GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM
(*Accredited by NAAC "A+" Grade)*
DEPARTMENT OF MATHEMATICS

ALLOCATION OF CREDITS TO Ist SEMESTER COURSES OF MATHEMATICS FOR BSc, MATHEMATICS (MAJOR) FOR THE ACADEMIC YEAR 2023-24 IN ACCORDANCE WITH GUIDELINES OF THE APSCHE,THE STATUTORY REGULATORY AUTHORITY OF HIGHER EDUCATION,A.P. IN SIGLE MAJOR SUBJECT SYSTEM w.e.f. 2023-24

S. No	Course Code	Semester	Title of the Course	Hrs/ Week	Max. Marks (SEE)	Marks in CIA	Credits
1	**124701**	**I**	Essentials and Applications of Mathematical, Physical a n d Chemical Sciences	4	50	5 0	4
2.	124702	I	Advances in Mathematical, Physical and Chemical Sciences	4	5 0	5 0	4
3.	224701	II	Differential Equations & Problem Solving Sessions	5	50	50	4
4	224702	II	Analytical Solid Geometry & Problem Solving Session	5	50	50	4

SYLLABUS OF MATHEMATICS FOR Ist SEMESTER COURSES OF MATHEMATICS FOR BSc, MATHEMATICS (MAJOR) FOR THE ACADEMIC YEAR 2023-24 IN ACCORDANCE WITH GUIDELINES OF THE APSCHE,THE STATUTORY REGULATORY AUTHORITY OF HIGHER EDUCATION,A.P. IN SIGLE MAJOR SUBJECT SYSTEM w.e.f. 2023-24

SEMESTER-I

COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL ANDCHEMICAL SCIENCES

COURSE CODE: 124701

Theory | Credits: 4 | 5 hrs/week

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:

1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.

2. To Explain the basic principles and concepts underlying a broad range of fundamentalareas of physics and to Connect their knowledge of physics to everyday situations

3. To Explain the basic principles and concepts underlying a broad range of fundamentalareas of chemistry and to Connect their knowledge of chemistry to daily life.

4. Understand the interplay and connections between mathematics, physics, and chemistry invarious applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALS OF MATHEMATICS:

Complex Numbers: Introduction of the new symbol i – General form of a complex number –

Modulus-Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles**Vectors:** Definition of vector addition – Cartesian form – Scalar and vector product and problems **Statistical Measures**: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS:

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY: :

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.

2. Elementary Trigonometry by H.S.Hall and S.R.Knight

3.Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.

4.Basic Statistics by B.L.Agarwal, New age international Publishers

5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman

6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker

7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.

8. Physics for Technology and Engineering" by John Bird

9. Chemistry in daily life by Kirpal Singh

10. Chemistry of bio molecules by S. P. Bhutan

11. Fundamentals of Computers by V. Raja Raman

12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS:

1: Complex Number Exploration

Provide students with a set of complex numbers in both rectangular and polar forms.

They will plot the complex numbers on the complex plane and identify their properties

2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors.

They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis

Give students a dataset containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).
They will interpret the results and analyze the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS:

1. Concept Mapping

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

2. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.
Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.
Students will work in small groups to carry out the experiment, collect data, and analyze the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine,or environmental issues.
Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.
2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.
They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.
Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.
4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates,proteins, fats, or vitamins.
Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.
3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of

mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

.4: Mathematical Modeling

Present students with real-world problems that require mathematical modeling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidthof
2. your college network) and prepare a report covering network architecture.
3. Identify the types of malwares and required firewalls to provide security.
4. Latest Fraud techniques used by hackers.

SEMESTER-I

COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICALAND CHEMICALSCIENCES

COURSE CODE: 124702

Theory Credits: 4 5 hrs/week

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.

3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.

3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics.Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..

UNIT I: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms – Point ofintersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product ruleand quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration **Matrices:** Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose ofa matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. **Recent advances in the field of nanotechnology**: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

Mathematical Modelling applications in physics and chemistry

Application of Renewable energy: Grid Integration and Smart Grids,

Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine

Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A.Bohara

"Biophysics: An Introduction" by Rodney Cotterill

6. "Medical Physics: Imaging" by James G. Webster
7. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
8. Nano materials and applications by M.N.Borah

11 Environmental Chemistry by Anil.K.D.E.

12. Digital Logic Design by Morris Mano

13.Data Communication & Networking by Bahrouz Forouzan.

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STUDENT ACTIVITIES

UNIT I: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, suchas slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including theirslopes,intercepts, and point of intersection.
2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications,such as analyzing rates of change or optimizing functions.

3: Integration Exploration
Students will explore the concept of integration as a reverse process of differentiation andapply basicmethods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics andchemistry4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrixmultiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solvingsystems ofequations or representing transformations in geometry.

UNIT II: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology,biophysics,medical physics, or shape memory materials.
Students will analyze the case studies, identify the challenges or problems presented, andproposeinnovative solutions based on the recent advances in the respective field.
They will consider factors such as energy generation, energy storage, efficiency, sustainability, materials design, biomedical applications, or technological advancements.2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewableenergy,nanotechnology, biophysics, medical physics, or shape memory materials.
They will identify a specific research question or problem to investigate and design anexperiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based

ontheirfindings.

They will discuss the implications of their experimental results in the context of recentadvances inthe field.

3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology,biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNIT III: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtualscreening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity andselectivity of nano sensors in detecting specific analytes.
Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.
Students will perform their experiments or simulations, collect data, analyze the results, and drawconclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.
Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing withchemical pollutants.
For the dye removal using the catalysis method, students can explore case studies wherecatalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of thecatalysis method, and its applications in environmental remediation.
3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing anano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems.
Students will develop a detailed project plan, conduct experiments or simulations, analyzedata,

and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project

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UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS &CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model tooptimize the placement and configuration of solar panels in a solar farm.
Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.
They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.

2: Case Studies and Group Discussions

Assign students to analyze case studies related to the applications of mathematical modellingin nanotechnology, biophysics, medical physics, solid waste management, environmental remediation,or water treatment.
Students will discuss the mathematical models and computational methods used in the casestudies,analyze the outcomes, and evaluate the effectiveness of the modelling approach.
Encourage group discussions on the challenges, ethical considerations, and potentialadvancements in the field.

Students will present their findings and engage in critical discussions on the advantages andlimitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics,medical physics, solidwaste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiationtherapy in medical physics or designing a mathematical model to optimize wastemanagement practices.
Students will plan and execute their project, apply mathematical modelling techniques,analyzethe results, and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT V: Advanced Applications of computer Science

Students must be able to convert numbers from other number system to binary numbersystems

1. Identify the networking media used for your college network
2. Identify all the networking devices used in your college premises.

SEMESTER-II

COURSE 3: DIFFERENTIAL EQUATIONS

COURSE CODE: 224701

Theory Credits: 4 5 hrs/week

Course Outcomes

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

1. solve first order first degree linear differential equations.
2. convert a non-exact homogeneous equation to exact differential equation by using anintegrating factor.
3. know the methods of finding solution of a differential equation of first order but not of firstdegree.
4. solve higher-order linear differential equations for both homogeneous and non-homogeneous,with constant coefficients.
5. understand and apply the appropriate methods for solving higher order differential equations.

with Course focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

COURSE CONTENT

Unit – 1

Differential Equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations –Integratingfactors - Equations reducible to Exact Equations by Integrating Factors -

i) Inspection Method ii) $\frac{1}{Mx+Ny}$ iii) $\frac{1}{Mx-Ny}$

Unit – 2

Differential Equations of first order but not of first degree

Equations solvable for p, Equations solvable for y, Equations solvable for x – Clairaut's equation - Orthogonal Trajectories: Cartesian and Polar forms.

Unit – 3

Higher order linear differential equations

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

(i) $Q(x) = e^{a}_{x}$ (ii) $(x) = Sin\ ax$ (or) $Cos\ ax$

Unit – 4

Higher order linear differential equations (continued.)

Solution to a non-homogeneous linear differential equation with constant coefficients

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

P.I. of $(D) = Q$ 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

Unit – 5

Higher order linear differential equations with non-constant coefficients

Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; LegendreEquation; Method of variation of parameters

Additional Module: (4 HRS)

Plotting of second order solution family of differential equation- Plotting of third order solution family of differential equation- Growth model (exponential case only)- Decay model (exponential case only).

Activities

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /ProblemSolving Sessions.

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand &Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University Press.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

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II Semester end Examinations

Paper Code – 224701: Differential Equations

(For the batch admitted in 2023-24 under single major system)

TIME: $2\frac{1}{2}$ HRS. Total Marks: 50

PART – A

Answer any **Five** questions. Each question carries 3 marks. 5X3= 15M

Question	Topics	Nature	Marks
1,2	Unit – I	Theorem or problem	3,3
3,4	Unit – II	Theorem or problem	3,3
5,6	Unit – III	Theorem or problem	3,3
7	Unit – IV	Theorem or problem	3
8	Unit-V	Theorem or problem	3

PART – B

Answer All Questions. Each question carries 7 marks 5X 7 = 35 M

Question	Topic	Nature	Marks
9 or 10	Unit-I	Theorem or Problem	7
11 or 12	Unit-II	Theorem or Problem	7
13 or 14	Unit-III	Theorem or Problem	7
15 or 16	Unit-IV	Theorem or Problem	7
17 or 18	Unit-V	Theorem or Problem	7

Govt. College (Autonomous), Rajamahendravaram

Model Question Paper

Mathematics(H) & Computational Mathematics

Paper-I **Semester – II**

Paper Code – 224701 :: Differential Equations

(For the batch admitted in 2023-24 under single major system)

Time : $2\frac{1}{2}$ Hrs. **Max.Marks : 50**

PART – A

Answer any Five questions. Each question carries 3 Marks. **5 x 3M = 15 Marks**

1. Solve $(e^y+1)\cos x\,dx + e^y \sin x\,dx$.

2. Solve $\frac{dx}{y} = \frac{dy}{-x} = \frac{dz}{2x-3y}$.

3. Solve $4y^2p^2 + 2xy(3x+1)p + 3x^3=0$.

4. Solve $x^2(y - px) = p^2y$.

5. Solve $(D^2 - 3D + 2)y = \cos h\, x$.

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

7. Solve $(D^2 - 4D + 4)y = x^3$.

8. Solve $[(1+x)^2D^2 + (1+x)D+1]y = 4\cos \log(1+x)$.

PART – B

Answer all questions. Each question carries 7 Marks. **5 x 7M = 35 Marks**

9. Solve $x^2ydx-(x^3+y^3)dy=0$.

OR

10. Solve $x\frac{d^2y}{dx^2} + y = y^2 \log x$

11. Find the orthogonal trajectories of the family of curves $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ where 'a' is the parameter.

OR

12. Solve $y = 2xp + x^2p^4$.

13. Solve$(D^3 + D^2 - D - 1)y = \cos 2x$

OR

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

15. Solve $(D^2 -2D +4)y = 8(x^2 + e^{2x} + \sin 2x)$.

OR

16. Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = xe^x sinx.$

17. Solve $(D^2+a^2)y = \tan x$ by the method of variation of parameters.

OR

18. Solve $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10(x + \frac{1}{x})$.

SEMESTER-II

COURSE 4: ANALYTICAL SOLID GEOMETRY

COURSE CODE: 224702

Theory Credits: 4 5 hrs/week

Course Outcomes

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

1. understand planes and system of planes
2. know the detailed idea of lines
3. understand spheres and their properties
4. know system of spheres and coaxial system of spheres
5. understand various types of cones

Course Content

Unit-1

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.

Unit – 2

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 - Lengthof the perpendicular from a given point to a given line.

Unit – 3

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.

Unit – 4

Spheres (continued)

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

Unit– 5 Cones

Definitions of a cone – vertex, guiding curve and generators - Equation of the cone with a given vertexand guiding curve - Equations of cones with vertex at origin are homogenous - Condition that the general equation of the second degree should represent a cone - Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle.

Activities

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and itsapplications/ Problem Solving Sessions.

Text Book

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

Reference Books

1. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

Reference Books:

[1] A Text book of B.Sc Mathematics-Volume I by V.Venkateswara rao , N.Krishna Murthy, B.V.S.S.Sharma and S.Anjaneya Sastry, published by S.Chand & company , New Delhi.

[2] Ordinary and partial Differential equations Raisinghania , Published by S.chand & company , New Delhi.

[3] A Text Book of Mathematics by Dr.A. Anjaneyulu, Deepti Publications.

Co-Curricular Activities (15 Hours): Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving.

