt orthogonalisation process. Bessel's inequality and Parseval's Identity.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Linear algebra and its applications / Problem Solving.

Reference Books :

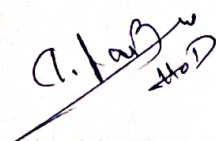
1. Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut- 250002.
2. Matrices by Shanti Narayana, published by S. Chand Publications.
3. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition), New Delhi.
4. Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt .Ltd. 4th Edition, 2007

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Sri. R. Ravi Shankar
Subject Experts
(from outside the parent
university)


A. Lakshmi
HOD

Learning Outcomes:

Students after successful completion of the course will be able to

1. Understand various numerical methods that are used to obtain approximate solutions
2. Understand various finite difference operators and interpolation methods.
3. Work out numerical differentiation and integration whenever and wherever analytical methods are not applicable.
4. Find numerical solutions of ordinary differential equations by using various numerical methods.
5. Analyze and evaluate the accuracy of numerical methods.

MODULE -I (12hrs)

Finite Differences and Interpolation with Equal intervals

Introduction, Errors, types of errors. Forward differences, Backward differences, Central Differences, Symbolic relations, n^{th} Differences of Some functions, Advancing Difference formula, Differences of Factorial Polynomial, Summation of Series. . Newton's formulae for interpolation. Central Difference Interpolation Formulae.

MODULE -II (12hrs)

Interpolation with Equal and Unequal intervals :

Gauss's Forward interpolation formulae, Gauss's backward interpolation formulae, Stirling's formula, Bessel's formula. Interpolation with unevenly spaced points, divided differences and properties, Newton's divided differences formula. Lagrange's interpolation formula, Lagrange's Inverse interpolation formula.

MODULE -III (12hrs)

Numerical Differentiation

Derivatives using Newton's forward difference formula, Newton's back ward difference formula, Derivatives using central difference formula, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function.

MODULE -IV (12hrs)

Numerical Integration

General quadrature formula on errors, Trapezoidal rule, Simpson's $1/3$ - rule, Simpson's $3/8$ - rule, and Weddle's rules, Euler – McLaurin Formula of summation and quadrature, The Euler transformation.

Additional input: Gaussian quadrature

MODULE -V (12hrs)

Numerical solution of ordinary differential equations

Introduction, Solution by Taylor's Series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge – Kutta methods. Predictor-Corrector Methods

References:

1. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd., New Delhi-110001, 2006.
2. P.Kandasamy, K.Thilagavathy, Calculus of Finite Differences and Numerical Analysis. S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.
3. R.Gupta, Numerical Analysis, Laxmi Publications (P) Ltd., New Delhi.
4. H.C Saxena, Finite Differences and Numerical Analysis, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
5. S.Ranganatham, Dr.M.V.S.S.N.Prasad, Dr.V.Ramesh Babu, Numerical Analysis, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
6. Web resources suggested by the teacher and college librarian including reading material.
- 7.Ccelms.ap.gov.in/

Suggested Co-Curricular Activities(15hrs):

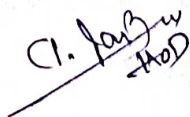
1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.
3. Invited lectures and presentations on related topics by experts in the specified area.

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C. Jayaraj
HOD

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

SKILL ENHANCEMENT COURSE-VII - A

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

MATHEMATICAL SPECIAL FUNCTIONS

SYLLABUS (75 Hours)

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
2. Find power series solutions of ordinary differential equations.
3. solve Hermite equation and write the Hermite Polynomial of order (degree) n , also find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations.
4. Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.
5. Solve Bessel equation and write the Bessel equation of first kind of order n , also find the generating function for Bessel function understand the orthogonal properties of Bessel function.

MODULE -I (12hrs)

Beta and Gamma functions, Chebyshev polynomials

Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions. Another form of Beta Function, Relation between Beta and Gamma Functions. Chebyshev polynomials, orthogonal properties of Chebyshev polynomials, recurrence relations, generating functions for Chebyshev polynomials.

MODULE -II (12hrs)

Power series and Power series solutions of ordinary differential equations

Introduction, summary of useful results, power series, radius of convergence, theorems on Power series. Introduction of power series solutions of ordinary differential equation. Ordinary and singular points, regular and irregular singular points, power series solution.

MODULE -III (12hrs)

Hermite polynomials

Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, generating function for Hermite polynomials. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

MODULE -IV (12hrs)

Legendre polynomials

Definition, Solution of Legendre's equation, Legendre polynomial of degree n , generating function of Legendre polynomials. Definition of $P_n(x)$ and $Q_n(x)$, General solution of Legendre's Equation (derivations not required) to show that $P_n(x)$ is the coefficient of h^n , in the expansion of $(1 - 2xh + h^2)^{-1/2}$. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials.

MODULE -V (12hrs)

Bessel's equation

Definition, Solution of Bessel's equation, Bessel's function of the first kind of order n , Bessel's function of the second kind of order n . Integration of Bessel's equation in series form=0, Definition of $J_n(x)$, recurrence formulae for $J_n(x)$. Generating function for $J_n(x)$, orthogonally of Bessel functions.

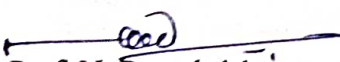
Reference Books:

1. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. J.N.Sharma and Dr.R.K.Gupta, Differential equations with special functions, Krishna PrakashanMandir.
3. Shanti Narayan and Dr.P.K.Mittal, Integral Calculus, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
4. George F.Simmons, Differential Equations with Applications and Historical Notes, Tata McGRAW-Hill Edition, 1994.
5. ShepleyL.Ross, Differential equations, Second Edition, John Willy & sons, New York, 1974.
6. Web resources suggested by the teacher and college librarian including reading material

Suggested Co-Curricular Activities(15hrs):

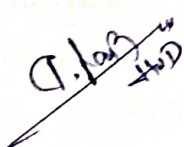
1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
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Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.
SKILL ENHANCEMENT COURSE-VI - B
CBCS/ SEMESTER SYSTEM
(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS
MULTIPLE INTEGRALS
AND
APPLICATIONS OF VECTOR CALCULUS
SYLLABUS (75 Hours)

Learning Outcomes:

Students after successful completion of the course will be able to

1. Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral / three variables in the case of triple integral.
2. Learn applications in terms of finding surface area by double integral and volume by triple integral.
3. Determine the gradient, divergence and curl of a vector and vector identities.
4. Evaluate line, surface and volume integrals.
5. understand relation between surface and volume integrals (Gauss divergence theorem), relation between line integral and volume integral (Green's theorem), relation between line and surface integral (Stokes theorem)

MODULE -I (12hrs)

Multiple integrals-I

Introduction, Double integrals, Evaluation of double integrals, Properties of double integrals.

Region of integration, double integration in Polar Co-ordinates, Change of variables in double integrals, change of order of integration.

MODULE -II (12hrs)

Multiple integrals-II

Triple integral, region of integration, change of variables. Plane areas by double integrals, surface area by double integral. Volume as a double integral, volume as a triple integral.

MODULE -III (12hrs)

Vector differentiation:

Vector differentiation, ordinary derivatives of vectors. Differentiability, Gradient, Divergence, Curl operators, Formulae involving the operators.

MODULE -IV (12hrs)

Vector integration:

Line Integrals with examples. Surface Integral with examples. Volume integral with examples

MODULE -V (12hrs)

Vector integral Theorems:

Gauss theorem and applications of Gauss theorem. Green's theorem in plane and applications of Green's theorem. Stokes's theorem and applications of Stokes theorem.

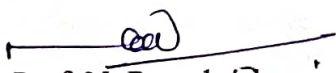
Reference Books:

1. Dr.MAnitha, Linear Algebra and Vector Calculus for Engineer, Spectrum University Press, SR Nagar, Hyderabad-500038, INDIA.
2. Dr.M.Babu Prasad, Dr.K.Krishna Rao, D.Srinivasulu, Y.AdiNarayana, Engineering MathematicsII, Spectrum University Press, SR Nagar, Hyderabad-500038,INDIA.
3. V.Venkateswararao, N. Krishnamurthy, B.V.S.S.Sarma and S.AnjaneyaSastry, A text Book of B.Sc., Mathematics Volume-III, S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.
4. R.Gupta, Vector Calculus, Laxmi Publications.
5. P.C.Matthews, Vector Calculus, Springer Verlag publications.
6. Web resources suggested by the teacher and college librarian including reading material.

Suggested Co-Curricular Activities(15hrs):

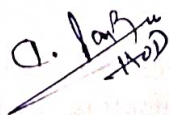
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A. Lakshmi
HOD

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.
SKILL ENHANCEMENT COURSE-VII- B
CBCS/ SEMESTER SYSTEM
(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS
INTEGRALS TRANSFORMS WITH APPLICATIONS
SYLLABUS (75 Hours)

Learning Outcomes:

Students after successful completion of the course will be able to

1. Evaluate Laplace transforms of certain functions, find Laplace transforms of derivatives and of integrals.
2. Determine properties of Laplace transform which may be solved by application of special functions namely Dirac delta function, error function, Bessel function and periodic function.
3. Understand properties of inverse Laplace transforms, find inverse Laplace transforms of derivatives and of integrals.
4. Solve ordinary differential equations with constant/ variable coefficients by using Laplace transform method.
5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.

MODULE -I (12hrs)

Laplace transforms- I

Definition of Laplace transform, linearity property-piecewise continuous function. Existence of Laplace transform, functions of exponential order and of class A. First shifting theorem, second shifting theorem and change of scale property.

MODULE -II (12hrs)

Laplace transforms- II

Laplace Transform of the derivatives, initial value theorem and final value theorem. Laplace transforms of integrals. Laplace transform of $t_n \cdot f(t)$, division by t , evolution of integrals by Laplace transforms. Laplace transform of some special functions-namely Dirac delta function, error function, Bessel function and Laplace transform of periodic function.