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

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II Semester End Examinations

PAPER –II – -SOLID GEOMETRY

COURSE CODE: 224702

(For the batch admitted in 2023-24 under single major system)

Duration: 2 ½ hrs Total Marks: 50

PART – A

Answer any **Five** questions. Each question carries 3 marks. 5 X3 M = 15 M

Question	Topics	Nature	Marks
1	Unit – I	Theorem or Problem	3
2	Unit – I	Theorem or Problem	3
3	Unit – II	Theorem or Problem	3
4	Unit – II	Theorem or Problem	3
5	Unit - III	Theorem or Problem	3
6	Unit - III	Theorem or Problem	3
7	Unit -IV	Theorem or Problem	3
8	Unit - V	Theorem or Problem	3

PART – B

Answer **All** Questions. Each question carries 7 marks 5X 7 M = 35 M

Question	Topic	Nature	Marks
9 or 10	Unit-I	Theorem or Problem	7
11 or 12	Unit-II	Theorem or Problem	7
13 or 14	Unit-III	Theorem or Problem	7
15 or 16	Unit-IV	Theorem or Problem	7
17 or 18	Unit-V	Theorem or Problem	7

GOVERNMENT AUTONOMOUS COLLEGE, RAJAMAHENDRAVARAM

Model Question Paper

Mathematics(H) & Computational Mathematics for Semester – II

Paper II- - Solid Geometry

COURSE CODE: 224702

(From the batch admitted in 2023-24 under single major system)

Time: 2 $\frac{1}{2}$ Hrs. **Max. Marks: 50**

PART – A

Answer any **five** questions. Each question carries 3 Marks. 5 x 3 M = 15 M

1. Find the equation of the plane through (4,4,0) and perpendicular to the planes x+2y+2z=5, and 3x+3y+2z-8=0.
2. A variable plane is at a constant distance 3p from the origin meets the axes in A, B, C. Show that the locus of the centroid of the triangle ABC is $x^{-2}+y^{-2}+z^{-2}=p^{-2}$.
3. Find the foot of the perpendicular form (2,-2,3)to the plane 2x-y-2z-9=0.
4. Find the image of (1, 3, 4) in the plane 2x-y+z+3=0.
5. Find the equation of spheres passing through the circle $x^2+y^2=4$, z=0 and is intersected by the plane x+2y+2z=0 in a circle of radius3.
6. Find the pole of the plane x-y+5z-3=0 w .r .t the sphere $x^2+y^2+z^2=9$.
7. Find the vertex of the cone $2x^2+2y^2+7z^2-10yz-10zx+2x+2y+26z-17=0$.
8. Find the equation to the cone which passes through the three coordinate axes and the lines $\frac{x}{1}=\frac{y}{-2}=\frac{z}{3}$ and $\frac{x}{2}=\frac{y}{1}=\frac{z}{1}$.

PART – B

Answer **all** questions. Each question carries **7** Marks. 5 x 7 M = 35 M

9. Find the equation to the plane through the intersection of the planes x+2y+3z+4=0, 4x+3y+3z+1=0 and perpendicular to the plane x+y+z+9=0.

Or

10. Find the bisecting plane of the acute angle between the planes 3x-2y+6z+2=0, -2x+y-2z-2=0.

11. Prove that the lines x+2y+3z-4=0=2x+3y+4z-5, 2x-3y+3z-5=0=3x-2y+4z-6 are coplanar. Also find their point of intersection and the plane containing lines.

Or

12. Find the length and equations to the line of SD between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$, $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-4}{4}$.

13. If r_1, r_2 are the radii of two orthogonal spneres, then the radius of the circle of their intersection is $\frac{r_1 r_2}{\sqrt{r_1{}^2+r_2{}^2}}$.

OR

14. Find the radical center of the spheres $x^2 + y^2 + z^2 + 4y = 0$, $x^2 + y^2 + z^2 + 2x + 2y + 2z + 2 = 0$, $x^2 + y^2 + z^2 + 3x - 2y + 8z + 6 = 0$, $x^2 + y^2 + z^2 - x + 4y - 6z - 2 = 0$.

15. Find the equation to the cone with vertex is the origin and whose base curve is $x^2+y^2+z^2+2ux+d=0$.

OR

16. Find the limiting points of the coaxial system of spheres $x^2+y^2+z^2-8x+2y-2z+32=0$, $x^2+y^2+z^2-7x+z+23=0$.

17. Find the angle between the lines of intersection of the plane x - 3y + z=0 and the cone $x^2-5y^2+z^2=0$.

Or

18. Find the equation of the right circular cone passing through A(1,-2,3)whose vertex is P(-2,-3,5) axis PQ which makes equal angles with the axes and semi vertical angle is 30°

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM
(*Accredited by NAAC "A+" Grade)*
DEPARTMENT OF MATHEMATICS

ALLOCATION OF CREDITS TO Ist SEMESTER COURSES OF COMPUTATIONAL MATHEMATICS FOR BSc COMPUTATIONAL MATHEMATICS (MAJOR) FOR THE ACADEMIC YEAR 2023-24 IN ACCORDANCE WITH GUIDELINES OF THE APSCHE,THE STATUTORY REGULATORY AUTHORITY OF HIGHER EDUCATION,A.P. IN SIGLE MAJOR SUBJECT SYSTEM w.e.f. 2023-24

S. No	Course Code	Semester	Title of the Course	Hrs/ Week	Max. Marks (SEE)	Marks in CIA	Credits
1	**124801**	**I**	Essentials and Applications of Mathematical, Physical a n d Chemical Sciences	4	5 0	5 0	4
2.	124802	I	Advances in Mathematical, Physical and Chemical Sciences	4	5 0	5 0	4
3.	224801	II	Differential Equations & Problem Solving Sessions	5	50	50	4
4.	224802	II	Analytical Solid Geometry & Problem Solving Session	5	50	50	4

SEMESTER-I

COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

COURSE CODE: 124801

Theory | Credits: 4 | 5 hrs/week

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:

5. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.

6. To Explain the basic principles and concepts underlying a broad range of fundamentalareas of physics and to Connect their knowledge of physics to everyday situations

7. To Explain the basic principles and concepts underlying a broad range of fundamentalareas of chemistry and to Connect their knowledge of chemistry to daily life.

8. Understand the interplay and connections between mathematics, physics, and chemistry invarious applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALS OF MATHEMATICS:

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus-Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles**Vectors:** Definition of vector addition – Cartesian form – Scalar and vector product and problems **Statistical Measures**: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS:

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY: :

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:

4. Functions of one complex variable by John.B.Conway, Springer- Verlag.

5. Elementary Trigonometry by H.S.Hall and S.R.Knight

6.Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.

4.Basic Statistics by B.L.Agarwal, New age international Publishers

13. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman

14. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker

15. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway andJohn W. Jewett Jr.

16. Physics for Technology and Engineering" by John Bird

17. Chemistry in daily life by Kirpal Singh

18. Chemistry of bio molecules by S. P. Bhutan

19. Fundamentals of Computers by V. Raja Raman

20. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS:

1: Complex Number Exploration

Provide students with a set of complex numbers in both rectangular and polar forms.

They will plot the complex numbers on the complex plane and identify their properties

2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors.

They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis

Give students a dataset containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).
They will interpret the results and analyze the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS:

3. Concept Mapping

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

4. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.
Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.
Students will work in small groups to carry out the experiment, collect data, and analyze the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine,or environmental issues.
Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.
2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.
They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.
Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.
4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates,proteins, fats, or vitamins.
Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.
3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of

mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

.4: Mathematical Modeling

Present students with real-world problems that require mathematical modeling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

5. Identifying the attributes of network (Topology, service provider, IP address and bandwidthof

6. your college network) and prepare a report covering network architecture.

7. Identify the types of malwares and required firewalls to provide security.

8. Latest Fraud techniques used by hackers**.**

SEMESTER-I

COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICALAND CHEMICALSCIENCES

COURSE CODE: 124802

Theory Credits: 4 5 hrs/week

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

4. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.

5. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.

6. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.

5. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.

6. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics.Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..

UNIT I: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms – Point ofintersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product ruleand quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose ofa matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. **Recent advances in the field of nanotechnology**: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS &CHEMISTRY

Mathematical Modelling applications in physics and chemistry

Application of Renewable energy: Grid Integration and Smart Grids,

Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine

Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1.Coordinate Geometry by S.L.Lony, Arihant Publications

2. Calculus by Thomas and Finny, Pearson Publications

3.Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.

4."Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle

5."Energy Storage: A Nontechnical Guide" by Richard Baxter

6."Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara

7."Biophysics: An Introduction" by Rodney Cotterill

8."Medical Physics: Imaging" by James G. Webster

9."Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas

10.Nano materials and applications by M.N.Borah

11.Environmental Chemistry by Anil.K.D.E.

12.Digital Logic Design by Morris Mano

13.Data Communication & Networking by Bahrouz Forouzan.

STUDENT ACTIVITIESUNIT

I: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, suchas slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including theirslopes,intercepts, and point of intersection.
2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications,such as analyzing rates of change or optimizing functions.

3: Integration Exploration
Students will explore the concept of integration as a reverse process of differentiation andapply basicmethods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics andchemistry4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrixmultiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solvingsystems ofequations or representing transformations in geometry.

UNIT II: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology,biophysics,medical physics, or shape memory materials.
Students will analyze the case studies, identify the challenges or problems presented, andproposeinnovative solutions based on the recent advances in the respective field.
They will consider factors such as energy generation, energy storage, efficiency, sustainability, materials design, biomedical applications, or technological advancements.2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewableenergy,nanotechnology, biophysics, medical physics, or shape memory materials.
They will identify a specific research question or problem to investigate and design anexperiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based ontheirfindings.

They will discuss the implications of their experimental results in the context of recentadvances inthe field.

3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology,biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNIT III: ADVANCES IN CHEMISTRY:

4. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtualscreening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity andselectivity of nano sensors in detecting specific analytes.
Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.
Students will perform their experiments or simulations, collect data, analyze the results, and drawconclusions based on their findings.

5. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.
Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing withchemical pollutants.
For the dye removal using the catalysis method, students can explore case studies wherecatalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of thecatalysis method, and its applications in environmental remediation.
3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing anano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems.
Students will develop a detailed project plan, conduct experiments or simulations, analyzedata,

and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT IV:

ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS &CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model tooptimize the placement and configuration of solar panels in a solar farm.
Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.
They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.

2: Case Studies and Group Discussions

Assign students to analyze case studies related to the applications of mathematical modellingin nanotechnology, biophysics, medical physics, solid waste management, environmental remediation,or water treatment.
Students will discuss the mathematical models and computational methods used in the casestudies,analyze the outcomes, and evaluate the effectiveness of the modelling approach.
Encourage group discussions on the challenges, ethical considerations, and potentialadvancements in the field.

Students will present their findings and engage in critical discussions on the advantages andlimitations of mathematical modelling in solving complex problems in these areas.

6. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics,medical physics, solidwaste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiationtherapy in medical physics or designing a mathematical model to optimize wastemanagement practices.
Students will plan and execute their project, apply mathematical modelling techniques,analyzethe results, and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT V: Advanced Applications of computer Science

Students must be able to convert numbers from other number system to binary number systems

3. Identify the networking media used for your college network

4. Identify all the networking devices used in your college premises.

SEMESTER-II

COURSE 3: DIFFERENTIAL EQUATIONS

COURSE CODE: 224801

Theory Credits: 4 5 hrs/week

Course Outcomes

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

1. solve first order first degree linear differential equations.
2. convert a non-exact homogeneous equation to exact differential equation by using anintegrating factor.
3. know the methods of finding solution of a differential equation of first order but not of firstdegree.
4. solve higher-order linear differential equations for both homogeneous and non-homogeneous,with constant coefficients.
5. understand and apply the appropriate methods for solving higher order differential equations.

with Course focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Course Content

Unit – 1

Differential equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations –Integratingfactors - Equations reducible to Exact Equations by Integrating Factors -

i) Inspection Method ii) $\frac{1}{Mx+Ny}$ iii) $\frac{1}{Mx-Ny}$

Unit – 2

Differential Equations of first order but not of first degree

Equations solvable for p, Equations solvable for y, Equations solvable for x – Clairaut's equation - Orthogonal Trajectories: Cartesian and Polar forms.

Unit – 3

Higher order linear differential equations

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

(i) $Q(x) = e^{a}_{x}$ (ii) $(x) = Sin\ ax$ (or) $Cos\ ax$

Unit – 4

Higher order linear differential equations (continued.)

Solution to a non-homogeneous linear differential equation with constant coefficients

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

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

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

Unit – 5

Higher order linear differential equations with non-constant coefficients

Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; LegendreEquation; Method of variation of parameters

Additional Module: (4 HRS)

Plotting of second order solution family of differential equation- Plotting of third order solution family of differential equation- Growth model (exponential case only)- Decay model (exponential case only).

Activities

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /ProblemSolving Sessions.

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand &Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University Press.

*****

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

Govt. College (Autonomous), Rajamahendravaram

Blue Print

II Semester end Examinations

Paper Code – 224801: Differential Equations

(For the batch admitted in 2023-24 under single major system)

TIME: $2\frac{1}{2}$ HRS. Total Marks: 50

PART – A

Answer any **Five** questions. Each question carries 3 marks. 5X3= 15M

Question	Topics	Nature	Marks
1,2	Unit – I	Theorem or problem	3,3
3,4	Unit – II	Theorem or problem	3,3
5,6	Unit – III	Theorem or problem	3,3
7	Unit – IV	Theorem or problem	3
8	Unit-V	Theorem or problem	3

PART – B

Answer All Questions. Each question carries 7 marks 5X 7 = 35 M

Question	Topic	Nature	Marks
9 or 10	Unit-I	Theorem or Problem	7
11 or 12	Unit-II	Theorem or Problem	7
13 or 14	Unit-III	Theorem or Problem	7
15 or 16	Unit-IV	Theorem or Problem	7
17 or 18	Unit-V	Theorem or Problem	7

Govt. College (Autonomous), Rajamahendravaram

Model Question Paper

Mathematics(H) & Computational Mathematics

Paper-I **Semester – II**

Paper Code – 224801 :: Differential Equations

(For the batch admitted in 2023-24 under single major system)

Time : $2\frac{1}{2}$ Hrs. **Max.Marks : 50**

PART – A

Answer any Five questions. Each question carries 3 Marks. 5 x 3M = 15 Marks

1. Solve $(e^y+1)\cos x\,dx + e^y \sin x\,dx$.

2. Solve $\frac{dx}{y} = \frac{dy}{-x} = \frac{dz}{2x-3y}$.

3. Solve $4y^2p^2 + 2xy(3x+1)p + 3x^3=0$.

4. Solve $x^2(y - px) = p^2y$.

5. Solve $(D^2 - 3D + 2)y = \cos h\, x$.

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

7. Solve $(D^2 - 4D + 4)y = x^3$.

8. Solve $[(1+x)^2D^2 + (1+x)D+1]y = 4\cos \log(1+x)$.

PART – B

Answer all questions. Each question carries 7 Marks. 5 x 7M = 35 Marks

9. Solve $x^2y\,dx - (x^3+y^3)dy=0$.

OR

10. Solve $x\frac{d^2y}{dx^2} + y = y^2 \log x$

11. Find the orthogonal trajectories of the family of curves

$x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ where 'a' is the parameter.

OR

12. Solve $y = 2xp + x^2p^4$.

13. Solve$(D^3 + D^2 - D - 1)y = \cos 2x$

OR

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

15. Solve $(D^2 -2D +4)y = 8(x^2 + e^{2x} + \sin 2x)$.

OR

16. Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = xe^x sinx$.

17. Solve $(D^2+a^2)y = \tan x$ by the method of variation of parameters.

OR

18. Solve $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10(x + \frac{1}{x})$.

SEMESTER-II

COURSE 4: ANALYTICAL SOLID GEOMETRY

COURSE CODE: 224802

Theory Credits: 4 5 hrs/week

Course Outcomes

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

6. understand planes and system of planes
7. know the detailed idea of lines
8. understand spheres and their properties
9. know system of spheres and coaxial system of spheres
10. understand various types of cones

Course Content

UNIT-1

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.

Unit – 2 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 - Lengthof the perpendicular from a given point to a given line.

Unit – 3 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.

Unit – 4 Spheres (continued)

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

Unit– 5 Cones

Definitions of a cone – vertex, guiding curve and generators - Equation of the cone with a given vertexand guiding curve - Equations of cones with vertex at origin are homogenous - Condition that the general equation of the second degree should represent a cone - Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle.

Activities

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and itsapplications/ Problem Solving Sessions.

Text Book

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

Reference Books

4. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
5. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
6. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

Reference Books:

[1] A Text book of B.Sc Mathematics-Volume I by V.Venkateswara rao , N.Krishna Murthy, B.V.S.S.Sharma and S.Anjaneya Sastry, published by S.Chand & company , New Delhi.

[2] Ordinary and partial Differential equations Raisinghania , Published by S.chand & company , New Delhi.

[3] A Text Book of Mathematics by Dr.A. Anjaneyulu, Deepti Publications.

Co-Curricular Activities (15 Hours): Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving.

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT AUTONOMOUS COLLEGE, RAJAMAHENDRAVARAM

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II Semester End Examinations

PAPER –II – -SOLID GEOMETRY

COURSE CODE: 224802

(For the batch admitted in 2023-24 under single major system)

Duration: 2 ½ hrs Total Marks: 50

PART – A

Answer any **Five** questions. Each question carries 3 marks. 5 X3 M = 15 M

Question	Topics	Nature	Marks
1	Unit – I	Theorem or Problem	3
2	Unit – I	Theorem or Problem	3
3	Unit – II	Theorem or Problem	3
4	Unit – II	Theorem or Problem	3
5	Unit - III	Theorem or Problem	3
6	Unit - III	Theorem or Problem	3
7	Unit -IV	Theorem or Problem	3
8	Unit - V	Theorem or Problem	3

PART – B

Answer **All** Questions. Each question carries 7 marks 5X 7 M = 35 M

Question	Topic	Nature	Marks
9 or 10	Unit-I	Theorem or Problem	7
11 or 12	Unit-II	Theorem or Problem	7
13 or 14	Unit-III	Theorem or Problem	7
15 or 16	Unit-IV	Theorem or Problem	7
17 or 18	Unit-V	Theorem or Problem	7

GOVERNMENT AUTONOMOUS COLLEGE, RAJAMAHENDRAVARAM

Model Question Paper

Mathematics(H) & Computational Mathematics for Semester – II

Paper II- - Solid Geometry

COURSE CODE: 224802

(From the batch admitted in 2023-24 under single major system)

Time: 2 $\frac{1}{2}$ Hrs. **Max. Marks: 50**

PART – A

Answer any **five** questions. Each question carries 3 Marks. 5 x 3 M = 15 M

3. Find the equation of the plane through (4,4,0) and perpendicular to the planes x+2y+2z=5, and 3x+3y+2z-8=0.

2. A variable plane is at a constant distance 3p from the origin meets the axes in A, B, C. Show that the locus of the centroid of the triangle ABC is $x^{-2}+y^{-2}+z^{-2}=p^{-2}$.

3. Find the foot of the perpendicular form (2,-2,3)to the plane 2x-y-2z-9=0.

4. Find the image of (1, 3, 4) in the plane 2x-y+z+3=0.

5. Find the equation of spheres passing through the circle $x^2+y^2=4$, z=0 and is intersected by the plane x+2y+2z=0 in a circle of radius3.

6. Find the pole of the plane x-y+5z-3=0 w .r .t the sphere $x^2+y^2+z^2=9$.

7. Find the vertex of the cone $2x^2+2y^2+7z^2-10yz-10zx+2x+2y+26z-17=0$.

8. Find the equation to the cone which passes through the three coordinate axes and the lines $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and $\frac{x}{2} = \frac{y}{1} = \frac{z}{1}$.

PART – B

Answer **all** questions. Each question carries **7** Marks. 5 x 7 M = 35 M

9. Find the equation to the plane through the intersection of the planes

x+2y+3z+4=0, 4x+3y+3z+1=0 and perpendicular to the plane x+y+z+9=0.

Or

10. Find the bisecting plane of the acute angle between the planes 3x-2y+6z+2=0, -2x+y-2z-2=0.

11. Prove that the lines x+2y+3z-4=0=2x+3y+4z-5, 2x-3y+3z-5=0=3x-2y+4z-6

are coplanar. Also find their point of intersection and the plane containing lines.

Or

12. Find the length and equations to the line of SD between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}, \frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-4}{4}$.

13. If r_1, r_2 are the radii of two orthogonal spneres, then the radius of the circle

of their intersection is $\frac{r_1 r_2}{\sqrt{r_1^2+r_2^2}}$.

OR

14. Find the radical center of the spheres $x^2 + y^2 + z^2 + 4y = 0$,

$x^2 + y^2 + z^2 + 2x + 2y + 2z + 2 = 0$, $x^2 + y^2 + z^2 + 3x - 2y + 8z + 6 = 0$,

$x^2 + y^2 + z^2 - x + 4y - 6z - 2 = 0$.

15. Find the equation to the cone with vertex is the origin and whose base

curve is $x^2+y^2+z^2+2ux+d=0$.

OR

16. Find the limiting points of the coaxial system of spheres
$x^2+y^2+z^2-8x+2y-2z+32=0$, $x^2+y^2+z^2-7x+z+23=0$.

17. Find the angle between the lines of intersection of the plane x - 3y + z=0 and

the cone $x^2-5y^2+z^2=0$.

Or

18. Find the equation of the right circular cone passing through A(1,-2,3)whose vertex is

P(-2,-3,5) axis PQ which makes equal angles with the axes and semi vertical angle is 30°

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **12473**	**TITLE OF THE COURSE** **Single Major System** **Skill Enhancement Course** **Analytical Skills**	All Ist BSc/B.A/B.COM SEMESTER-I			
Teaching	Hours Allocated: 30 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge	2	0	-	2

Course Objectives:

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

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.
CO2	Acquire competency in the use of verbal reasoning.
CO3	Apply the skills and competencies acquired in the related areas.
CO4	Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

UNIT-I - **Data analysis: (6hrs)**

The data given in a table, graph, bardiagram, piechart, venn diagram or a passage is to be analyzed and the questions pertaining to the data are to be answered.

UNIT-II - **Sequence and Series: (6hrs)**

Analogies of numbers and alphabets completion of blank spaces following the pattern in a:b::c:d relationship odd thing out; missing numbers in a sequence or a series.

UNIT-III- **Arithmetic Ability: (6hrs)**

Algebraic operations BODMAS, Fractions, Divisibility rules, LCM &GCD (HCF).Date, Time and Arrangement Problems: Calendar problems, Clock problems, Blood relationship.

UNIT-IV- **Quantitative Aptitude: (6hrs)**
Averages , Ratios and Proportion, Problems an ages, Time -distance -speed.

UNIT-V- **Businesses Computations (6hrs)**
Percentages, Profit&Loss , Partnership , Simple compound interest.

Text Book:

Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.

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.

Co-Curricular Activities (03 hrs):

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

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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COMMON FOR ALL II B.A/B.COM/B.Sc.,

Single Major System

SEMESTER: I, SKILL ENHANCEMENT COURSE

(For the Batch admitted in 2023-24)

Analytical Skills

TIME: 2Hrs | Max Marks: 50M

UNIT- I

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

UNIT- II

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

UNIT- III

Answer ALL questions (Each question cares one marks) — 10 x 1 =10M

UNIT- IV

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

UNIT- V

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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COMMON FOR ALL I B.A/B.COM/B.Sc.,

Model Question Paper

SEMESTER: I- SKILL ENHANCEMENT COURSE

(For the Batch admitted in 2023-24)

Analytical Skills

TIME:2 Hrs Max Marks:50M

UNIT- I Answer ALL questions. 10 x 1 =10M

I .A) Study the following table carefully answer the questions.

Subject/ student	History Out of 50	Geography Out of 50	Math Out of 150	Science Out of 100	English Out of 75	Hindi Out of 75
Amit	76	85	69	73	64	88
Bharath	84	80	85	78	73	72
Umesh	82	67	92	87	69	76
Mikhil	73	72	78	69	58	83
Pratiksha	68	79	64	91	66	65
Ritesh	79	87	88	93	82	72

i)What is the approximately the integral percentage of marks obtained by Umesh is all the subjects?

a) 80% b) 84% c) 86.% d) 78.%

ii)What is the average percentage of marks obtained by all students in Hindi?

a) 77.45% b) 79.33% c) 75.52% d) 73.52%

iii) What is the average marks of all the students in Mathematics?

a) 128 b) 119 c) 112 d) 138

iv) What is the average marks obtained by all the students in geography?

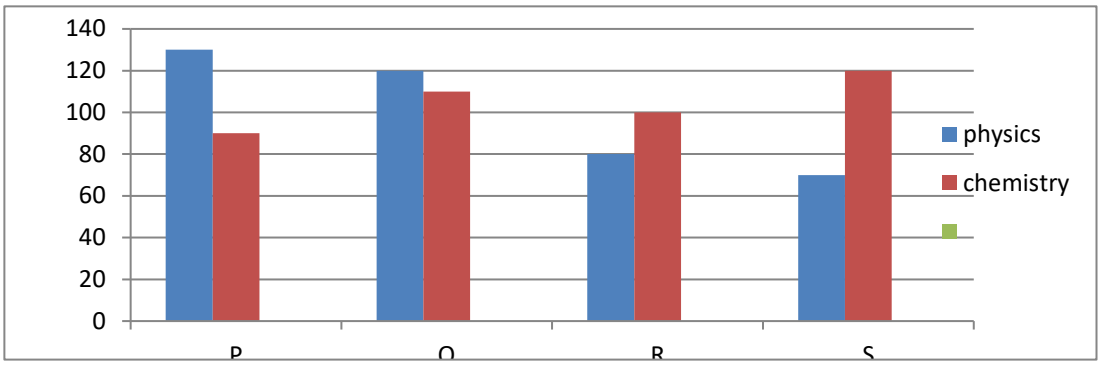
a) 38.26 b) 37.26 c) 39.16 d) 37.96

v) What are the total marks obtained by Rithish in the entire subject taken together?

a) 401.75 b) 410.75 c) 402.75 d) 420.75

.