MODULE -III (12hrs)

Inverse Laplace transforms

Definition of Inverse Laplace transform, linear property, first shifting theorem, second shifting theorem, change of scale property, use of partial fractions. Inverse Laplace transforms of derivatives, inverse, Laplace transforms of integrals, multiplication by powers of 'p', division by 'p'. Convolution, convolution theorem proof and applications.

MODULE -IV (12hrs)

Applications of Laplace transforms

Solutions of differential equations with constants coefficients, solutions of differential equations with variable coefficients. Applications of Laplace transforms to integral equations- Abel's integral equation. Converting the differential equations into integral equations, converting the integral equations into differential equations.

MODULE -V (12hrs)

Fourier transforms.

Integral transforms, Fourier integral theorem (without proof), Fourier sine and cosine integrals. Properties of Fourier transforms, change of scale property, shifting property, modulation theorem. Convolution. Convolution theorem for Fourier transform, Parseval's Identify, finite Fourier transforms.

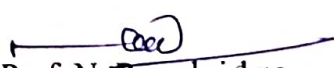
Reference Books:

1. Dr.S.Sreenadh, S.Ranganatham, Dr.M.V.S.S.N.Prasad, Dr.V.RameshBabu, Fourier series and Integral Transforms, S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. A.R. Vasistha, Dr. R.K. Gupta, Laplace Transforms, Krishna Prakashan Media Pvt. Ltd. Meerut.
3. M.D.Raisinghania, H.C. Saxsena , H.K. Dass, Integral Transforms, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
4. Dr. J.K. Goyal, K.P. Gupta, Laplace and Fourier Transforms, PragathiPrakashan, Meerut.
5. ShanthiNarayana , P.K. Mittal, A Course of Mathematical Analysis, S. Chand & Company Pvt.Ltd. Ram Nagar, New Delhi-110055.
6. Web resources suggested by the teacher and college librarian including reading material.

Suggested Co-Curricular Activities(15hrs):

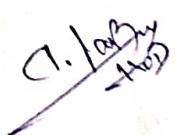
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T. Jagan
Head

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

SKILL ENHANCEMENT COURSE-VI – C

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

PARTIAL DIFFERENTIAL EQUATIONS

AND

FOURIER SERIES

SYLLABUS (75 Hours)

Learning Outcomes:

Students after successful completion of the course will be able to

1. Classify partial differential equations, formation of partial differential equations and solve Cauchy's problem for first order equations.
2. Solve Lagrange's equations by various methods, find integral Surface passing through a given curve and Surfaces orthogonal to a given system of Surfaces.
3. Find solutions of nonlinear partial differential equations of order one by using Char pit's method.
4. Find solutions of nonlinear partial differential equations of order one by using Jacobi's method.
5. Understand Fourier series expansion of a function $f(x)$ and Parseval's theorem.

MODULE -I (12hrs)

Introduction of partial differential equations

Partial Differential Equations, classification of first order partial differential equations, Rule I, derivation of a partial differential equations by the elimination of arbitrary constants Rule II, derivation of a partial differential equation by the elimination of arbitrary function ϕ from the equations $\phi(u, v) = 0$ where u and v are functions of x, y and z . Cauchy's problem for first order equations

MODULE -II (12hrs)

Linear partial differential equations of order one

Lagrange's equations, Lagrange's method of solving $Pp+Qq=R$, where P, Q and R are functions of x, y and z , type 1 based on Rule I for solving $dx/p = dy/Q = dz/R$, type 2 based on Rule II for solving $dx/p = dy/Q = dz/R$. Type 3 based on Rule III for solving $dx/p = dy/Q = dz/R$, type 4 based on Rule IV for solving $dx/p = dy/Q = dz/R$. Integral Surface passing through a given curve, the Cauchy problem, Surfaces orthogonal to a given system of Surfaces.

MODULE -III(12hrs)

Non-linear partial differential equations of order one-I

Complete integral, particular integral, singular integral and general integral, geometrical interpretation of integrals of $f(x, y, z, p, q) = 0$, method of getting singular integral from the PDE of first order, compatible system of first order equations. Char pit's method, Standard form I, only p and q present. Standard form II, Clairaut equations.

MODULE -IV (12hrs)

Non-linear partial differential equations of order one-II

Standard Form III, only p , q and z present. Standard Form IV, equation of the form $f_1(x, p) = f_2(y, q)$. Jacobi's method, Jacobi's method for solving partial differential equations with three or more independent variables, Jacobi's method for solving a non-linear first order partial differential equations in two independent variables.

MODULE -V (12hrs)

Fourier series:

Introduction, Euler's formulae for Fourier series expansion of a function $f(x)$, Dirichlet's conditions for Fourier series, convergence of Fourier series. Functions having arbitrary periods. Change of interval, Half range series. Parseval's theorem, illustrative examples based on Parseval's theorem, some particular series.

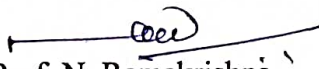
Reference Books:

1. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. Dr.S.Sreenadh, S.Ranganatham, Dr.M.V.S.S.N.Prasad, Dr.V.RameshBabu, Fourier Series and Integral Transforms, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
3. Prof T.Amaranath, An Elementary Course in Partial Differential Equations Second Edition, Narosa Publishing House, New Delhi.
4. Fritz John, Partial Differential Equations, Narosa Publishing House, New Delhi, 1979.
5. I.N.Sneddon, Elements of Partial Differential Equations by McGraw Hill, International Edition, Mathematics series.
6. Web resources suggested by the teacher and college librarian including reading material

Suggested Co-Curricular Activities(15hrs):

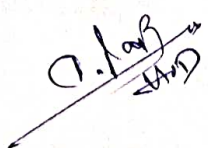
1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.
3. Invited lectures and presentations on related topics by experts in the specified area.

Signed and approved by


Prof. N. Ramakrishna,
Subject Expert
(University Nominee)


Sri. P. Mahalakshmi Naidu,
Subject Experts
(from outside the parent
university)


Sri. R. Ravi Shankar
Subject Experts
(from outside the parent
university)


A. J. Jayaram
Head

Learning Outcomes:

Students after successful completion of the course will be able to

1. Find quotients and remainders from integer division, study divisibility properties of integers and the distribution of primes.
2. Understand Dirichlet multiplication which helps to clarify interrelationship between various arithmetical functions.
3. Comprehend the behaviour of some arithmetical functions for large n .
4. Understand the concepts of congruencies, residue classes and complete residues systems.
5. Comprehend the concept of quadratic residues mod p and quadratic non residues mod p .

MODULE -I (12hrs)

Divisibility

Introduction, Divisibility, Greatest Common Divisor, Prime numbers, The fundamental theorem of arithmetic, The series of reciprocals of the primes. The Euclidean algorithm, The greatest common divisor of more than two numbers.

MODULE -II (12hrs)

Arithmetical Functions and Dirichlet Multiplication

Introduction, The Mobius function $\mu(n)$, The Euler totient function $\phi(n)$, A relation connecting ϕ and μ , A product formula for $\phi(n)$. The Dirichlet product of arithmetical functions, Dirichlet inverses and Mobius inversion formula, The Mangoldt function $\Lambda(n)$. Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function $\lambda(n)$, The divisor functions $\sigma\alpha(n)$.

MODULE -III (12hrs)

Averages of Arithmetical Functions

Introduction, The big oh notation. Asymptotic equality of functions, Euler's summation formula, some elementary asymptotic formulas. The average order of $d(n)$, The average order of the divisor functions $\sigma\alpha(n)$, The average order of $\phi(n)$. The average order of $\mu(n)$ and $\Lambda(n)$, The partial sum of a Dirichlet product, Applications of $\mu(n)$ and $\Lambda(n)$.

MODULE -IV (12hrs)

Congruences

Definition and basic properties of congruences, Residue classes and complete residue systems. Linear congruences, reduced residue systems and the Euler-Fermat theorem. Polynomial congruences modulo p . Lagrange's theorem. Applications of Lagrange's theorem, Simultaneous linear congruences. The Chinese remainder theorem. Applications of the Chinese remainder theorem.

MODULE -V (12hrs)

Quadratic Residues and the Quadratic Reciprocity Law

Quadratic Residues, Legendre's symbol and its properties, Evaluation of $(-1/p)$ and $(2/p)$, Gauss lemma, The Quadratic reciprocity law, Applications of the reciprocity law, The Jacobi Symbol. Gauss sums and the quadratic reciprocity law, the reciprocity law for quadratic Gauss sums. Another proof of the quadratic reciprocity law.

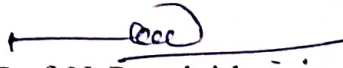
Reference Books:

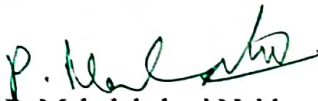
1. Tom M. Apostol, Introduction to Analytic Number theory, Springer International Student Edition.
2. David, M. Burton, Elementary Number Theory, 2nd Edition UBS Publishers.
3. Hardy & Wright, Number Theory, Oxford Univ, Press.
4. Dence, J. B & Dence T.P, Elements of the Theory of Numbers, Academic Press.
5. Niven, Zuckerman & Montgomery, Introduction to the Theory of Numbers.
6. Web resources suggested by the teacher and college librarian including reading material.

Suggested Co-Curricular Activities(15hrs):

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.
3. Invited lectures and presentations on related topics by experts in the specified area.

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A. K. Srinivas
HOD

Recommended Question Paper Patterns and Models :
BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-I,
DIFFERENTIAL EQUATIONS

Module	TOPIC	S.A.Q (each carry 5 marks) (including choice)	E.Q (each carry 10marks) (including choice)	Total Marks (including choice)
I	Differential Equations of 1 st order and 1 st degree	2	2	30
II	Orthogonal Trajectories, Differential Equations of 1 st order but not of 1 st degree	2	2	30
III	Higher Order Linear Differential Equations (with constant coefficients) – I	1	2	25
IV	Higher Order Linear Differential Equations (with constant coefficients) – II	2	2	30
V	Higher Order Linear Differential Equations (with non constant coefficients) Introduction of partial differential equations	1	2	25
TOTAL		8	10	140

S.A.Q. = Short answer questions (each carry 5 marks) & E.Q. = Essay questions (each carry 10marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

B.A./B.Sc. MATHEMATICS
COURSE-I, DIFFERENTIAL EQUATIONS
MODEL PAPER

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions

5x5=25M

Each question carries 5 marks

1. Solve $y(1+xy)dx + x(1-xy)dy = 0$.
2. Solve $(1+y^2)dx = (\tan^{-1}y - x)dy$.
3. Solve $p^2 - 5p + 6 = 0$.
4. Solve $(D^4 - 4D^3 + 6D^2 - 4D + 1)y = 0$.
5. Solve $(D^2 - 3D + 2)y = \cosh x$.
6. Solve $(D^2 + 2D + 1)y = x \cos x$.
7. solve $(D^2 - 3D + 2)y = e^{4x} + \sin 3x$.
8. solve $(x^2 D^2 - 2xD + 2)y = x + \frac{1}{x}$.

SECTION-B

Answer any FIVE questions.

5x10=50M

Each question carries 10 marks.

9 a). Solve $(1 + e^{\frac{x}{y}})dx + e^{\frac{x}{y}}(1 - \frac{x}{y})dy = 0$

(or)

b) Solve $x \frac{dy}{dx} + y = y^2 \log x$.

10 a). Find the orthogonal trajectories of the family of curves $r^n \cos n\theta = a^n$ where a is a parameter.

(or)

b). Solve $p^2 + 2py \cot x = y^2$.

11 a). Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.

(or)

b). Solve $(D^2 + 9)y = \cos^3 x$

12. a). Solve $(D^4 + 2D^2 + 1)y = x^2 \cos x$

(or)

b). Solve $\frac{d^2 y}{dx^2} - 6 \frac{dy}{dx} + 13y = 8e^{3x} \sin 2x$.

13. a). Solve $(x^3 D^3 + 2x^2 D^2 + 2)y = 10(x + \frac{1}{x})$

(or)

b). Solve $(D^2 + 1^2)y = \operatorname{Cosec} x$ by the method of variation of parameters.

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks (including choice)
I	The Plane	2	2	30
II	The Right Line	2	2	30
III	The Sphere	2	2	30
IV	The Sphere & The Cone	1	2	25
V	The Cone & cylinder	1	2	25
TOTAL		8	10	140

S.A.Q. = Short answer questions (each 5 marks)

E.Q. = Essay questions (each 10 marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.
CBCS/ SEMESTER SYSTEM
(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS
COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY
MODEL PAPER

Time:3Hrs

Max.Marks:75 M

SECTION - A

Answer any Five questions. Each question carries 05 Marks.

$5 \times 5M = 25M$

1. A variable plane is at a constant distance 'P' from the origin meets the axis in A,B,C. Show that the locus of the tetrahedron OABC is $x^2+y^2+z^2 = 16p^2$
2. Find the equation of the plane that passes through the point (3,-3,1) and is normal to the line joining the points (3,4,-1) and (2,-1,5).
3. Find the image of (2,-1,3) in the plane $3x-2y-z-9 = 0$.
4. Find the angles between the lines $x-2y+z = 0$, $x+y-z = 0$ and $x+2y+z = 5$, $8x+12y+5z = 0$.
5. Find the equation of a sphere passing through the circle $x^2+y^2+z^2 = 4$, $z=0$ and is intersected by the plane $x+2y+2z=0$ in a circle of radius 3.
6. Find the pole of the plane $x-y-z+9 = 0$ w.r.t the sphere $x^2+y^2+z^2-2x+4y-6z+5 = 0$.
7. Find the length of the tangent line from the point (3, 1, -1) to the sphere $x^2+y^2+z^2-3x+5y+7 = 0$.
8. Find the equation to the right circular cone whose vertex is (3,2,1), axis line $\frac{x-3}{4} = \frac{y-2}{1} = \frac{z-1}{3}$ and semi vertical angle 30° .

SECTION - B

Answer all questions , Each question carries 10 marks.

$5 \times 10M = 50M$

9. (a). A Variable plane makes intercepts on the axes , the sum of whose squares is K^2 (a constant). Show that the locus of the foot of the perpendicular from the origin is $(x^2+y^2+z^2)(x^2+y^2+z^2)^2 = k^2$

OR

- (b) Find the equations of the planes bisecting the angle between the planes $x+2y+2z-3 = 0$, $3x+4y+12z+1 = 0$ and specify the one which bisects the acute angle.

10. (a). Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$; $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar. Also find their point of the intersection and the plane containing the lines.

OR

- (b) Find the length and equations to the line of shortest distance between the lines

$$\frac{x}{4} = \frac{y+1}{3} = \frac{z-2}{2} ; 5x-2y-3z+6=0 = x-3y+2z-3.$$

11. (a). Show that the two circles $x^2+y^2+z^2-y+2z=0$, $x-y+z=2$ and $x^2+y^2+z^2+x-3y+z-5=0$, $2x-y+4z-1=0$ lie on the same sphere and find its equation.

OR

- (b) Show that the spheres $x^2+y^2+z^2=25$, $x^2+y^2+z^2-24x-40y-18z+225=0$ touch externally. Find the point of contact.

12. (a). Find the limiting points of the coaxial system of spheres determined by the spheres $x^2+y^2+z^2+3x-3y+6=0$, $x^2+y^2+z^2-6y-6z+6=0$.

OR

- (b) If the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{1}$ represents one of the three mutually perpendicular generators of the cone $11yz+6zx-14xy=0$. Find the equations of the other two.

13. (a). Find the equation of the tangent plane at the point $(-3,0,-1)$ of the cone $7x^2+2y^2+2z^2-10zx+10xy+26x-2y+2z-17=0$.

OR

- (b) Find the equation to the right circular cone whose vertex is $P(2,-3,5)$, axis PQ which makes equal angles with coordinate axes and which passes through $A(1,-2,3)$.

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-III, ABSTRACT ALGEBRA

Module	TOPIC	S.A.Q.(including choice)	E.Q.(including choice)	Total Marks (including choice)
I	Groups	2	2	30
II	Subgroups, Cosets & Lagrange's theorem	1	2	25
III	Normal Subgroups and Homomorphism	1	2	25
IV	Permutations and Cyclic groups	2	2	30
V	Rings	2	2	30
Total		8	10	140

S.A.Q. = Short answer questions (each 5 marks)

E.Q. = Essay questions (each 10 marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5 M=25 M

1. Prove that the set Q^1 of rational numbers other than 1 forms an abelian group w.r.to the operation $*$ defined by $a*b = a+b-ab$ for all $a, b \in Q^1$.
2. If H is a subgroup of a group G then prove that, for $a, b \in G$, $a \in Hb \Leftrightarrow Ha = Hb$
3. Define order of an element. In a group G , prove that if $a \in G$ then $o(a) = o(a^{-1})$.
4. Show that every subgroup of a group G with index 2 is a normal subgroup of the group G .
5. Find the regular permutation group isomorphic the multiplicative group $\{1, \omega, \omega^2\}$
6. If f is a homomorphism of a group G into a group G' then prove that kernel f is a normal subgroup of G .
7. Show that field has no proper ideals.
8. Define a Boolean ring and prove that in a Boolean ring R , $a + a = 0 \forall a \in R$

SECTION-B

Answer any FIVE questions. Each question carries TEN marks.

5 X 10 M=50 M

9. a) Prove that a finite semi group satisfying the cancellation laws is a group

(or)
b) Prove that the set of matrices $A_\alpha = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$; $\alpha \in R$ forms an abelian group w.r.to the matrix multiplication, if $\cos \theta = \cos \phi \Rightarrow \theta = \phi$

10. a). If H and K are two subgroups of a group G , then show that $H \cup K$ is a subgroup of G iff either $H \subseteq K$ or $K \subseteq H$.

(or)
b). State and prove Lagrange's theorem for finite groups.

11 a). Let G and G' be two groups. If $f : G \rightarrow G'$ is a homomorphism then, prove the following

i) $f(e) = e'$ where e and e' are the identity elements in

ii) $f(a^{-1}) = [f(a)]^{-1}$, for each $a \in G$.

(or)

b). State and prove fundamental theorem of homomorphism of groups

12. a). State and prove Cayley's theorem.

(or)

b). Show that every subgroup of a cyclic group is cyclic

13. a). Prove that every finite integral domain is a field.

(or)

b). Show that the ring of integers $\mathbb{Z}$ is a principal ideal ring.