B)



1) Makes obtained by S in chemistry is what percentage of the total marks obtained by all the students in Chemistry?

a) 25 b) 28.5 c) 35 d) 31.5

2) If the marks obtained by T in physics were increased by 14% of the original makes .what would be his new approximate percentage in physics if the maximum marks in physics were 140?

a) 57 b) 32 c) 38 d) 41

3) Fill in the blank space in order to the make the sentence correct as per the given information. Total marks obtained by T in both the subjects together is more than the marks obtained by

a) Q in chemistry b) R in physics c) S in chemistry d) P in physics

4) What is the respective ratio between the total marks obtained by P in physics and chemistry together to the total marks obtained by T in physics and chemistry together?

a) 3:2 b) 4:3 c) 5:3 d) 2:1

5) What is the respective ratio between the total marks obtained by Q and S together in chemistry to the total marks obtained by P and R together in physics?

a) 23:25 b) 23:21 c) 17:19 d) 17:23

UNIT- II Answer ALL questions **10 x 1 =10M**

1) 1, 3, 5, 7, 9,--- . Find the missing term?

a) 10 b) 11 c) 12 d) 13

2)1, 2, 10, 37,101,442?based on addition / subtraction of cubes?

a) 402 b) 206 c) 226 d) 320

3) Find the missing number in the series. 4, 18 ,…,100,180,294.

a) 32 b) 36 c) 48 d) 40

4) Find the wrong number in the given series 1, 8, 27, 64,125,215.

a) 27 b) 64 c) 125 d) 215

5)0,3,8,15,24, ? 48

a) 41 b) 29 c) 37 d) 35

6) CXDW, EVFU, GTMS, IRJQ . . . . . .

a) KPLO b) KPMO c) KPNO d) KPOL

7) C,F,I, L O find the next term.

a) R b) S c) T d) U

8) AZY, EXW, IVU?

a) MTS b) MQS c) NRQ d) LST

9) AC, FH, K--,PR, UW

a) L b) J c) M d) N

10) 2, 6,18,54,--?

a) 108 b) 140 c) 150 d) 162

UNIT - III Answer ALL questions **10 x 1 =10M**

1) The value of$25 - 5\ [\ 2 + 3\{2 - 2(5 - 3) + 5\} - 10] \div 4\ is$;

a) 5 b) 23.5 c) 23.75 d) 25

2) If a, b, c are integers; $a^2 + b^2 = 45$ and $b^2 + c^2 = 40$, then the values of a, b and c respectively are:

a) 2,6,3 b) 3,2,6 c) 5,4,3 d) none of this

3) 4003 × 77 -- 21015 = ?× 116

a) 2477 b) 2478 c) 2467 d) 2476

4) Solving 1111.1 +111.11 + 11. 111 =?

a) 1111.1 b) 1232.231 c) 1323.132 d) 1233.321

5) $68 \times \sqrt{?} - 3421 = 591$

a) 3249 b) 3481 c) 3364 d) 3136

6) Find the value of $\left(\frac{343 \times 343 \times 343 - 113 \times 113 \times 113}{343 \times 343 + 343 \times 113 + 113 \times 113}\right)$ =

a) 231 b) 230 c) 233 d) 232

7) $\{(45)^3 + (65)^2\} \div ? = 1907$

a) 80 b) 70 c) 60 d) 50

8) Find the value of $\sqrt{3}$ up to three decimal places.

a) 1.736 b) 1.732 c) 1.785 d) 1.745

9) By how much is 3/4th of 968 less than 7/8th of 1008?

a) 154 b) 146 c) 165 d) 156

10) Find the value of $\sqrt{53824} = ?$

a) 202 b) 232 c) 242 d) 332

UNIT-IVAnswer ALL questions. **10 x 1 =10M**

1) The average of 1,3,5,7,9,11,13,15,17 ---------- ?

a) 10 b) 9 c) 8 d) 12

2) The mean properties of 4 and 9 is

a) 6 b) 4 c) 9 d) 36

3.) If the sides of two cubes are in the ratio 3 : 5 then the ratio of their volume are …

a) 27:125 b) 125:27 c) 9:25 d) none

4) The ratio of $4^{3.5}$: $2^5$is same as -----

a) 2 :1 b) 4:1 c) 7:5 d) 7:10

5) 20 men can do a piece of work in 20days working 8 hrs/ day. In how many days can 25 men can do the same work if they work 16 hrs/ day .

a) 10 b) 09 c) 08 d) 07

6. If $\frac{A}{3} = \frac{B}{4} = \frac{C}{5}$ then A: B: C is

a) 3:4: 5 b) 4:3: 5 c) 5: 3: 4 d) 5: 4: 3

7. I f $x : y = 2: 3\ then\ \frac{2x+3y}{2x-3y}$ is

a) $\frac{-13}{5}$ b) $\frac{13}{5}$c)$\frac{-5}{13}$ d) $\frac{5}{13}$

8. If 4 man can do a piece of work in 10 days in how many days can 8 men do it?

a) $4days$ b) $3days$c)5 days d) none of these

9. A: B =1: 2; B: C = 3.4 then A: B: C is

a) 6:8:3 b) 3:6:8 c) 3:8:6 d) 8:6:3

10. Convert 30 m/sec speed to km/hr

a) 84km/hr b) 96km/hr c) 108km/hr d) 120km/hr

UNIT- V Answer ALL questions **10 x 1 =10M**

1. One –fifth of a human a number is 81% what will be 68% of that number?

a) 195.2 b) 275.4 c) 225.6 d) 165.8

2. Suresh purchased a car for 25000 Rs and sold it for 34800 Rs. What is the percentage profit the made on the car?

a) 50% b) 39.2% c) 38.4% d) 38%

3. What is 170% of 1140

a) 1938 b) 1824 c) 1995 d) 1881

4. ----- % of 130 = 10.4

a) 34.6 b) 33 c) 32 d) none

5. A sum of Rs 5000 amount to Rs 6050 in2years. What is the rate of interact.

a) 15% b) 13% c) 11% d) 10.5%

6. Sum of three consecutive numbers is 2262. What is 41% of the highest number?

a) 301.51 b) 309.55 c) 309.14 d) none

7. What is 25% of 75 % of $3/5^{th}$ of 4240 is …

a) 595 b) 424 c) 348 d) 477

8. What percentage of 60 is15?

a) 25 % b) 30 % c) 35% d) none

9. What is the simple interest on 200 Rs for 4yers at 6% per annum?

a) 40Rs b) 46Rs c) 48Rs d) 45Rs

10. 25% of 25% is equal to……

a) 0.0625 b) 0.625 c) 0.00625 d) none

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM
(*Accredited by NAAC "A" Grade)*
DEPARTMENT OF MATHEMATICS

ALLOCATION OF CREDITS FOR THE ACADEMIC YEAR 2023-24 IN ACCORDANCE WITH APSCHE GUIDELINES

Programme: B.Sc Honours Mathematics (Major)

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	5	4
		2	Advances in Mathematical, Physical and Chemical Sciences	5	4
	II	3	Differential Equations & Problem Solving Sessions	5	4
		4	Analytical Solid Geometry & Problem Solving Sessions	5	4
II	III	5	Group Theory &Problem Solving Sessions	5	4
		6	Numerical Methods &Problem Solving Sessions	5	4
		7	Laplace Transforms & Problem Solving Sessions	5	4
		8	Special Functions of & Problem Solving Sessions	5	4
	IV	9	Ring Theory & Problem Solving Sessions	5	4
		10	Introduction to Real Analysis & Problem Solving Sessions	5	4
		11	Integral Transforms & Problem Solving Sessions	5	4

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
III	V	12	Linear Algebra &Problem Solving Sessions	5	4
		13	Vector Calculus & Problem Solving Sessions	5	4
		14	Functions of a complex variable & Problem Solving Sessions (OR)Advanced Numerical Methods &Problem Solving Sessions	5	4
		15	Number Theory &Problem Solving Sessions (OR) Mathematical Statistics &Problem Solving Sessions	5	4
	VI	Semester Internship/Apprenticeship with 12 Credits			
IV	VII	16	Algebra (OR) Classical Mechanics	5	4
		17	Real Analysis (OR) Discrete Mathematics	5	4
		18	Basic Topology (OR) Cryptography	5	4
		SEC			
		19	Lattice Theory & Boolean Algebra (OR) Finite Element Analysis	5	4
		20	Graph Theory (OR) Mathematical Finance	5	4
	VIII	21	Advanced Algebra (OR) Elements Of Elasticity & Fluid Dynamics	5	4
	Semester	**Course**	**Title of the Course**	No. of Hrs /Week	No. of Credits
			Course		
		22	**Advanced Analysis (OR) Advanced Linear Algebra**	5	4
		23	**Advanced Topology (OR) Differential Geometry**	5	4
		SEC			
		24	Ordinary Differential Equations (OR) Applications of Algebra	5	4
		25	Operation Research (OR) Mathematical Modelling	5	4

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM
(*Accredited by NAAC "A" Grade)*
DEPARTMENT OF MATHEMATICS

ALLOCATION OF CREDITS FOR THE ACADEMIC YEAR 2023-24

Programme: B.Sc Computational Mathematics (Degree)

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	5	4
		2	Advances in Mathematical, Physical and Chemical Sciences	5	4
	II	3	Differential Equations & Problem Solving Sessions	5	4
		4	Analytical Solid Geometry & Problem Solving Sessions	5	4
II	III	5	Group Theory &Problem Solving Sessions	5	4
		6	Numerical Methods &Problem Solving Sessions	3	3
			Numerical Methods &Problem Solving Sessions Practical Course (Lab in Matlab/Scilab)	2	1
		7	Discrete Mathematics & Problem Solving Sessions	5	4
		8	Probability and Statistics &Problem Solving Sessions.	3	3
			Probability and Statistics &Problem-Solving Sessions Practical Course (Lab in R)	2	1
	IV	9	Ring Theory & Problem Solving Sessions	5	4
		10	Introduction to Real Analysis & Problem Solving Sessions	5	4
		11	Number Theory and cryptography & Problem Solving Sessions	5	4

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
III	V	12	Linear Algebra & Problem Solving Sessions	5	4
		13	Vector Calculus & Problem solving Sessions	5	4
		14	Scientific Computing using Matlab/Scilab & Problem Solving Sessions (OR)Advanced Numerical Methods &Problem Solving Sessions	3	3
			Scientific Computing using Matlab/Scilab & Problem solving Sessions (OR) Advanced Numerical Methods &Problem Solving Sessions	2	1
		15	Theory of Computation &Problem Solving Sessions (OR) Machine Learning using Phython & Problem Solving Sessions	3	3
			Theory of computation lab course using JFLAP Software &Problem Solving Sessions (OR) Machine Learning using Phython & Problem Solving Sessions PracticalCourse	2	1
	VI	Semester Internship/Apprenticeship with 12 Credits			

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-128**	**TITLE OF THE COURSE** **Discrete Mathematics**	I B.Sc. IT Honours (II Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on sets	5	1	-	5

Course Objectives:

Students will learn about topics such as logic and proofs, sets and functions, probability, recursion, graph theory, matrices, Boolean algebra and other important discrete mathematics concepts.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Write an argument using logical notation and determine if the argument is or is not valid.
CO2	Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
CO3	Understand the basic principles of sets and operations in sets.
CO4	Prove basic set equalities.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit-l (12 hrs)

Sets, relations, partially ordered sets, Hasse diagrams, lattices, properties of lattices.

Unit-II (12 hrs)

Modular Lattices and properties, Characterization theorems.

Unit-III (12 hrs)

Distributive Lattices and properties, Characterization theorems.

Unit-IV (12 hrs)

Boolean Algebras, DeMorgan laws.

Unit-V (12 hrs)

Boolean homomorphism, Boolean rings, Boolean Polynomials.

Additional Module

Minimal form of Boolean Polynomials.

Reference Books:

1) Discrete Mathematical structures by kolman and Bus by and share poss, Prentice Hall of India.

2) Applied abstract Algebra of Rudolf Lidl& Gunter Pilz published by Springer Verlag.

Co-Curricular Activities (15 Hours):

Seminar/ Quiz/ Assignments/Discrete Mathematics and its applications/ Problem Solving.

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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IInd Semester end examinations

PAPER – MAT 128 - DISCRETE MATHEMATICS (ONLY FOR IT HONOURS)

(For the batches admitted in 2022-23 only)

Duration: $2\frac{1}{2}$ Hrs. Total Marks: 50

SECTION – A

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or problem	7
3 or 4	Unit – II	Theorem or problem	7
5 or 6	Unit – III	Theorem or problem	7
7 or 8	Unit – IV	Theorem or problem	7
9 or 10	Unit – V	Theorem or Problem	7

SECTION – B

Answer any Five questions. Each question carries 3 marks 5X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-II	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-III	Theorem or Problem	3
17	Unit-IV	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A+" Grade with 3.38 CGPA)

MODEL QUESTION PAPER

II[nd] Semester end examinations

PAPER - MAT 128 –DISCRETE MATHEMATICS

(For the batches admitted in 2022-23 only)

Duration: 2 $\frac{1}{2}$ Hrs. **SECTION – A** Total Marks : 50

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

1. Let (L,≤) be a lattice ordered set .We define xUy=Sup{x,y},x∩y=Inf {x,y}. Then prove that (L,U,∩) is a lattice.

OR

2. Let (L,U,∩) be a lattice and x,y,z∈L.Then prove thatxU(y∩z)≤ (xUy)∩(xUz)

and x∩(yUz)≥(x∩y)U(x∩z).

3. A lattice (L,U,∩) is a modular for all x,y,z∈ L .

Prove that xU{y∩(xUz)}=(xUy)∩(xUz).

OR

4. Let (G,.)be a group and L be the set of all Normal Subgroups of G.

Define v, ∧ on L as follows: For N1,N2∈ L , Define N1vN2= N1 N2 &

N1∧N2= N1vN2. Then prove that (L,v,∧) is a modular lattice.

5. Prove that a lattice (L,v,∧) is distributive iff for all x,y,z∈ L

(x∧y)v(y∧z)v(z∧x)=(xvy)∧(yvz)∧(zvx).

OR

6. Prove that cancellation law holds in distributive lattice.

7. State and prove Demorgan's laws.

OR

8. Let B_1, B_2 be two Boolean algebras and $f: B_1 \rightarrow B_2$ be a Boolean homomorphism.

Then prove that 1)f(0)=0,f(1)=12)For all $a,b \in B_1$, $a \leq b \Rightarrow f(a) \leq f(b)$.

9. State and prove Representation theorem for finite Boolean algebras.

OR

10. Explain the Kruskal algorithm and Prisms algorithm.

SECTION-B

Answer any five of the following. Each question carries 3 marks. 5 x 3= 15 M

11. Define poset and give an example.

12. Let $(L,v,\wedge)$ be a lattice. If $x,y \in L \& x \leq y$ for all $z \in L$, prove that $xvz \leq yvz \& x \wedge z \leq y \wedge z$.

13. Define Modular lattice and give an example.

14. Prove that every distributive lattice is modular.

15. Prove that every chain is distributive.

16. Let$(B,v,\wedge)$ be a Boolean Algebra and $x,y \in B$ then prove that $x \leq y$ iff $y' \leq x'$.

17. Prove that every Boolean ring is of characteristic 2.

18. If $(L,v,\wedge)$ is a distributive lattice with 0,1.Then each element x in L has atleast one complement.

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM
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DEPARTMENT OF MATHEMATICS

ALLOCATION OF CREDITS FOR THE ACADEMIC YEAR 2023-24 FOR IIIrd, IVth,Vth SEMESTERS FOR THE CBCS SYLLABUS 2020-21 GIVEN BY APSCHE

S. No	Course Code	Semester	Title of the Course	Hrs/ Week	Max. Marks (SEE)	Marks in CIA	Credits
1.	MAT 127	III	Abstract Algebra	5+1	50	50	5
	LSC-AS		Analytical Skills	2	50	-	2
2.	MAT 115	IV	Real Analysis	5+1	50	50	5
	MAT 118		Linear Algebra	5+1	50	50	5
3.	MAT 129	V **(To choose One pair from the Three alternate pairs of SECs)**	6A: Numerical Methods	5+1	50	50	5
	MAT 130		7A: Mathematical Special Functions	5+1	50	50	5
			Or				
	MAT 131		6B: Multiple integrals and Applications of Vector Calculus	5+1	50	50	5
	MAT 132		7B: Integral transforms with Applications	5+1	50	50	5
			Or				
	MATP133		6C: Partial Differential Equations and Fourier Series	5+1	50	50	5
	MAT 134		7C: Number theory	5+1	50	50	5
4.	MATC 1	II	Basic Mathematics (For Non-Maths)	4	50	50	4
	MATC 2		Competitive Mathematics (For Mathematics)	4	50	50	4

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-126**	**TITLE OF THE COURSE** **Abstract Algebra**	II B.Sc. (III Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on sets and number system.	5	1	-	5

Course Objectives:

To provide the learner with the skills, knowledge and competencies to carry out their duties and responsibilities in Pure Mathematics environment.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Acquire the basic knowledge and structure of groups, subgroups and cyclic groups.
CO2	Get the significance of the notation of a normal subgroups.
CO3	Understand the ring theory concepts with the help of knowledge in group theory and to prove the theorems.
CO4	Study the homomorphisms and isomorphisms with applications.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

UNIT - I (12 Hrs) Binary Operation & 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. Order of an element of a group .

[1] Chapter 1 (Section 1.10), Chapter 2 (Sections 2.1 to 2.17)

Problem Solving Sessions: Including all Exercise Problems

UNIT- II (12 Hrs) SUBGROUPS, COSETS :-

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-Cosets definition –properties of coset –index of a subgroup of a finite group-Lagrange's Theorem- Appilications.

[1] Chapter 3 (Sections 3.1 to 3.6) & Chapter 4 (Sections 4.1 to 4.6)

Problem Solving Sessions: Including all Exercise Problems

UNIT –III: (12 Hrs) NORMAL SUBGROUPS, HOMOMORPHISM:-

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 – simple group – quotient group – criteria for the existence of a quotient group.

Definition of homomorphism- Image of homomorphism- Elementary Properties of homomorphism-Isomorphism- Automorphism definitions and elementary properties- Kernel of a homomorphism-Fundamental theorem on homomorphism of groups and applications.

[1] Chapter 5 **(**Sections 5.2 to 5.4) & Chapter 6 (Sections 6.1 to 6.5)

Problem Solving Sessions: Including all Exercise Problems

UNIT-IV (12 Hrs) PERMUTATIONS AND CYCLIC GROUPS -

Definition of Permutation - Permutation multiplication- Inverse of a Permutation- Cyclic permutations-Transpositions - Even and Odd Permutations - Alternating Groups - Cayley's Theorem- Applications-Definition of Cyclic Group - Elementary Properties -The classification of Cyclic group- Sub groups of finite cyclic group and applications.

[1] Chapter 7 (Sections 7.1 to 7.6) & Chapter 8 (Sections 8.1 to 8.5)

Problem Solving Sessions: Including all Exercise Problems

UNIT-V (12 Hrs) RINGS:-

Definition of Ring and it's basic properties, Boolean ring, Zero divisors of ring, Cancellation laws in a ring, Some special types of rings, Characteristic of ring, Subrings, Ideals.

[1] Chapter 9 (Sections 9.1 to 9.12) & Chapter 10 (Sections 10.1 & 10.2)

Problem Solving Sessions: Including all Exercise Problems

Additional Module: (5 HRS)

Symmetry of Atomic Orbitals in Chemistry- Group Theory and its Applications in Robotics- Computer Vision & Computer Graphics - Medical Image Analysis-Rubik's Cube

Reference Books :

[1] A Text book of B.Sc Mathematics-Volume II by V.Venkateswara rao , N.Krishna Murthy, B.V.S.S.Sharma and S.Anjaneya Sastry, published by S.Chand & company , New Delhi.

[2] A Text Book of Mathematics by Dr.A. Anjaneyulu, Deepti Publications

[3] "Topics in Algebra " by I N Herstein.

[4] "Modern Algebra" by M.L Khanna .

Co-Curricular Activities (15 Hours):

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

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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II BSc Mathematics

III Semester end Examinations

Paper Code—MAT126**:: ABSTRACT ALGEBRA**

(For the batch admitted in 2022-23)

DURATION: 2 ½ HRS. Total Marks : 50

PART- A

Answer any Five questions. Each question carries 3 marks. **5 X 3 = 15 M**

Question	Topics	Nature	Marks
1	Unit – I	Theorem or problem	3
2	Unit – I	Theorem or problem	3
3	Unit – II	Theorem or problem	3
4	Unit – II	Theorem or problem	3
5	Unit - III	Theorem or problem	3
6	Unit - III	Theorem or problem	3
7	Unit - IV	Theorem or problem	3
8	Unit - V	Theorem or problem	3

PART – B

Answer All Questions. Each question carries 7 marks **5X 7 = 35 M**

Question	Topic	Nature	Marks
9 or 10	Unit-I	Theorem or Problem	7
11 or 12	Unit-II	Theorem or Problem	7
13 or 14	Unit-III	Theorem or Problem	7
15 or 16	Unit-IV	Theorem or Problem	7
17 or 18	Unit-V	Theorem or Problem	7

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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II B.Sc., Mathematics Paper –III Semester – III

Paper Code- MAT 126 **:: ABSTRACT ALGEBRA**

(For the batch admitted in 2022-23)

Model Question Paper

Time: 2 ½ HRS. Max. Marks: 50

SECTION-A

Answer any FIVE questions. Each question carries 3 marks: **5 x 3 = 15 M**

1. Prove that the set G = $\{1,2,3,4,5,6\}$ is a finite abelian group of order 6 w.r.t x_7.

2. In a group G for every a$\in G$, $a^2 = e$. Prove that G is an abelian group

3. If H_1 and H_2 are two sub groups of a group G, then prove that $H_1 \cap H_2$ is also a sub group of G

4. If H is any subgroup of a group G, then show that $H^{-1} = H$.

5. If M, N are two normal subgroups of G such that M$\cap N = \{e\}$, then prove that every element of M commutes with every element of N.

6. The necessary and sufficient condition for a homomorphism f of a group G onto a group G^1 with kernel k to be an isomorphism of $G \text{ on to } G^1$ is that k={e}

7. Examine whether the following permutation is even or odd.

$$\begin{pmatrix} 1&2&3&4&5&6&7&8&9 \\ 6&1&4&3&2&5&7&8&9 \end{pmatrix}$$

8. Prove that a field has no zero divisors.

SECTION – B

Answer any **FIVE** questions . Each question carries **7** marks. **5 x 7 = 35 M**

9. In a group G ($\neq \emptyset$), for a, b, x, y $\in$ G,the equations ax = b and ya = b have

unique solutions.

OR

10. Prove that a finite semi – group (G,.) satisfying the cancellation laws is a group.
11. H is a non – empty complex of a group G. Prove that the necessary and sufficient condition for H to be a subgroup of G is a, b $\in H \Rightarrow ab^{-1} \in H$ where b^{-1} is the inverse of b in G.

OR

12. State and prove Lagrange′s theorem .
13. Prove that a sub group H of a group G is a normal sub group of G iff each left coset of H in G is a right coset of H in G.

OR

14. State and prove fundamental theorem on homomorphism of groups.
15. If f = (1 2 3 4 5 8 7 6) and g = (4 1 5 6 7 3 2 8) are cyclic permutations, then show that $(fg)^{-1} = g^{-1}f^{-1}$.

OR

16. Prove that every subgroup of cyclic group is cyclic.
17. Prove that every finite integral domain is a field.

OR

18. Prove that $Q[\sqrt{2}] = \{a + b\sqrt{2} \mid a, b \in Q\}$ is a field with respect to ordinary addition and multiplication of numbers.

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **LSC-AS**	**TITLE OF THE COURSE** **Analytical Skills**	II B.Sc/B.A/B.COM (III Sem)			
Teaching	Hours Allocated: 30 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge	2	0	-	2

Course Objectives:

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

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.
CO2	Acquire competency in the use of verbal reasoning.
CO3	Apply the skills and competencies acquired in the related areas.
CO4	Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

UNIT-I - **Data analysis: (6hrs)**

The data given in a table, graph, bardiagram, piechart, venn diagram or a passage is to be analyzed and the questions pertaining to the data are to be answered.

UNIT-II - **Sequence and Series: (6hrs)**

Analogies of numbers and alphabets completion of blank spaces following the pattern in a:b::c:d relationship odd thing out; missing numbers in a sequence or a series.

UNIT-III- **Arithmetic Ability: (6hrs)**

Algebraic operations BODMAS, Fractions, Divisibility rules, LCM &GCD (HCF).Date, Time and Arrangement Problems: Calendar problems, Clock problems, Blood relationship.

UNIT-IV- **Quantitative Aptitude: (6hrs)**

Averages , Ratios and Proportion, Problems an ages, Time -distance -speed.

UNIT-V- **Businesses Computations (6hrs)**

Percentages, Profit&Loss , Partnership , Simple compound interest.

Text Book:

Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.

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.

Co-Curricular Activities (03 hrs):

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

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

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COMMON FOR ALL II B.A/B.COM/B.Sc.,

SEMESTER: III, FOUNDATION COURSE(LSC)

(For the Batch admitted in 2022-23)

Analytical Skills

TIME: 2Hrs | Max Marks: 50M

UNIT- I

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

UNIT- II

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

UNIT- III

Answer ALL questions (Each question cares one marks) — 10 x 1 =10M

UNIT- IV

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

UNIT- V

Answer ALL questions (Each question caries one mark) — 10 x 1 =10M

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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COMMON FOR ALL II B.A/B.COM/B.Sc.,

Model Question Paper

SEMESTER: III- FOUNDATION COURSE(LSC)

(From the Batch admitted in 2022-23)

Analytical Skills

TIME:2 Hrs Max Marks:50M

UNIT- I Answer ALL questions. 10 x 1 =10M

I .A) Study the following table carefully answer the questions.

Subject/ student	History Out of 50	Geography Out of 50	Math Out of 150	Science Out of 100	English Out of 75	Hindi Out of 75
Amit	76	85	69	73	64	88
Bharath	84	80	85	78	73	72
Umesh	82	67	92	87	69	76
Mikhil	73	72	78	69	58	83
Pratiksha	68	79	64	91	66	65
Ritesh	79	87	88	93	82	72

i)What is the approximately the integral percentage of marks obtained by Umesh is all the subjects?

a) 80% b) 84% c) 86.% d) 78.%

ii)What is the average percentage of marks obtained by all students in Hindi?

a) 77.45% b) 79.33% c) 75.52% d) 73.52%

iii) What is the average marks of all the students in Mathematics?

a) 128 b) 119 c) 112 d) 138

iv) What is the average marks obtained by all the students in geography?