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COURSE-IV, REAL ANALYSIS

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks (including choice)
I	Real Number System and Real Sequence	2	2	30
II	Infinite Series	1	2	25
III	Limits and Continuity	1	2	25
IV	Differentiation and Mean Value Theorem	2	2	30
V	Riemann Integration	2	2	30
	TOTAL	8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

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B.A./B.Sc. MATHEMATICS
COURSE-IV, REAL ANALYSIS
MODEL PAPER

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions .Each question carries FIVE marks

5X5M=25M

1. Prove that every Cauchy sequence is convergent.
2. Show that $\lim\left(\frac{1}{(n+1)^2} + \frac{1}{(n+2)^2} + \dots + \frac{1}{(n+n)^2}\right) = 0$.
3. Test the convergence of the series $\sum_{n=1}^{\infty} (\sqrt[3]{n^3 + 1} - n)$.
4. Examine for continuity of the function f defined by $f(x) = |x| + |x - 1|$ at $x=0$ and $x=1$.
5. Show that $f(x) = x \sin \frac{1}{x}$, $x \neq 0$; $f(x) = 0$, $x = 0$ is continuous but not derivable at $x=0$.
6. Verify Rolle's theorem for the function $f(x) = x^3 - 6x^2 + 11x - 6$ on $[1, 3]$.
7. If $f(x) = x^2$ for $x \in [0, a]$ then prove that $\int_0^a x^2 dx = \frac{a^3}{3}$.
8. prove that if $f: [a, b] \rightarrow \mathbb{R}$ is continuous on $[a, b]$ then f is R- integrable on $[a, b]$.

SECTION B

Answer all questions .Each question carries TEN marks

5X10M=50M

- 9.(a) A monotonic sequence is convergent iff it is bounded.

OR

- (b) Show that the sequence $S_n = \frac{1}{n+1} + \frac{1}{n+2} + \dots + \frac{1}{n+n} \forall n \in \mathbb{Z}^+$ is convergent.

10.(a) State and prove Cauchy n^{th} root test.

OR

(b) Test for the convergence of the series $\sum \frac{2.4.6.....2n}{5.7.9.....(2n+3)}$

11.(a) If $f: [a,b] \rightarrow \mathbb{R}$ is continuous then it is bounded on $[a,b]$ and attains its bounds.

OR

(b) Determine the constants a, b so that the function f defined by $f(x) = 2x+1$ if $x \leq 1$

$$f(x) = ax^2+b \text{ if } 1 < x < 3, \quad f(x) = 5x+2a \text{ if } x \geq 3$$

12. (a) State and prove Lagrange Mean Value Theorem or First Mean Value theorem.

OR

b) Find c of Cauchy Mean Value theorem for $f(x) = \sqrt{x}$ and $g(x) = \frac{1}{\sqrt{x}}$ in $[a,b]$ where $0 < a < b$.

13. (a) The necessary and sufficient condition for a bounded function $f: [a,b] \rightarrow \mathbb{R}$ to be Riemann integrable is for each $\varepsilon > 0 \exists$ a partition P of $[a,b]$ such that $0 \leq U(P, f) - L(P, f) < \varepsilon$

OR

(b) State and prove fundamental theorem of Riemann Integration

BLUE PRINT FOR QUESTIONPAPER PATTERN**COURSE-V, LINEAR ALGEBRA**

Unit	TOPIC	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Vector spaces - I	2	2	30
II	Vector spaces - II	1	2	25
III	Linear Transformation	2	2	30
IV	Char. values and char. vectors	1	2	25
V	Inner product spaces	2	2	30
Total		8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

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CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

COURSE-V, LINEAR ALGEBRA

Time: 3Hrs

Max.Marks:75M

SECTION - A

Answer any **FIVE** questions. Each question carries **FIVE** marks **5 X 5 M=25 M**

1. Let p, q, r be fixed elements of a field F . Show that the set W of all triads (x, y, z) of elements of F , such that $px+qy+rz=0$ is a vector subspace of $V_3(R)$.
2. Define linearly independent & linearly dependent vectors in a vector space. If α, β, γ are linearly independent vectors of $V(R)$ then show that $\alpha + \beta, \beta + \gamma, \gamma + \alpha$ are also linearly independent.
3. Prove that every set of $(n + 1)$ or more vectors in an n dimensional vector space is linearly dependent.
4. The mapping $T : V_3(R) \rightarrow V_3(R)$ is defined by $T(x, y, z) = (x-y, x-z)$. Show that T is a linear transformation.
5. Let $T: R^3 \rightarrow R^2$ and $H: R^3 \rightarrow R^2$ be defined by $T(x, y, z) = (3x, y+z)$ and $H(x, y, z) = (2x-z, y)$. Compute i) $T+H$ ii) $4T-5H$ iii) TH iv) HT .
6. If the matrix A is non-singular, show that the eigen values of A^{-1} are the reciprocals of the eigen values of A .
7. State and prove parallelogram law in an inner product space $V(F)$.
8. Prove that the set $S = \left\{ \left(\frac{1}{3}, \frac{-2}{3}, \frac{-2}{3} \right), \left(\frac{2}{3}, \frac{-1}{3}, \frac{2}{3} \right), \left(\frac{2}{3}, \frac{2}{3}, \frac{-1}{3} \right) \right\}$ is an orthonormal set in the inner product space $R^3(R)$ with the standard inner product.

SECTION - B

Answer **ALL** the questions. Each question carries **TEN** marks. **5 X 10 M = 50 M**

- 9(a)) Define vector space. Let $V(F)$ be a vector space. Let W be a non empty sub set of V . Prove that the necessary and sufficient condition for W to be a subspace of V is $a, b \in F$ and $\alpha, \beta \in V \Rightarrow a\alpha + b\beta \in W$.

(OR)

- (b) Prove that the four vectors $(1,0,0)$, $(0,1,0)$, $(0,0,1)$ and $(1,1,1)$ of $V_3(C)$ form linearly dependent set, but any three of them are linearly independent.

- 10(a) Define dimension of a finite dimensional vector space. If W is a subspace of a finite dimensional vector space $V(F)$ then prove that W is finite dimensional and $\dim W \leq n$.

(OR)

- (b) If W be a subspace of a finite dimensional vector space $V(F)$ then Prove that $\dim V/W = \dim V - \dim W$.

- 11(a) Find $T(x, y, z)$ where $T: R^3 \rightarrow R$ is defined by $T(1, 1, 1) = 3$, $T(0, 1, -2) = 1$, $T(0, 0, 1) = -2$

(OR)

- (b) State and prove Rank Nullity theorem.

- 12(a) Find the eigen values and the corresponding eigen vectors of the matrix

$$A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}.$$

(OR)

- (b) State and prove Cayley-Hamilton theorem.

- 13(a) State and prove Schwarz's inequality in an Inner product space $V(F)$.

(OR)

- (b) Given $\{(2,1,3), (1,2,3), (1,1,1)\}$ is a basis of $R^3(R)$. Construct an orthonormal basis using Gram-Schmidt orthogonalisation process.

BLUE PRINT FOR QUESTION PAPER PATTERN**SKILL ENHANCEMENT COURSE-VI - A
NUMERICAL METHODS**

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks (including choice)
I	Finite Differences and Interpolation with Equal intervals	2	2	30
II	Interpolation with Equal and Unequal intervals	1	2	25
III	Numerical differentiation	1	2	25
IV	Numerical Integration	2	2	30
V	Numerical solutions of ODE	2	2	30
	TOTAL	8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

SKILL ENHANCEMENT COURSE-VI - A

NUMERICAL METHODS

MODEL PAPER

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions

5x5=25M

Each question carries 5 marks

1. If $u_0 = 3, u_1 = 12, u_2 = 81, u_3 = 200, u_4 = 100, u_5 = 8$ then find the value of $\Delta^5 u_0$
2. Using the inverse Lagrange's Interpolation formula find the value of x if $y_1 = 4, y_3 = 12, y_4 = 19, y_x = 7$.
3. Apply Guass forward formula to find the value of $f'(10)$ if $f(0) = 14, f(4) = 24, f(8) = 32, f(12) = 35, f(16) = 40$
4. Evaluate $\int_0^1 x^3 dx$ with five sub-intervals by Trapezoidal rule.
5. Using Euler's method solve for y at $x=2$ from $\frac{dy}{dx} = 3x^2 + 1, y(1)=2$ with step size $h=0.5$
6. Using R-K method of second order compute $y(2.5)$ from $\frac{dy}{dx} = \frac{x+y}{x}, y(2)=2$ taking $h=0.5$.
7. Find u_3 , using the data $u_0 = 8, u_1 = 11, u_4 = 68, u_5 = 123$.
8. Solve $\frac{dy}{dx} - 1 = xy$ and $y(0)=1$ find $y(0.1)$ using Taylor Series Method.

SECTION B

Answer any FIVE questions. Each question carries 10 marks.

5x10=50M

9. (a) Prove the following

$$\text{i) } \Delta = \frac{1}{2} \delta^2 + \delta \left(1 + \frac{\delta^2}{4} \right)^{1/2}$$

$$\text{ii) } \mu^2 = 1 + \delta^2/4$$

Or

b) Find the missing value from the following data

x:	0	5	10	15	20	25
f(x)	6	10	-	17	-	31

10. (a) Given $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, and $\sin 60^\circ = 0.8660$ then

find the value of $\sin 48^\circ$

OR

(b) By means of Newton divided difference formula find the value of $f(8)$ and $f(15)$ from the following data.

X	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

11. a) Find $f'(1.1)$ and $f''(1.1)$ from the following table :

X	1.1	1.2	1.3	1.4	1.5
f(x)	2.0091	2.0333	2.0692	2.1143	2.1667

or

b) Find the value of $f'(1.5)$ for $f(x) = \frac{1}{1+x^2}$ using the following data

X	1.0	1.1	1.2	1.3	1.4
f(x)	0.5000	0.4524	0.4098	0.3719	0.3378

12 a) State and prove Simpson's One-Third Rule

OR

b) Integrate numerically $\int_0^{\pi/2} \sqrt{\sin x}$ by Weddle's rule

13. a) Using the Euler's modified method , solve numerically the equation
 $y' = x + |\sqrt{y}|$ with $y(0) = 1$ for $0 \leq x \leq 0.6$ in step of 0.2.

or

b) Solve $\frac{dy}{dx} = -2xy^2$ with $y(0) = 1$ and $h=0.2$ on the interval $[0, 1]$ using

Runge – Kutta fourth order method.