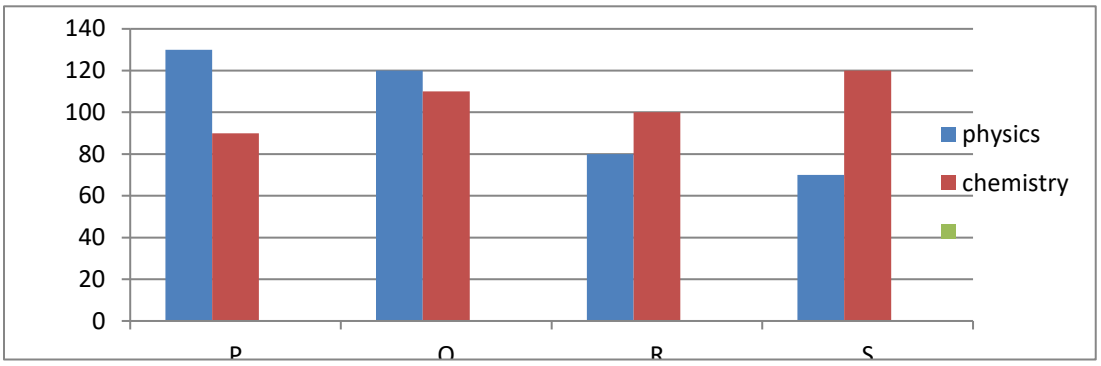
a) 38.26 b) 37.26 c) 39.16 d) 37.96

v) What are the total marks obtained by Rithish in the entire subject taken together?

a) 401.75 b) 410.75 c) 402.75 d) 420.75

.

C)



1) Makes obtained by S in chemistry is what percentage of the total marks obtained by all the students in Chemistry?

a) 25 b) 28.5 c) 35 d) 31.5

2) If the marks obtained by T in physics were increased by 14% of the original makes .what would be his new approximate percentage in physics if the maximum marks in physics were 140?

a) 57 b) 32 c) 38 d) 41

3) Fill in the blank space in order to the make the sentence correct as per the given information. Total marks obtained by T in both the subjects together is more than the marks obtained by

a) Q in chemistry b) R in physics c) S in chemistry d) P in physics

4) What is the respective ratio between the total marks obtained by P in physics and chemistry together to the total marks obtained by T in physics and chemistry together?

a) 3:2 b) 4:3 c) 5:3 d) 2:1

5) What is the respective ratio between the total marks obtained by Q and S together in chemistry to the total marks obtained by P and R together in physics?

a) 23:25 b) 23:21 c) 17:19 d) 17:23

UNIT- II Answer ALL questions **10 x 1 =10M**

1) 1, 3, 5, 7, 9,--- . Find the missing term?

a) 10 b) 11 c) 12 d) 13

2)1, 2, 10, 37,101,442?based on addition / subtraction of cubes?

a) 402 b) 206 c) 226 d) 320

3) Find the missing number in the series. 4, 18 ,…,100,180,294.

a) 32 b) 36 c) 48 d) 40

4) Find the wrong number in the given series 1, 8, 27, 64,125,215.

a) 27 b) 64 c) 125 d) 215

5)0,3,8,15,24, ? 48

a) 41 b) 29 c) 37 d) 35

6) CXDW, EVFU, GTMS, IRJQ . . . . . .

a) KPLO b) KPMO c) KPNO d) KPOL

7) C,F,I, L O find the next term.

a) R b) S c) T d) U

8) AZY, EXW, IVU?

a) MTS b) MQS c) NRQ d) LST

9) AC, FH, K--,PR, UW

a) L b) J c) M d) N

10) 2, 6,18,54,--?

a) 108 b) 140 c) 150 d) 162

UNIT - III Answer ALL questions **10 x 1 =10M**

1) The value of$25 - 5\ [\ 2 + 3\{2 - 2(5 - 3) + 5\} - 10] \div 4$ *is* ;

a) 5 b) 23.5 c) 23.75 d) 25

2) If a, b, c are integers; $a^2 + b^2 = 45$ and $b^2 + c^2 = 40$, then the values of a, b and c respectively are:

a) 2,6,3 b) 3,2,6 c) 5,4,3 d**)** none of this

3) 4003 × 77 -- 21015 = ?× 116

a) 2477 b) 2478 c) 2467 d) 2476

4) Solving 1111.1 +111.11 + 11. 111 =?

a) 1111.1 b) 1232.231 c) 1323.132 d) 1233.321

5) $68 \times \sqrt{?} - 3421 = 591$

a) 3249 b) 3481 c) 3364 d) 3136

6) Find the value of $\left(\frac{343\times343\times343-113\times113\times113}{343\times343+343\times113+113\times113}\right)$ =

a) 231 b) 230 c) 233 d) 232

7) $\{(45)^3+(65)^2\}\div ?=1907$

a) 80 b) 70 c) 60 d) 50

8) Find the value of $\sqrt{3}$ up to three decimal places.

a) 1.736 b) 1.732 c) 1.785 d) 1.745

9) By how much is 3/4th of 968 less than 7/8th of 1008?

a) 154 b) 146 c) 165 d) 156

10) Find the value of $\sqrt{53824}=$?

a) 202 b) 232 c) 242 d) 332

UNIT-IVAnswer ALL questions. **10 x 1 =10M**

1) The average of 1,3,5,7,9,11,13,15,17 ---------- ?

a) 10 b) 9 c) 8 d) 12

2) The mean properties of 4 and 9 is

a) 6 b) 4 c) 9 d) 36

3.) If the sides of two cubes are in the ratio 3 : 5 then the ratio of their volume are …

a) 27:125 b) 125:27 c) 9:25 d) none

4) The ratio of $4^{3.5}$: $2^5$is same as -----

a) 2 :1 b) 4:1 c) 7:5 d) 7:10

5) 20 men can do a piece of work in 20days working 8 hrs/ day. In how many days can 25 men can do the same work if they work 16 hrs/ day .

a) 10 b) 09 c) 08 d) 07

6. If $\frac{A}{3}=\frac{B}{4}=\frac{C}{5}$ then A: B: C is

a) 3:4: 5 b) 4:3: 5 c) 5: 3: 4 d) 5: 4: 3

7. I f $x:y=2:3\ then\ \frac{2x+3y}{2x-3y}$ is

a) $\frac{-13}{5}$ b) $\frac{13}{5}$c)$\frac{-5}{13}$ d) $\frac{5}{13}$

8. If 4 man can do a piece of work in 10 days in how many days can 8 men do it?

a) $4days$ b) $3days$c)5 days d) none of these

9. A: B =1: 2; B: C = 3.4 then A: B: C is

a) 6:8:3 b) 3:6:8 c) 3:8:6 d) 8:6:3

10. Convert 30 m/sec speed to km/hr

a) 84km/hr b) 96km/hr c) 108km/hr d) 120km/hr

UNIT- V Answer ALL questions **10 x 1 =10M**

10. One –fifth of a human a number is 81% what will be 68% of that number?

a) 195.2 b) 275.4 c) 225.6 d) 165.8

11. Suresh purchased a car for 25000 Rs and sold it for 34800 Rs. What is the percentage profit the made on the car?

b) 50% b) 39.2% c) 38.4% d) 38%

12. What is 170% of 1140

a) 1938 b) 1824 c) 1995 d) 1881

13. ----- % of 130 = 10.4

a) 34.6 b) 33 c) 32 d) none

14. A sum of Rs 5000 amount to Rs 6050 in2years. What is the rate of interact.

a) 15% b) 13% c) 11% d) 10.5%

15. Sum of three consecutive numbers is 2262. What is 41% of the highest number?

a) 301.51 b) 309.55 c) 309.14 d) none

16. What is 25% of 75 % of 3/5th of 4240 is …

a) 595 b) 424 c) 348 d) 477

17. What percentage of 60 is15?

a) 25 % b) 30 % c) 35% d) none

18. What is the simple interest on 200 Rs for 4yers at 6% per annum?

a) 40Rs b) 46Rs c) 48Rs d) 45Rs

10. 25% of 25% is equal to……

a) 0.0625 b) 0.625 c) 0.00625 d) none

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-115**	**TITLE OF THE COURSE** **Real Analysis**	II B.Sc. (IV Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on number system.	5	1	-	5

Course Objectives:

To formalise the study of numbers and functions and to investigate important concepts such as limits and continuity. These concepts underpin calculus and its applications.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Get clear idea about the real numbers and real valued functions.
CO2	Obtain the skills of analyzing the concepts and applying appropriate methods for testing convergence of a sequence/ series.
CO3	Test the continuity and differentiability and Riemann integration of a function.
CO4	Know the geometrical interpretation of mean value theorems.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

UNIT–I : REAL NUMBERS (12Hrs)

The algebraic and order properties of R, Absolute Value and Real line , Completeness property of R, Applications of supreme property, 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 Sequences, Limit point of sequence ,subsequences and the Bolzano –Weierstrass Theorem – Cauchy sequences –Cauchy ′s general principle of convergence Theorem .

UNIT-II: INFINITE SERIES (12Hrs)

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. Geometric series test
2. p–series test
3. Limit comparison test
4. Cauchy's n^{th} Root Test
5. D'Alembert's Ratio Test
6. Raabe′s Test
7. Integral Test
8. Alternating Series – Leibnitz test, Absolute convergence and Conditional convergence, Semi convergence.

UNIT-III: CONTINUITY (12Hrs)

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.

UNIT – IV: DIFFERENTIATION AND MEAN VALUE THEOREMS (12 Hrs)

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 mean value theorem, Cauchy's mean value theorem; L'Hospital's Rules,

Generalised mean value theorems: Taylor's Theorem, Maclaurin ′s theorem.

UNIT – V: RIEMANN INTEGRATION (12 Hrs)

The Riemann Integral, Riemann integral functions, DarbouxTheorem. 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.

Reference Books :

1.Real analysis by Rabert&Bartely and D. R Sherbart, Published by John wiley
2. A Text Book of B.Sc. Mathematics by B V SS 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 Raising kania Published by S chand& company Pvt. Ltd, New Delhi

Suggested Activities:

Seminar / Quiz / Assignments / Project on Real analysis and it′s applications.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

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IV Semester End Examinations

PAPER IV-MAT 115 - REAL ANALYSIS

(From the Batch admitted in 2022-23)

Duration: 2 ½ hrs. Total Marks: 50

PART- A

Answer any Five questions. Each question carries 3 marks. **5 X 3 = 15 M**

Question	Topics	Nature	Marks
1	Unit – I	Theorem or problem	3
2	Unit– I	Theorem or problem	3
3	Unit – II	Theorem or problem	3
4	Unit – III	Theorem or problem	3
5	Unit –IV	Theorem or problem	3
6	Unit – IV	Theorem or problem	3
7	Unit –V	Theorem or problem	3
8	Unit -V	Theorem or problem	3

PART – B

Answer All Questions. Each question carries 7 marks **5X 7 M = 35 M**

Question	Topic	Nature	Marks
9 or 10	Unit-I	Theorem or Problem	7
11 or 12	Unit-II	Theorem or Problem	7
13 or 14	Unit-III	Theorem or Problem	7
15 or 16	Unit-IV	Theorem or Problem	7
17 or 18	Unit-V	Theorem or Problem	7

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MODEL QUESTION PAPER

II B.Sc., Mathematics Semester – IV

Paper IV - MAT 115 - REAL ANALYSIS

(From the Batch admitted in 2022-23)

Time: 3Hrs Max .Marks : **50**

SECTION-A

I. Answer any FIVE of the following. 5 x 3 = 15 M

1. Prove that every convergent sequence is bounded.
2. Prove that the sequence $\{s_n\}$where s_n=$\frac{1}{n+1}+\frac{1}{n+2}+\cdots+\frac{1}{n+n}$ is convergent.
3. Test for convergence$\sum_{n=1}^{\infty}(\sqrt[3]{n^3+1}-n)$.
4. If f: S→R is uniformly continuous, then show that f is continuous in S.
5. Discuss the applicability of Lagrange s mean – value theorem for f(x) = x (x-1)(x-2) on [0, ½].
6. Find **C** of Cauchy's mean – value theorem for f(x) = $\sqrt{x}$ and g(x)= $\frac{1}{\sqrt{x}}$ in [a , b] where $0 < a < b$.
7. If f: [a , b] → R is continuous on [a , b], then prove that f is integrable on [a , b] .
8. Evaluate$\int_0^{\pi/4}(sec^4 x - tan^4 x)$dx.

SECTION-B

II Answer all the FIVE questions. 5 x 7 = 35 M

9. State and prove Sandwich theorem or squeeze theorem.

OR

10. State and prove Cauchy's first theorem on limits.

11. Test for convergence: i) $\sum_{n=1}^{\infty}(\sqrt{n^3+1}-\sqrt{n^3})$

ii) $\sum_{n=1}^{\infty}(\sqrt{n^4+1}-\sqrt{n^4-1})$.

OR

12. State and prove Limit comparison test .
13. Examine for continuity the function f defined by f(x) = |x| + | x – 1| at x= 0,1.

OR

14. If f: [a , b] → R is continuous on [a , b] then show that f is bounded on [a , b] .

15. State and prove Rolle′s theorem.

OR

16. State and prove Lagrange′s mean value theorem.

17. Prove that f(x) = x^2 is integrable on [0,a] and $\int_0^a x^2\,dx = \frac{a^3}{3}$.

OR

18. State and prove Fundamental theorem of integral calculus.

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-118**	**TITLE OF THE COURSE** **Linear Algebra**	II B.Sc. (IV Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Abstract Algebra.	5	1	-	5

Course Objectives:

This course will cover the analysis and implementation of algorithms used to solve linear algebra problems in practice. This course will enable students to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subject.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand the concepts of vector spaces, subspaces, basises, dimension and their properties.
CO2	Understand the concepts of linear transformations and their properties.
CO3	Apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods.
CO4	Learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit – I – Vector Spaces - I (12 hrs)

Vector spaces, General properties of vector spaces, Vector subspaces, Algebra of subspaces, linear combination of vectors, Linear span, linear sum of two subspaces, Linear independence and dependence of vectors.