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE- VII A MATHEMATICAL SPECIAL FUNCTIONS

Module	TOPIC	S.A.Q (including choice)	E.Q (including choice)	Total Marks
I	Beta and gamma functions, Chebyshev Polynomials	2	2	30
II	Power Series and Power Series soln's of ODE	1	2	25
III	Hermite Polynomials	2	2	30
IV	Legendre Polynomials	2	2	30
V	Bessel's Equations	1	2	25
TOTAL		8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
Critical thinking question	Problem solving type	10 marks
Total		75 marks

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any **FIVE** questions. Each question carries **FIVE** marks 5 X 5 M=25 M

1. Evaluate $\int_0^2 \frac{x^2}{\sqrt{2-x}} dx$.
2. Prove that $(1-x^2)T'_n(x) = -nxT'(x) + nT_{n-1}(x)$.
3. Determine the radius of convergence and the exact interval of convergence of each of the following power series
i) $\sum \frac{nx^n}{(n+1)^2}$ ii) $\sum \frac{3^n x^n}{n!}$ iii) $\sum \frac{x^n}{n^2}$ iv) $\sum \frac{x^n}{n^n}$.
4. Prove that $H'_n(x) = 2nH_{n-1}(x)$, $n \geq 1$.
5. Prove that i) $H_{2n}(0) = (-1)^n \frac{(2n)!}{n!}$ and ii) $H_{2n+1}(0) = 0$.
6. (Beltrami's result) : $(2n+1)(x^2-1)P'_n = n(n+1)(P_{n+1}-P_{n-1})$.
7. Prove that i) $P'_n(1) = \frac{1}{2}n(n+1)$ ii) $P'_n(-1) = -\frac{1}{2}n(n+1)$.
8. Prove that $\frac{d}{dx}[x^{-n}J_n(x)] = x^{-n}J_{n+1}(x)$.

SECTION - B

Answer **ALL** the questions. Each question carries **TEN** marks. 5 X 10 M = 50 M

9. (a) Prove that $B(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$

OR

(b) Show that $\frac{1}{\sqrt{1-x^2}}U'_n(x)$ satisfies the differential equation

10. (a) Find the salutation in series of $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + x^2y = 0$ about $x = 0$.

OR

(b) Prove that $e^{2tx-t^2} = \sum_{n=0}^{\infty} \frac{t^n}{n!} H_n(x)$.

11. (a) Solve by power series method $y'' - xy' = e^{-x}$, $y(0) = 2$, $y'(0) = -3$.

OR

(b) Prove that $\int_{-\infty}^{\infty} e^{-x^2} H_n(x) H_m(x) dx = \begin{cases} 0 & \text{if } m \neq n \\ \sqrt{\pi} 2^n n! & \text{if } m = n \end{cases}$

12. (a) Show that $(1-2hx+x^2)^{-1/2} = \sum_{n=0}^{\infty} h^n P_n(x)$.

OR

(b) Prove that $\int_{-1}^{+1} (1-x^2) (P'_n)^2 dx = \frac{2n(n+1)}{2n+1}$.

13. (a) Show that

$$i) J_{-1/2}(x) = \sqrt{\left(\frac{2}{\pi x}\right)} \cos x, \quad ii) J_{1/2}(x) = \sqrt{\left(\frac{2}{\pi x}\right)} \sin x \text{ and } iii) [J_{\frac{1}{2}}(x)] + [J_{-1/2}(x)]^2 = \frac{2}{\pi x}.$$

OR

(b) Show that $x^n J^n(x)$ is solution of $x \frac{d^2 y}{dx^2} + (1 - 2n) \frac{dy}{dx} + xy = 0$.

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SKILL ENHANCEMENT COURSE-VI - B MULTIPLE INTEGRALS AND

APPLICATIONS OF VECTOR CALCULUS

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks (including choice)
I	Multiple Integrals-I	2	2	30
II	Multiple Integrals-II	1	2	25
III	Vector differentiation	1	2	25
IV	Vector Integration	2	2	30
V	Vector integral theorems	2	2	30
	TOTAL	8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

SKILL ENHANCEMENT COURSE-VI - B

MULTIPLE INTEGRALS

AND

APPLICATIONS OF VECTOR CALCULUS

MODEL PAPER

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions
Each question carries 5 marks

5x5=25M

1. By changing into polar coordinates, evaluate $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{x^2+y^2} dx dy$
2. Change the order of the integration in $\int_0^1 \int_{x^2}^{2-x} xy dx dy$ & hence evaluate the double integration
3. Using double integration find the area of the cardioid $r = a(1 - \cos \theta)$
- 4 Find the directional derivative of $\phi = xy^2 + yz^2 + x^2$ along the tangent to the curve $x = t, y = t^2, z = t^3$
At the point (1,1,1).
5. Find the angle of intersection of spheres $x^2+y^2+z^2 = 29$ and $x^2+y^2+z^2+4x-6y-8z-47 = 0$ at (4,-3,2).
6. Compute $\int_{\Sigma} (ax^2+by^2+cz^2).ds$ over the sphere $x^2+y^2+z^2=1$
7. If $\vec{r} = a \cos t \mathbf{i} + a \sin t \mathbf{j} + at \tan \theta \mathbf{k}$, then find $\left| \frac{dr}{dt} \times \frac{d^2r}{dt^2} \right|$ and $\left[\frac{dr}{dt} \frac{d^2r}{dt^2} \frac{d^3r}{dt^3} \right]$
8. State the Green's theorem in a plane.

SECTION B

Answer any FIVE questions. Each question carries 10 marks.

5x10=50M

9. (a) By changing the order of the integration, evaluate $\int_0^3 \int_1^{\sqrt{4-y}} (x+y) dx dy$

OR

b) By using the transformations $x+y=u, y=uv$ S.T. $\int_0^1 \int_0^{1-x} e^{y/(x+y)} dx dy = \frac{1}{2}(e-1)$

10. (a) Find the area enclosed by the parabolas $x^2 = y$ & $y^2 = x$

OR

(b) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dx dy dz}{\sqrt{1-x^2-y^2-z^2}}$

11. a) Prove that $\nabla r^n = nr^{n-2} \vec{r}$

OR

b) Find the angle of intersection of spheres $x^2+y^2+z^2 = 29$ and $x^2+y^2+z^2+4x-6y-8z-47 = 0$ at $(4,-3,2)$.

12 a) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = 3x^2\vec{i} + (2xz-y)\vec{j} + z\vec{k}$ along the straight line 'C' from $(0,0,0)$ to $(2,1,3)$.

OR

b) If $\vec{F} = 2xz\vec{i} - x\vec{j} + y^2\vec{k}$ then, evaluate $\int_V \vec{F} \cdot d\vec{v}$ where V is the region bounded by the surfaces $x=0, x=2, y=0, y=6, z=x^2, z=4$.

13. a) State and prove Gauss Divergence theorem

OR

b) Verify Stokes theorem for $\vec{F} = -y^3 + x^3$ where S is $x^2 + y^2 = 1$ and $z = 0$

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COURSE- VII B INTEGRALS TRANSFORMS WITH APPLICATION

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Laplace Transforms – I	2	2	30
II	Laplace Transforms – II	1	2	25
III	Inverse Laplace Transforms	2	2	30
IV	Applications of Laplace Transforms	1	2	25
V	Fourier Transform	2	2	30
TOTAL		8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks
	Total	75 Marks

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

COURSE-VII B

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

INTEGRALS TRANSFORMS WITH APPLICATIONS

MODEL PAPER

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any **FIVE** questions. Each question carries **FIVE** marks 5 X 5 M = 25 M

1. Find $L\{7e^{2t} + 9e^{-2t} + 5 \cos t + 7t^3 + 5 \sin 3t + 2\}$.
2. Obtain the Laplace transform of the function $F(t) = \begin{cases} (t-1)^2, & t > 1 \\ 0, & 0 < t < 1 \end{cases}$
3. Find $L\left\{\frac{e^{-at} - e^{-bt}}{t}\right\}$.
4. Find $L^{-1}\left\{\frac{p}{(p^2-25)^2}\right\}$.
5. Use convolution theorem to find $L^{-1}\left[\frac{1}{(p-2)(p^2+1)}\right]$.
6. Solve $(D+1)y=0, t > 0$, if $y=y_0$ When $t=0$.
7. Show that the Fourier transform of $f(x) = e^{-x^2/2}$ is $e^{-p^2/2}$.
8. Solve the integral equation $\int_0^\infty f(x) \cos \lambda x dx = e^{-\lambda}$.

SECTION - B

Answer **ALL** the questions. Each question carries **TEN** marks. 5 X 10 M = 50 M

9. Show that $L\{\sinh at \sin at\} = \frac{2a^2p}{p^4+4a^4}$.

OR

Find i) $L\{(1+te^{-t})^3\}$ ii) find $L\{G(t)\}$ where $G(t) = \begin{cases} \sin(t-\pi/3), & t > \pi/3 \\ 0, & t < \pi/3 \end{cases}$

10. (a) If $F(t)$ is continuous for all $t \geq 0$ and of exponential order as $t \rightarrow \infty$ or $F'(t)$ is of class A,
Then $t \xrightarrow{Lt} \infty F(t) = p \xrightarrow{Lt} \infty pL\{F(t) = p \xrightarrow{Lt} 0 [p f(p)]$.

OR

(b) Find $L\{t^2 - 3t + 1\} \sin 3t$.

11. (a) Find $L^{-1} \left\{ \frac{p+1}{(p^2+2p+2)^2} \right\}$.

OR

(b) Find the inverse Laplace Transform of $\frac{1}{(p+1)^2 (p^2+4)}$.

12. (a) Solve $(D^2 + 6D + 9) y = \sin x$, where $y(0) = 1, y'(0) = 0$.

OR

(b) Solve $[tD^2 + (1 - 2t)D - 2]y = 0$ if $y(0) = 1, y'(0) = 2$.

13. (a) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$ and hence evaluate

$$\int_0^\infty \left(\frac{x \cos x - \sin x}{x^3} \right) \cos \frac{x}{2} dx.$$

OR

(b) Find the finite Fourier sine and cosine transforms of the function $f(x) = 2x, 0 < x < 4$.

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COURSE- VI C PARTIAL DIFFERENTIAL EQUATIONS & FOURIER SERIES

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Introduction to PDE	2	2	30
II	Linear PDE of order I	1	2	25
III	Non linear PDE of order one-I	2	2	30
IV	Non linear PDE of order one-II	1	2	25
V	Fourier Series	2	2	30
TOTAL		8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks
	Total	75 Marks

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

SKILL ENHANCEMENT COURSE-VI – C

PARTIAL DIFFERENTIAL EQUATIONS

AND

FOURIER SERIES

MODEL PAPER

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions

5x5=25M

Each question carries 5 marks

1. Find the differential equation of family spheres whose centers lies on z-axis.
2. Solve $xp + yq = 3z$
3. Solve $(z - y)p + (x - z)q = y - x$
4. Solve $z = ax + by\left(\frac{a^3}{b} + \frac{b^3}{a}\right)$
5. Solve $zpq = p + q$
6. Solve $p^2 z^2 + q^2 = p^2 q$
- 7 Obtain the Fourier series expansion of $f(x) = e^{ax}$ in $(0, 2\pi)$
- 8 Obtain the Fourier series of $f(x) = (\pi - x)/2$ in the interval $(0, 2\pi)$

SECTION B

Answer any FIVE questions.

5x10=50M

Each question carries 10 marks.

9. (a) . Obtain the form of partial differential equation by eliminating the arbitrary constants
 $z = ax^2 + by^2$ where a, b are constants

OR

- b) Obtain the form of partial differential equation by eliminating the arbitrary function

$$z = (x + y)\Phi(x^2 - y^2)$$

10. (a) Solve the P.D.E $z(z^2 + y)(px - qy) = x^4$

OR

- (b) Solve the P.D.E. $(x^2 - y^2 - yz)p + (x^2 - y^2 - 2x)q = z(x - y)$

11. a) Solve the P.D.E. $pqz = p^2(xq + p^2) + q^2(yp + q^2)$

OR

b) Solve the P.D.E. $(p - q)(z - px - qy) = 1$

12 a) Solve the P.D.E. $zpy^2 = x(y^2 + z^2q^2)$

OR

b). Solve the PDE $z = q^2(x^2 + y^2)$

13. a) Find the Fourier series of $f(x) = \begin{cases} 0 & -\pi \leq x \leq 0 \\ x^2 & 0 \leq x \leq \pi \end{cases}$

OR

b) State and prove Parseval's theorem

**BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE- VII C
NUMBER THEORY**

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Divisibility	2	2	30
II	Arithmetic al Functions and Dirichlet Multiplicat ion	1	2	25
III	Averages of Arithmetic al Functions	2	2	30
IV	Congruences	1	2	25
V	Quadratic Residues and the Quadratic Reciprocit y Law	2	2	30
TOTAL		8	10	140

S.A.Q. = Shortanswerquestions (5 marks)

E.Q. = Essayquestions (10marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks
	Total	75 Marks

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

SKILL ENHANCEMENT COURSE-VII – C

NUMBER THEORY

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions. Each question carries 5 marks 5x5=25M

1. Show that the infinite series $\sum \frac{1}{p_n}$ is diverges
2. Prove that , given any two integers a, b there is a common divisor d of a, b of the form $d = ax + by, x, y$ are integers.
3. Define big oh notation and Asymptotic equality of a function
4. Show that $\sum_{n \leq x} \mu(n) \left[\frac{x}{n} \right] = 1 \forall x \geq 1$
5. Show that $\sum_{n \leq x} \Lambda(n) \left[\frac{x}{n} \right] = \log[x] \forall x \geq 1$
6. Prove that an integer $n > 0$ is divisible by 9. iff the sum of the digits in its decimal expansion is divisible by 9.
- 7 Determine whether 219 is a quadratic residue or non residue mod 383
- 8 Determine whether 888 is a quadratic residue or non quadratic residue of the prime 1999.

SECTION B

Answer any FIVE questions.

5x10=50M

Each question carries 10 marks.

9. (a) . State and prove the fundamental theorem of arithmetic

OR

- b) State and Prove Euclidean Algorithm

10. (a) Define Euler totient function $\varphi(n)$, mobius function $\mu(n)$, mangoldt function $\Lambda(n)$

OR

- (b) State and prove Mobius Inversion formula

11. a) Prove that $\sum_{n \leq x} \frac{1}{n} = \log x + c + O\left(\frac{1}{x}\right) \forall x \geq 1$

OR

- b) Prove that $\sum_{n \leq x} d(n) = x \log x + (2c - 1)x + O(\sqrt{x}) \forall x \geq 1$ where c is the Eluler's constant

12 a) State and Prove Lagrange's Theorem

OR

b). State and Prove Chinese Remainder theorem

13. a) If p & q are distinct odd primes then prove that $(p/q)(q/p) = (-1)^{(p-1)(q-1)/4}$

OR

b) Define Legendre's symbol. Let P be an odd prime. Then prove that $(n/p) \equiv n^{p-1/2} \pmod{p}$

Dr.V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

Arts/Science/Commerce: LIFE SKILLS COURSES

SEMESTER-III.

ANALYTICAL SKILLS

Syllabus (30 Hrs.)

Course Objective: Intended to inculcate quantitative analytical skills and reasoning as an inherent ability in students.

Course Outcomes:

After successful completion of this course, the student will be able to:

1. Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.
2. Acquire competency in the use of verbal reasoning.
3. Apply the skills and competencies acquired in the related areas.
4. Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.

MODULE – I: (10 Hours)

Arithmetic ability: Algebraic operations BODMAS, Fractions, Divisibility rules, LCM & GCD (HCF).

Verbal Reasoning: Number Series, Coding & Decoding, Blood relationship, Clocks, Calendars.

MODULE – II: (10 Hours)

Quantitative aptitude: Averages, Ratio and proportion, Problems on ages, Time-distance – speed.

Business computations: Percentages, Profit & loss, Partnership, simple compound interest.

MODULE – III: (07 Hours)

Data Interpretation: Tabulation, Bar Graphs, Pie Charts, line Graphs. Venn diagrams.

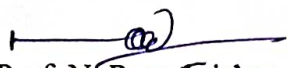
Recommended Co-Curricular Activities (03 hrs)

Surprise tests / Viva-Voice / Problem solving/Group discussion.

Reference Books:

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc-Graw Hill Publications.
4. Quantitative Aptitude for Competitive Examination by R. S. Agrawal, S.Chand Publications.

Signed and approved by


Prof. N. Ramakrishna,
Subject Expert
(University Nominee)


Sri. P. Mahalakshmi Naidu,
Subject Experts
(from outside the parent
university)


Sri. R. Ravi Shankar
Subject Experts
(from outside the parent
university)



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LIFE SKILL COURSE ANALYTICAL SKILLS

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Arithmetic ability n Verbal Reasoning	4	2	40
II	Quantitative aptitude, Business computations	3	2	35
III	Data Interpretation	1	1	15
TOTAL		8	5	90

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

Arts/Science/Commerce: LIFE SKILLS COURSES

SEMESTER-III., PAPER- ANALYTICAL SKILLS

MODEL QUESTION PAPER FORMAT

Time: 90 minutes

Max. Marks: 50

PART – A

- I. Answer any **four** questions. Each answer carries **5 marks** 4*5=20 Marks
(Total 8 questions, at least 1 question should be given from each unit)

1. If H.C.F., L.C.M of two numbers are 16 and 240 respectively and one number is 40; find the other number ?
2. Explain “Pie Charts” ?
3. If $A : B = 2 : 3$ and $B : C = 4 : 5$ Then $A : B : C = ?$
4. Devide Rs. 672 in 5 : 3 ratio ?
5. A train travelled 450 Kms in 7 hours and 740 kms in 10 hours. Find the average speed of the train ?
6. October 30, 2020 was a Friday. What day of the week lies on October 30, 2021?
7. If A is a brother of B ; B is the sister of C ; and C is the father of D, how D is related to A.?
8. Find the value of $78 - [5 + 3 \text{ of } (25 - 2 * 10)] = ?$

PART - B

- II. Answer any **three** questions. Each answer carries **10 marks** 3*10=30 Marks
(Total 5 questions, at least 1 question should be given from each unit)

9. (a) Find the angle between the hour hand and the minute hand of a clock when the time is 4 : 10
(b) How many natural numbers between 17 and 80 are divisible by 6?
10. Find the missing terms in the following sequences with suitable explanations.
 - (i) 22, 21, 23, 22, 24, 23,
 - (ii) 6, 11, 21, 36, 56, ----?
 - (iii) $2:8 :: 4 : ?$
 - (iv) Manager : Assistant : : Doctor :
 - (v) SCD, TEF, UGH ----- WKL

11. Sachin is younger than Rahul by 4 years. If their ages are in the respective ratio of 7:9, find their present ages?

12. A man travelled from the village to the post office at the rate of 25kmph and walked back at the rate of 4kmph. If the whole journey took 5 hours 48 minutes, find the distance of post office from the village?
13. Study the following table and answer the questions based on it.