[1] Chapter 1 (Sections 1.9 to 1.35)

Problem Solving Sessions Including all Exercise Problems

Unit – II – Vector Spaces - II (12 hrs)

Basis of vector space, Finite dimensional vector spaces, Dimension of a vector space, Dimension of a subspace.

[1] Chapter 2 (Sections 2.1 to 2.18)

Problem Solving Sessions: Including all Exercise Problems

Unit – III – Linear Transformations (12 hrs)

Linear Transformations, Linear operators, Range and null space of linear transformation, Rank and nullity of linear transformations, Linear transformations as vectors, Product of linear transformations, Invertible linear transformation.

[1] Chapter 3 (Sections 3.1 to 3.23) & Chapter 4 (Sections 4.7 to 4.14)

Problem Solving Sessions: Including all Exercise Problems

Unit-IV – Matrices (12 hrs)

Characteristic vectors and Characteristic values, Cayley – Hamilton theorem and its applications.

[1] Chapter 7 (Sections 7.2 to 7.9)

Problem Solving Sessions: Including all Exercise Problems

Unit-V – Inner Product Space (12 hrs)

Inner product spaces, Euclidean and Unitary spaces, Norm or length of a vector, Schwartz inequality, Orthogonality, Orthonormal set, complete orthonormal set, Gram-Schmidt Orthogonalisation process.

[1] Chapter 8 (Sections 8.3 to 8.5) & Chapter 9 (Sections 9.2 to 9.5)

Problem Solving Sessions: Including all Exercise Problems

Additional Module: (5 HRS)

Use the Wronskian to test a set of solutions of a linear homogeneous Differential equation for linear Independence.- Identify and sketch the Graph of a conic section and Perform a rotation of axis.- Electrical Circuit Problems.

Reference Books :

[1] A Text book of B.Sc Mathematics-Volume III by V.Venkateswara rao , N.Krishna Murthy, B.V.S.S.Sharma and S.Anjaneya Sastry, published by S.Chand & company , New Delhi.

[2] A Text Book of Mathematics by Dr.A. Anjaneyulu, Deepti Publications

[3] Linear algebra by J.N.Sharma and A.R.Vasista, Krishna Prakasham Mandir,Meerut.

[4] Linear Algebra by Kenneth Hoffman and Ray Kunze, Pearson Education,New Delhi.

[5] Linear Algebra by Stephen H. Friedberg et al Prentice Hall of India Pvt.Ltd. 4th edt. 2007.

Co-Curricular Activities (15 Hours):

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

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

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II nd B.Sc., MATHEMATICS PAPER- V IVth SEMESTER

Paper Code—MAT 118 **:: LINEAR ALGEBRA**

(For the batch admitted in 2022-23)

Duration: 2 ½ HRS. **SECTION – A** Total Marks: 50

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or problem	7
3 or 4	Unit – II	Theorem or problem	7
5 or 6	Unit – III	Theorem or problem	7
7 or 8	Unit – IV	Theorem or problem	7
9 or 10	Unit – V	Theorem or problem	7

SECTION – B

Answer any **Five** questions. Each question carries 3 marks 5X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-II	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-III	Theorem or Problem	3
17	Unit-IV	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

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IInd B.Sc., Mathematics – IVth Semester

Model Paper

Paper Code—MAT 118 :: Linear Algebra

(For the batch admitted in 2022-23)

Time : 2 ½ HRS. **Max Marks : 50**

Section – A

Answer **all** questions. Each question carries **7** marks. 5 X 7 = 35 M.

1. If S, T are the subspaces of a vector space V(F).Then show that

(i) S $\subseteq$ T $\Rightarrow L(S) \subseteq L(T)$. (ii)L(S U T) = L(S) + L(T).

(OR)

2. Let V(F) be a vector space and S=$\{\alpha_1, \alpha_2, \ldots, \alpha_n\}$ is a finite subset of non zero vectors of V(F) then show that S is linearly dependent iff some vector $\alpha_k \in S$, $2 \leq k \leq n$, can be expressed as a linear combination of its preceding vectors.

3. If W is a subspace of a finite dimensional vector space V(F) then show that

dim (V/W) = dim V – dim W.

(OR)

4. Let W_1 and W_2 be two subspaces of a finite dimensional vector space V(F) then show that dim($W_1 + W_2$) = dimW_1 + dimW_2 – dim ($W_1 \cap W_2$).

5. If U(F) and V(F) are two vector spaces, T:U $\rightarrow$V is a linear transformation

and U finite dimensional vector space then show that $\rho(T)+\upsilon(T)$ =dim U.

(OR)

6. The set $\{e_1, e_2, e_3\}$ is the standard basis of V_3(R). T: V_3(R)$\rightarrow$$V_3$(R) is a linear

operator defined by T(e_1)= e_1+e_2,T(e_2)= e_2+e_3,T(e_3)= $e_1+e_2+e_3$. Show that T is

non-singular and find its inverse.

7. Find the characteristic roots and corresponding characteristic vectors of the matrix

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

(OR)

8. State and prove Cayley-Hamilton theorem.

9. State and Prove Cauchy-Schwarz's inequality.

(OR)

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

SECTION – B

Answer any **five** questions. Each question caries 3 marks. 5 x 3 =15 M

11. Show that the intersection of any family of subspaces of a vector space is a subspace.
12. Verify the vectors {(1,-2,1),(2,1,-1),(7,-4,1)} are L.D or L.I.
13. If W is the subspace of $V_4(R)$ generated by the vectors {(1,-2,5,-3), (2,3,1,-4), (3,8,-3,-5)}.Find a basis of W and its dimension.
14. Let U(F) and V(F) be two vector spaces and T:U$\rightarrow$V is a linear transformation. Then show that null space N(T) is a subspace of U(F).
15. A linear transformation T on a finite dimensional vector space is invertible iff T is non-singular.
16. Show that the characteristic vectors corresponding to distinct characteristic roots of a matrix are linearly independent.
17. In an inner product space V(F), show that $\|\alpha+\beta\| \le \|\alpha\| + \|\beta\|, \ \forall\ \alpha, \beta \in V$.
18. State and prove Triangle inequality.

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CBCS: MATHEMATICS

III B.Sc (For the batches admitted in 2021-22)

(Skill Enhancement Courses (SECs) for Semester V)

PAPER	SUBJECT	Hours/Week	Credits	Marks	
				CIA	SEE
6 &7 **(To choose One pair from the Three alternate pairs of SECs)**	6A - Numerical Methods	6	5	50	50
	7A - Mathematical Special Functions	6	5	50	50
	Or				
	6B - Multiple integrals and Applications of Vector Calculus	6	5	50	50
	7B - Integral transforms with Applications	6	5	50	50
	Or				
	6C - Partial Differential Equations and Fourier Series	6	5	50	50
	7C - Number Theory	6	5	50	50

Note-1: For Semester–V, for the domain subject Mathematics, any one of the three pairs of SEC'S shall be chosen as courses 6 and 7, i.e., (6A & 7A) or (6B & 7B) or (6C & 7C), the pair shall not be broken. A, B, C allotment is random, not on any priority basis.

Note-2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in the syllabus citing related real field situations.

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-129**	**TITLE OF THE COURSE** **6A- Numerical Methods**	III B.Sc. (V Sem) (Common for MSCs; MPCs; MGCs; MEIoT)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on theory of equations	5	1	-	5

Course Objectives:

This course will cover the classical fundamental topics in numerical methods such as, approximation, numerical integration, numerical linear algebra, solution of nonlinear algebraic systems and solution of ordinary differential equations.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand various finite difference concepts and interpolation methods.
CO2	Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
CO3	Find numerical solutions of ordinary differential equations by using various numerical methods.
CO4	Analyze and evaluate the accuracy of numerical methods.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit – 1: Finite Differences and Interpolation with Equal intervals (12h)

1. Introduction, Forward differences, Backward differences, Central Differences, Symbolic relations, nth Differences of Some functions,

2. Advancing Difference formula, Differences of Factorial Polynomial, Summation of Series.

3. Newton's formulae for interpolation. Central Difference Interpolation Formulae.

Unit – 2: Interpolation with Equal and Unequal intervals (12h)

1. Gauss's Forward interpolation formulae, Gauss's backward interpolation formulae, Stirling's formula, Bessel's formula.

2. Interpolation with unevenly spaced points, divided differences and properties, Newton's divided differences formula.

3. Lagrange's interpolation formula, Lagrange's Inverse interpolation formula.

Unit – 3: Numerical Differentiation (12h)

1. Derivatives using Newton's forward difference formula, Newton's back ward difference formula,

2. Derivatives using central difference formula, Stirling's interpolation formula,

3. Newton's divided difference formula, Maximum and minimum values of a tabulated function.

Unit – 4: Numerical Integration (12h)

1. General quadrature formula one errors, Trapezoidal rule,

2. Simpson's1/3– rule, Simpson's 3/8 – rule, and Weddle's rules,

3. Euler – McLaurin Formula of summation and quadrature, The Euler transformation.

Unit – 5: Numerical solution of ordinary differential equations (12h)

1. Introduction, Solution by Taylor's Series,

2. Picard's method of successive approximations.

3. Euler's method, Modified Euler's method, Runge – Kutta methods.

III. 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.

IV. Co-Curricular Activities:

A) Mandatory:

1. **For Teacher**: Teacher shall train students in the following skills for 15 hours, by taking relevant outside data (Field/Web).

1. Applications of Newton's forward and back ward difference formulae.

2. Applications of Gauss forward and Gauss back ward, Stirling's and Bessel's formulae.

3. Applications of Newton's divided differences formula and Lagrange's interpolation formula.

4. Various methods to find the approximation of a definite integral.

5. Different methods to find solutions of Ordinary Differential Equations.

2. **For Student**: Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the workdone in the areas like the following, by choosing any one of the aspects.

1. Collecting the data from the identified sources like Census department or Electricity department, by applying the Newton's, Gauss and Lagrange's interpolation formula, making observations and drawing conclusions.(Or)

2. Selection of some region to find the area by applying Trapezoidal rule, Simpson's1/3– rule, Simpson's 3/8 – rule, and Weddle's rules. Comparing the solutions with analytical solution and concluding which one is the best method.(Or)

3.Findingsolutionof the ODE by Taylor's Series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge–Kutta methods. Comparing the solutions with analytical solution, selecting the best method.

3. **Max. Marks for Fieldwork/Project work Report: 05**.

4. **Suggested Format for Fieldwork/Project work Report:**

Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5. **Unit tests (IE).**

b) Suggested Co-Curricular Activities:

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.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

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III rd B.Sc., MATHEMATICS PAPER- 6A Vth SEMESTER

Paper Code—MAT 129 :: NUMERICAL METHODS

(Common for MSCs; MPCs; MGCs; MEIoT)

(For the batch admitted in 2021-22)

Duration: 2 ½ HRS. **SECTION – A** Total Marks: 50

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or problem	7
3 or 4	Unit – II	Theorem or problem	7
5 or 6	Unit – III	Theorem or problem	7
7 or 8	Unit – IV	Theorem or problem	7
9 or 10	Unit – V	Theorem or problem	7

SECTION – B

Answer any **Five** questions. Each question carries 3 marks 5 X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-III	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-IV	Theorem or Problem	3
17	Unit-IV	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

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MODEL QUESTION PAPER

III rd B.Sc., Mathematics --- Semester-V

Paper Code—MAT 129 ::6A - NUMERICAL METHODS

(Common for MSCs; MPCs; MGCs; MEIoT)

(For the batch admitted in 2021-22)

Time : 2 ½ HRS. **Section – A** **Max Marks : 50**

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

1. State and prove Newton's Divided difference interpolation formula.

(OR)

2. Use Stirling's formula to find y_{28} given y_{20} =49225, y_{25} =48316, y_{30} =47236,

y_{35} =45926, y_{40} =44306.

3. Derive Lagrange's formula for unequal intervals.

(OR)

4. Use Newton's divided difference formula to find f(x) from the following table :

x	0	1	2	4	5	6
f(x)	1	14	15	5	6	19

5. Using the given table, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 2.2.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

(OR)

6. From the following table, find 'x' for which 'y' is maximum and find the value of y.

x	1.2	1.3	1.4	1.5	1.6
y	0.9320	0.9636	0.9855	0.9975	0.9996

7. State and prove Simpson's $\frac{3}{8}$ Rule.

(OR)

8. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Weddle's rule?

9. Using Euler's modified method, find y(0.2) for $\frac{dy}{dx} = x + |\sqrt{y}|$ with y(0) = 1.

(OR)

10. Given $\frac{dy}{dx}$ = y-x with y(0)=2, find y(0.1) and y(0.2) correct to four decimal places by Runge-Kutta fourth order method.