Expenditure of a company (in pesetas) per annum over the given years

Year	Item of expenditure				
	Salary	Fuel and Transport	Bonus	Interest on Loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	101	3.84	41.6	94
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

- (i). What is the average amount of interest per year which the company had to pay during this period?
 a) 32.43 b) 33.72 c) 34.18 d) 36.66 []
- (ii). The total amount of bonus paid by the company during the given period is approximately what percent of the total amount of salary paid during this period.
 (a) 0.1% b) 0.5% c) 1.0% d) 1.25% []
- (iii). Total expenditure on all these items in 1998 was approximately what percent of the total expenditure in 2002?
 a) 0.62% b) 0.66% c) 0.69% d) 0.71% []
- (iv). The total expenditure of the company over these items during the year 2000 is?
 a) 544.44 b) 501.11 c) 446.46 d) 478.87 []
- (v). The ratio between the total expenditure and taxes for all the years and the total expenditure on Fuel and Transport for all the years respectively is approximately?
 a) 4:7 b) 10:13 c) 15:18 d) 5:8 []

Dr.V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM.

**CBCS/ SEMESTER SYSTEM
LIFE SKILLS COURSES**

**(w.e.f. 2022-23)
ELEMENTARY STATISTICS**

Syllabus (30 Hrs.)

Learning Objectives:

At the end of the course student will be able to

1. Understand the concept of Statistics and its merits and demerits. Distinguishing primary and secondary data. Classification, Tabulation and Pictorial representation of data.
2. Understand the basic nature of data and how a single value describes the entire data set. Measuring the degree of departure of a distribution from symmetry and reveals the direction of scatteredness of the items.
3. Understand the spread of the data and to draw conclusions from the comparison of averages. And understand the concept of correlation and regression and to learn the degree of association between two variables and establishing relationship between the variables.

MODULE I: (8hrs)

Meaning, scope and limitations of Statistics:

Collection of data: Primary and Secondary, Classification and Tabulation, Construction of frequency distribution. Graphical Representation: Histogram, Bar, Pie and Frequency polygon.

MODULE II: (12hrs)

Measures of Central Tendency:

Features of good average, Arithmetic Mean, Median, Mode. Empirical relationship between Mean Median and Mode and skewness based on central values.

MODULE III: (10hrs)

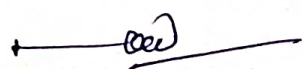
Measures of Dispersion:

Range, Quartile Deviation (QD), Mean Deviation (MD), Variance, Standard Deviation (SD), relationship between QD, MD and SD. Familiarization of the concepts relating to Correlation and Linear Regression line.

Reference Books:

1. Statistics (Theory, Methods, Application) D C Sancheti, V K Kapoor, Sultan Chand and Sons, New Delhi
2. Statistical Methods, S.P. Gupta, Sultan Chand and Sons, New Delhi
3. Statistics (Theory and Practice) B.N Gupta, Sahitya Bhavan, Agra

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LIFE SKILL COURSE ELEMENTARY STATISTICS

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Meaning, scope, Limitations of Statistics	3	1	25
II	Measures of central Tendencies	3	2	35
III	Measures of Dispersion	2	2	30
TOTAL		8	5	90

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Dr. V. S. KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

**CBCS/ SEMESTER SYSTEM
(w.e.f. 2022-23)
B.A./B.Sc. MATHEMATICS
LIFE SKILLS COURSES
SEMESTER-II
ELEMENTARY STATISTICS
MODEL QUESTION PAPER FORMAT**

Time: 90 minutes

Max. Marks: 50

PART – A

I. Answer any four questions. Each answer carries 5 marks 4*5=20 Marks

(Total 8 questions, at least 1 question should be given from each unit)

1. "The arithmetic mean is the best among all averages" give reasons for the statement.
2. What are the merits and limitations of Median?
3. State the importance of Statistics to industry and commerce
4. Explain the differences between primary data and secondary data.
5. Explain about histogram.
6. What is skewness? How does it differ from dispersion?
7. Define quartile deviation, mean deviation and standard deviation,
8. Write a brief note on correlation and regression.

PART – B

II. Answer any three questions. Each answer carries 10 marks 3*10=30 Marks

(Total 5 questions, at least 1 question should be given from each unit)

1. What are the rules which have to be followed while drawing a diagram.
2. calculate AM, Median and Mode for the following data.

Classes	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	3	5	12	10	6	4

3. Calculate the Mode using Mean and Median following data.

Classes	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	4	6	20	32	33	17	10

4. Compute Standard Deviation from the following data.

Classes	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	10	15	25	35	8	7

5. Calculate the Mean and Quartile deviations for the following data.

Classes	10	20	30	40	50	60	50	60
Frequency	15	30	53	75	100	110	115	12

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CBCS/ SEMESTER SYSTEM

(w.e.f. 2022-23)

B.A./B.Sc. MATHEMATICS

ADD ON COURSE

For All UG students

BASIC STATISTICS FOR DATA ANALYSIS

Syllabus (60 Hrs.)

Course Outcomes:

After successful completion of this course, the student will be able to:

1. Collect different kinds of data as per the requirement.
2. Will be able to calculate measures of central tendencies and dispersion
3. Understand the concept of Probability.
4. Able to differentiate among different types of distributions.

Module-I (12 Hours)

Introduction to Statistics:

Concepts of primary and secondary data. Diagrammatic and graphical representation of data: Histogram, frequency polygon, Ogive curve, Pie. Measures of central tendency: Mean, median, mode.

Module -II (10 Hours)

Measures of Dispersion:

Range, Quartile deviation, mean deviation, standard deviation and variance.

Module -III (12 Hours)

Introduction to Probability:

Basic concepts of Probability, random experiment, trail, outcome, sample space, event. Definition of probability, conditional probability, independent events, addition and multiplication theorems of probability for 2 events. Bayes theorem. Correlation meaning, types, scatter diagram. Karl Pearson's coefficient and Regression

Module-IV (14 Hours)

Random Variables:

Definition of random variable, discrete and continuous random variables, functions of random variable. Probability mass function and density function, distribution function and its properties. Simple problems on p.m.f, p.d.f.

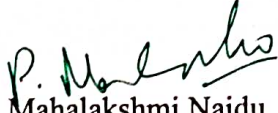
Module-V (12 Hours)

Distributions:

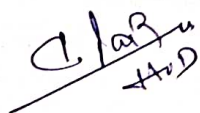
Binomial, Poisson, Geometric, Uniform, Normal, Exponential distributions: definition, mean, variance, M.G.F, C.F, P.G.F, C.G.F.

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C. Lakshmi
HrD

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ADD ON COURSE**

BASIC STATISTICS FOR DATA ANALYSIS

Module	TOPIC	L.A.Q(includi ng choice)	Total Marks
I	Introduction to Statistics	2	20
II	Measures of Dispersion	2	20
III	Introduction to Probability	1	10
IV	Random Variables	1	10
V	Distributions	2	20
TOTAL		8	80

Dr.V.S.KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM.
ADD ON COURSE

For All UG students

BASIC STATISTICS FOR DATA ANALYSIS

MODEL QUESTION PAPER PATTERN

Answer any five questions. Each question carries equal marks.

5 x 10 = 50

1. What is primary and secondary data.
2. Explain different methods of data representations with suitable examples.
3. Explain standard deviation.
4. Define random variables and its types.
5. Explain correlation coefficient and its types, properties also.
7. Derive mean of a normal distribution.
8. Difference between discrete and continuous distributions.

Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM.
MATHEMATICS MINOR I
CBCS / SEMESTER SYSTEM
B.Sc. CHEMISTRY(HONS) & PHYSICS (HONS)
(w.e.f. 2022-23)
SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

- Draw different types of charts and solve equations numerically.
- Understand various types of distributions, regression.
- Know the methods differentiation.
- Know the methods integration and numerical integration.
- Solve matrix equations using determinants and matrices.

Syllabus:

MODULE I (12 Hours)

Fundamentals of mathematics I:

Mathematical functions, polynomial expressions, logarithms, exponential function, units of a measurement, inter conversion of units, constants and variables, equation of a straight line, plotting graphs, data representation, pie charts and histogram. Algebraic operations on real scalar variables, roots of quadratic equations Analytically and iteratively. Numerical method of finding roots (Newton-Raphson, binary-bisection).

MODULE II (12 Hours)

Fundamentals of mathematics II:

Uncertainties in measurement: types of uncertainties, combining. Use of statistical tools, data reduction and the propagation of errors, binomial Poisson and Gaussian distribution, graphical and numerical data reduction. Numerical curve fitting : the method of least squares (regression)

MODULE III (12 Hours)

Differential calculus:

The tangent line and the derivatives of a function, differentiation, differentials of higher order derivatives, discontinuities, stationery points, points of inflexion, min-max problems, limiting values, L'Hospital rule, combining limits.

Calculus of several variables: functions, change of variables, total differential, chain rule, partial differentiation.

MODULE IV (12 Hours)

Integral calculus:

Integration, odd-even functions, indefinite integrals, standard integrals, methods of integration (by parts, substitution, partial fractions and others), trigonometric functions.

Numerical integration: Trapezoidal, Simpson's rules (applications in Chemistry and Physics need to be emphasized throughout).

MODULE V (12 Hours)

Determinants and Matrices:

Determinant, matrix algebra, Simultaneous equations: method of substitution and elimination constancy and independence. Homogeneous linear equations. Simultaneous equations with more than two unknowns, Cramer's rule, matrix inversion methods. Orthogonal, unitary matrices and diagonalisation of a matrix

Co-Curricular Activities (15 Hours)

Seminar/ Quiz/ Assignments/ Applications of mathematics to Real life Problem /Problem Solving.

Reference Books:

1. Maths for chemists, vols I & II M.C.R. Cockett G. Dogget, Royal society of Chemistry
2. Numerical methods, schand & company
3. Intermediate Mathematics vols IA, IB, IIA & IIB.

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A. Jagadeesh
HOD

**RECOMMENDED QUESTION PAPER PATTERN
BLUE PRINT FOR QUESTION PAPER PATTERN**

COURSE- MATHEMATICS MINOR I

Module	TOPIC	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	Fundamentals of mathematics I	2	2	30
II	Fundamentals of mathematics II	2	2	30
III	Differential calculus	1	2	25
IV	Integral calculus	2	2	30
V	Determinants and matrices	1	2	25
TOTAL		8	10	140

S. A. Q = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M
Essay questions : 5 X 10 M = 50 M

Total Marks = 75 M

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks
Total		75 Marks

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CBCS/ SEMESTER SYSTEM
(W.e.f 2022-23)
B.Sc. PHYSICS(HONS), CHEMISTRY (HONS)
MATHEMATICS MINOR I
MODEL QUESTION PAPER

Time: 3Hrs

Max.Marks:75M

I. Answer any FIVE of the following:

5x5=25

1. With an example each explain Pie chart and histogram.
2. Write a note on data representation.
3. Explain about Binomial, Poisson and Gaussian distributions.
4. Explain about data reduction & propagation of errors.

5. If $y = \cot^{-1} \sqrt{\frac{1-\sin x}{1+\sin x}}$ find $\frac{dy}{dx}$.

6. Evaluate (i) $\int \frac{xe^x}{(1+x)^2} dx$ (ii) $\int \frac{1}{\sqrt{2x-x^2}} dx$

7. Find the value of $\int (x^2 - 1)(4 + 3x) dx$

8. Diagonalize the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

II. Answer any FIVE of the following:

5x10=50

(one question from each unit)

9.(a) Apply Newton-Raphson method to find an approximate root of the equation which is correct to three decimal places to the equation $x^3 - 3x - 5 = 0$ which lies near 2.

OR

(b) Find an approximate value of the real root of $x^3 - x - 1 = 0$ by Bisection method.

10.(a) Using the method of least squares find the equation of straight line that fits best for the following data.

X	1	2	3	4	5
Y	14	27	40	55	68

OR

(b) Find the values of a, b, c so that $y = a + bx + cx^2$ is the best fit for the data.

X	0	1	2	3	4
Y	1	0	3	10	21

11.(a) Find two positive numbers whose sum is 15 so that the SUM of their squares is minimum.

OR

(b) If $x=a(t-\sin t)$, $y=a(1+\cos t)$ find $\frac{d^2y}{dx^2}$.

12.(a) The following table gives the velocity v of a particle at time t . Find the distance moved by the particle in 12 seconds also the acceleration at $t=2$.

T(sec)	0	2	4	6	8	10	12
V(m/sec)	4	6	16	34	60	94	136

OR

(b) Find the value of $\int \frac{x^2 + 1}{x^2 - 5x + 6} dx$

13.(a) Solve the following using matrix inversion method.

$$2x_2 + 4x_3 = 2, 2x_1 + 4x_2 + 2x_3 = 3, 3x_1 + 3x_2 + x_3 = 1$$

OR

(b) Using the properties of determinants show that

$$\begin{vmatrix} a^2 + 1 & ab & ac \\ ab & b^2 + 1 & bc \\ ca & cb & c^2 + 1 \end{vmatrix} = 1 + a^2 + b^2 + c^2$$

Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM.
MATHEMATICS MINOR II
CBCS / SEMESTER SYSTEM
B.Sc. CHEMISTRY(HONS) & PHYSICS (HONS)
(w.e.f. 2022-23)
SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Solve linear differential equations
2. Conversion of non-exact equations to exact differential equations by using integrating factors.
3. Know the methods of finding solutions of differential equations of the first order but not of the first degree.
4. Solve higher-order linear differential equations, both homogeneous and non-homogeneous with constant coefficients.
5. Understand the concept and apply appropriate methods for solving differential equations.

Course Syllabus:

MODULE I (12 Hours)

Differential Equations of first order and first degree:

Method of variable separable, Homogeneous differential equations, Exact differential equations; Integrating factors; Change of variables and Linear Differential Equations; Differential equations reducible to linear form;.

MODULE II (12 Hours)

Orthogonal Trajectories

Differential Equations of first order but not of the first degree:

Equations solvable for p ; Equations solvable for y ; Equations solvable for x ; Equations that do not contain x (or y); Equations homogeneous in x and y ; Equations of the first degree in x and y – Clairaut's Equation.

MODULE III (12 Hours)

Higher order linear differential equations-I:

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators

General solutions of $f(D)y = 0$

General solution of $f(D)y = Q$, when Q is a function of x , $\frac{1}{f(D)}$ is expressed as partial fractions

P.I. of $f(D)y = Q$ when $Q = be^{ax}$

P.I. of $f(D)y = Q$ when Q is $b \cdot \sin ax$ or $b \cdot \cos ax$

MODULE IV (12 Hours)

Higher order linear differential equations-II:

Solution of the non-homogeneous linear differential equations with constant coefficients

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax}V$, where V is a function of x .

P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x .

P.I. of $f(D)y = Q$ when $Q = x^mV$, where V is a function of x .

MODULE V (12 Hours)

Higher order linear differential equations-III :

Method of variation of parameters; Linear differential Equations with non-constant coefficients;

The Cauchy-Euler Equation, Legendre's linear equations, miscellaneous differential equations.

Introduction of partial differential equations :

Partial Differential Equations, classification of first order partial differential equations,

Rule I, derivation of a partial differential equations by the elimination of arbitrary constants

2. Rule II, derivation of a partial differential equation by the elimination of arbitrary function ϕ from the equations $\phi(u, v) = 0$ where u and v are functions of x, y and z .

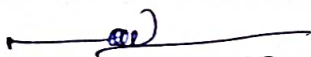
Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving

Reference Books :

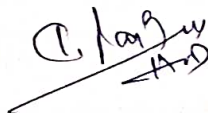
1. A text book of Mathematics for B.A/B.Sc, Vol 1, by N. Krishna Murthy & others, published by S.Chand& Company, New Delhi
2. Ordinary and Partial Differential Equations by Dr. M.D.Raisinghania, published by S. Chand & Company, New Delhi.
3. Differential Equations with applications and programs – S. Balachandra Rao& HR Anuradha-Universities Press.
4. Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

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A.D.

Recommended Question Paper Patterns and Models :
BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-MATHEMATICS MINOR-II,
DIFFERENTIAL EQUATIONS

Module	TOPIC	S.A.Q (each carry 5 marks) (including choice)	E.Q (each carry 10marks) (including choice)	Total Marks (including choice)
I	Differential Equations of 1 st order and 1 st degree	2	2	30
II	Orthogonal Trajectories, Differential Equations of 1 st order but not of 1 st degree	2	2	30
III	Higher Order Linear Differential Equations (with constant coefficients) – I	1	2	25
IV	Higher Order Linear Differential Equations (with constant coefficients) – II	2	2	30
V	Higher Order Linear Differential Equations (with non constant coefficients) Introduction of partial differential equations	1	2	25
TOTAL		8	10	140

S.A.Q. = Short answer questions (each carry 5 marks) & E.Q. = Essay questions (each carry 10marks)

Weightage for each level of Bloom's Taxonomy

Knowledge Question	Definition and explanation type	10 marks
Understanding Question	Describe type	5 marks
Analysis and Application Question	Problem solving type/ Theorem proof type	50 marks
critical thinking question	Problem solving type	10 marks

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.
CBCS/ SEMESTER SYSTEM
(W.e.f 2022-23)

B.A./B.Sc. MATHEMATICS
COURSE-MATHEMATICS MINOR-II,
DIFFERENTIAL EQUATIONS
MODEL PAPER

Time:3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions

5x5=25M

Each question carries 5 marks

1. Solve $y(1+xy)dx + x(1-xy)dy = 0$.
2. Solve $(1+y^2)dx = (\tan^{-1}y - x)dy$.
3. Solve $p^2 - 5p + 6 = 0$.
4. Solve $(D^4 - 4D^3 + 6D^2 - 4D + 1)y = 0$.
5. Solve $(D^2 - 3D + 2)y = \cosh x$.
6. Solve $(D^2 + 2D + 1)y = x \cos x$.
7. solve $(D^2 - 3D + 2)y = e^{4x} + \sin 3x$.
8. solve $(x^2 D^2 - 2xD + 2)y = x + \frac{1}{x}$.

SECTION-B

Answer any FIVE questions.

5x10=50M

Each question carries 10 marks.

9. a). Solve $(1 + e^{\frac{x}{y}})dx + e^{\frac{x}{y}}(1 - \frac{x}{y})dy = 0$

(or)

b) Solve $x \frac{dy}{dx} + y = y^2 \log x$.

10. a). Find the orthogonal trajectories of the family of curves $r^n \cos n\theta = a^n$ where a is a parameter.

(or)

b). Solve $p^2 + 2py \cot x = y^2$.

11. a). Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.

(or)

b). Solve $(D^2 + 9)y = \cos^3 x$

12. a). Solve $(D^4 + 2D^2 + 1)y = x^2 \cos x$

(or)

b). Solve $\frac{d^2 y}{dx^2} - 6 \frac{dy}{dx} + 13y = 8e^{3x} \sin 2x$.

13. a). Solve $(x^3 D^3 + 2x^2 D^2 + 2)y = 10(x + \frac{1}{x})$

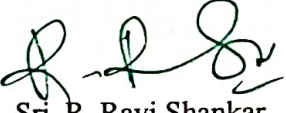
(or)

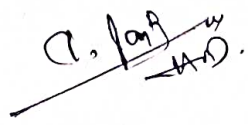
b). Solve $(D^2 + 1^2)y = \text{Cosec } x$ by the method of variation of parameters.

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