SECTION – B

Answer any five of the following. Each question carries 3 marks. 5 x 3 = 15 M

11. Find the value of f(27.5) by using Newton's backward interpolation formula for the data.

X	25	26	27	28	29
f(x)	16.195	15.919	15.630	15.326	15.006

12. Apply Gauss forward formula to obtain f(33) given that

x	25	30	35	40
f(x)	0.2707	0.3027	0.3386	0.3794

13. Apply Lagrange's formula to find f(5) and f(6) given that f(1)=2,f(2)=4,f(3)=8 and f(7) = 128.

14. Find the derivative of f(x) at x=1.4 from the following table.

x	0.1	0.2	0.3	0.4
f(x)	1.10517	1.22140	1.34986	1.49182

15. Find $f^1(5)$ from the following table.

x	2	4	9	10
y	4	56	711	980

16. State and prove Trapezoidal Rule?

17. Show that $\int_0^1 \frac{dx}{1+x} = \log 2 = 0.69315$ by using Simpson's 3/8 rule.

18. Solve $\frac{dy}{dx} = 1 + y^2, y(0) = 0$ by Picard's method .

.	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem) **(Common for MSCs; MPCs; MGCs; MEIoT)**			
Course Code **MAT-130**	**TITLE OF THE COURSE** **7A -Mathematical Special Functions**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Integration	5	1	-	5

Course Objectives:

This course will cover the particular mathematical functions that have more or less established names and notations due to their importance in mathematical analysis, functional analysis, geometry, physics, or other applications.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
CO2	Find power series solutions of ordinary differential equations.
CO3	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.
CO4	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 unction.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit – 1: Beta and Gamma functions, Chebyshev polynomials (12h)

1. Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.

2. Another form of Beta Function, Relation between Beta and Gamma Functions.

3. Chebyshev polynomials, orthogonal properties of Chebyshev polynomials, recurrence relations, generating functions for Chebyshev polynomials.

Unit – 2: Power series and Power series solutions of ordinary differential equations (12h)

1. Introduction, summary of useful results, power series, radius of convergence, theorems on Power series

2. Introduction of power series solutions of ordinary differential equation

3. Ordinary and singular points, regular and irregular singular points, power series solution.

Unit – 3: Hermite polynomials (12h)

1. Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, generating function for Hermite polynomials.

2. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials.

3. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

Unit – 4: Legendre polynomials (12h)

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree n, generating function of Legendre polynomials.

2. Definition of Pn(x) and Qn(x), General solution of Legendre's Equation (derivations not required) to show that Pn(x) is the coefficient of h n , in the expansion of $(1 - 2xh + h^2)^{-1/2}$

3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials.

Unit – 5: Bessel's equation (12h)

1. 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.

2. Integration of Bessel's equation in series form=0, Definitionof Jn(x), recurrence for mulae for Jn(x).

3. Generating function for Jn(x), orthogonally of Bessel functions.

III. 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 Prakashan Mandir.
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. Shepley L.Ross, Differential equations, Second Edition, John Willy & sons, New York, 1974.
6. Web resources suggested by the teacher and college librarian including reading material.

IV. Co-Curricular Activities:

A) Mandatory:

1. For Teacher: Teacher shall train students in the following skills for 15 hours, by taking relevant outside data (Field/Web).

1. Beta and Gamma functions, Chebyshev polynomials.

2. Power series, power series solutions of ordinary differential equations,

3. Procedures of finding series solutions of Hermite equation, Legendre equation and Bessel equation.

4. Procedures of finding generating functions for Hermite polynomials, Legendre Polynomials and Bessel's function.

2. For Student: Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work, make observations and conclusions and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following, by choosing any one of the aspects.

1. Going through the web sources like Open Educational Resources on the properties of Beta and Gamma functions, Chebyshev polynomials, power series solutions of ordinary differential equations. (or) 2. Going through the web sources like Open Educational Resources on the properties of series solutions of Hermite equation, Legendre equation and Bessel equation.

3. Max. Marks for Fieldwork/Project work Report: 05.

4. Suggested Format for Fieldwork/Project work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5. Unit tests (IE).

B) Suggested Co-Curricular Activities:

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.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A+" Grade with 3.38 CGPA)

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Vth Semester end examinations

Paper 7A -MAT 130 – MATHEMATICAL SPECIAL FUNCTIONS

(Common for MSCs; MPCs; MGCs; MEIoT)

(For the batch admitted in 2021-22)

Duration: $2\frac{1}{2}$ Hrs. Total Marks: 50

SECTION – B

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or problem	7
3 or 4	Unit – II	Theorem or problem	7
5 or 6	Unit – III	Theorem or problem	7
7 or 8	Unit – IV	Theorem or problem	7
9 or 10	Unit – V	Theorem or Problem	7

SECTION – B

Answer any Five questions. Each question carries 3 marks. 5X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-III	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-IV	Theorem or Problem	3
17	Unit-V	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A+" Grade with 3.38 CGPA)

MODEL QUESTION PAPER

III B.Sc.,Mathematics V Semester

PAPER 7A -MAT 130 – MATHEMATICAL *SPECIAL FUNCTIONS*

(Common for MSCs; MPCs; MGCs; MEIoT)

(For the batch admitted in 2021-22)

Time: $2\frac{1}{2}$ Hrs. ***Max.Marks: 50***

SECTION-A

Answer all **Five** questions. Each question carries 7 marks. 5 x 7 = 35 M

1. Prove that $H_n(x) = (-1)^n\, e^{x^2}\, \frac{d^n}{dx^n}\left(e^{-x^2}\right)$.

(OR)

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

3. Prove that $L_n(x) = \frac{e^x}{n!}\, \frac{d^n}{dx^n}(x^n e^{-x})$ and find the polynomials $L_0(x), L_1(x), L_2(x)$.

(OR)

4. Prove that $\int_0^{\infty} e^{-x} L_n(x) L_m(x) dx = \delta_{mn} = \begin{cases} 0 & if\ m \neq n \\ 1 & if\ m = n \end{cases}$

5. Prove that $P_n(x) = \frac{1}{n! 2^n} \frac{d^n}{dx^n}(x^2 - 1)^n$.

(OR)

6. Prove that $\int_{-1}^{1} P_m(x) P_n(x)\, dx = 0 \;\; if\ m \neq n$.

7. Prove that $x\, J_n^1(x) = n\, J_n(x) - x\, J_{n+1}(x)$.

(OR)

8. Prove that a) $J_{\frac{-1}{2}}(x) = \sqrt{\left(\frac{2}{\pi x}\right)}\ cosx$ $b)$ $J_{\frac{1}{2}}(x) = \sqrt{\left(\frac{2}{\pi x}\right)}\ sinx.$

9. Prove that $\beta(l,m) = \frac{\Gamma(l)\,\Gamma(m)}{\Gamma(l+m)}$.

10. Prove that $\Gamma(m)\,\Gamma\left(m+\frac{1}{2}\right) = \frac{\sqrt{\pi}}{2^{2m-1}}\,\Gamma(2m)$.

SECTION-B

Answer any five of the following. Each question carries 3 marks**.** **5 x 3 = 15 M**

11. Prove that $2x\,H_n(x) = 2nH_{n-1}(x) + H_{n+1}(x)$.

12. Prove that $H_{2n}(0) = (-1)^n \frac{(2n)!}{n!}$.

13. Prove that $xL_n^{11}(x) + (1-x)L_n^1(x) + nL_n(x) = 0$.

14. Prove that $nP_n(x) = xP_n^1(x) - P_{n-1}^1(x)$.

15. Prove that $\int_{-1}^{1} P_m(x)P_n(x)\,dx = 0\ \ if\ m \neq n$.

16. Prove that $\frac{d}{dx}(xJ_nJ_{n+1}) = x\left({J_n}^2 - {J_{n+1}}^2\right)$.

17. Compute a) $\Gamma\left(\frac{-1}{2}\right)$ $b)$ $\Gamma\left(\frac{-3}{2}\right)$.

18. Evaluate $\int_0^a x^4\sqrt{a^2-x^2}$ dx .

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-131**	**TITLE OF THE COURSE** **6B- Multiple Integrals and Applications of Vector Calculus**	III B.Sc. (V Sem) **(Common for MPC; MPG; MGC; MPE; MES; MSAS; MSEM; MCAC; MPReM)**			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Integration and vectors	5	1	-	5

Course Objectives:

This course will cover the geometry of space, multivariate and vector-valued functions from a graphical, numerical, and symbolic perspective, differentiation and integration of vector-valued functions, partial differentiation, and multiple integration of multivariate functions.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	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.
CO2	Determine the gradient, divergence and curl of a vector and vector identities.
CO3	Evaluate line, surface and volume integrals.
CO4	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) .

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit – 1: Multiple Integrals-I (12h)

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

2. Region of integration, double integration in Polar Co-ordinates,

3. Change of variables in double integrals, change of order of integration.

Unit – 2: Multiple Integrals-II (12h)

1. Triple integral, region of integration, change of variables.

2. Plane areas by double integrals, surface area by double integral.

3. Volume as a double integral, volume as a triple integral.

Unit – 3: Vector Differentiation (12h)

1. Vector differentiation, ordinaryderivatives of vectors.

2. Differentiability, Gradient, Divergence, Curl operators,

3. Formulae involving the separators.

Unit – 4: Vector Integration (12h)

1. Line Integrals with examples.

2. Surface Integral with examples.

3. Volume integral with examples.

Unit – 5: Vector Integration Applications (12h)

1. Gauss theorem and applications of Gauss theorem.

2. Green's theorem in plane and applications of Green's theorem.

3. Stokes's theorem and applications of Stokes theorem.

III. Reference Books:

1. Dr.M Anitha, 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 Mathematics-II, Spectrum University Press, SR Nagar, Hyderabad-500038,INDIA.

3. V.Venkateswararao, N. Krishnamurthy, B.V.S.S.Sarma and S.Anjaneya Sastry, A text Book of B.Sc., Mathematics Volume-III, S. Chand & Company, Pvt. Ltd., Ram Nagar,NewDelhi-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.

IV. Co-Curricular Activities:

A) Mandatory:

1. For Teacher: Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

1. The methods of evaluating double integrals and triple integrals in the class room and train to evaluate these integrals of different functions over different regions.

2. Applications of line integral, surface integral and volume integral.

3. Applications of Gauss divergence theorem, Green's theorem and Stokes's theorem.

2. For Student: Fieldwork/Project work Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following, by choosing any one of the following aspects.

1. Going through the web sources like Open Educational Resources to find the values of double and triple integrals of specific functions in a given region and make conclusions. (or)

2. Going through the web sources like Open Educational Resources to evaluate line integral, surface integral and volume integral and apply Gauss divergence theorem, Green's theorem and Stokes theorem and make conclusions.

3. Max. Marks for Fieldwork/Project work Report: 05.

4. Suggested Format for Fieldwork/Project work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5. Unit tests (IE).

B) Suggested Co-Curricular Activities:

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.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A+" Grade with 3.38 CGPA)

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Vth Semester End Examinations

Paper 6B – MAT 131 – Multiple Integrals &Applications of Vector Calculus

(Common for MPC; MPG; MGC; MPE; MES; MSAS; MSEM; MCAC; MPReM)

(For the batches admitted in 2021-22 only)

Duration: $2\frac{1}{2}$ Hrs. Total Marks: 50

SECTION – A

Answer all questions. Each question carries 07 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or Problem	07
3 or 4	Unit – II	Theorem or Problem	07
5 or 6	Unit – III	Theorem or Problem	07
7 or 8	Unit – IV	Theorem or Problem	07
9 or 10	Unit – V	Theorem or Problem	07

SECTION – B

Answer any Five questions. Each question carries 3 marks. 5X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-II	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-III	Theorem or Problem	3
17	Unit-IV	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A+" Grade with 3.38 CGPA)

THIRD YEAR B.Sc. DEGREE EXAMINATION

SEMESTER V MATHEMATICS

Paper 6B – MAT 131 – Multiple Integrals &Applications of Vector Calculus

(Common for MPC; MPG; MGC; MPE; MES; MSAS; MSEM; MCAC; MPReM)

(For the Batches admitted in 2021-22 only)

Model Paper

Time : $2\frac{1}{2}$ Hrs. **Max Marks : 50**

Section – A

Answer **all** questions. Each question carries 7 marks. 5 X 7 = 35 M.

1. Evaluate $\iint_R x^2\,dxdy$ where R is the region bounded by the rectangle hyperbola xy=16 and the lines y=x, y=0 and x=8.

(OR)

2. Find the value of $\int (x + y^2)dx + (x^2 - y)dy$, taken in the clockwise sense along the closed curve C formed by y^2=x and y=x between (0,0) and (1,1).

3. Change the order of integration, evaluate $\int_0^1 \int_{x^2}^{2-x} xy\,dx\,dy$.

(OR)

4. Find the area of the surface $x^2+y^2+z^2=a^2$ that lies inside the surface $(x^2+y^2)^2=a^2(x^2-y^2)$.

5. Prove that the necessary and sufficient condition for f(t) to have constant direction is $f \times \frac{df}{dt} = 0$.

(OR)

6. Prove that Curl $(\bar{A} \times \bar{B}) = \bar{A}$ div $\bar{B} - \bar{B}$ div $\bar{A} + (B.\nabla)A - (A.\nabla)B$

7. If $\bar{F} = 4xz\bar{\imath} - y^2\bar{\jmath} + yz\bar{k}$, evaluate $\int \bar{F}.\bar{N}dS$ where S is the surface of the cube bounded by $x = 0, x = a, y = 0, y = a, z = 0, z = a$.

(OR)

8. If $\bar{F} = 2xz\,\bar{i} - x\,\bar{j} + y^2\,\bar{k}$, evaluate $\int_V \bar{F}.dV$ where V is the region bounded by the surfaces x=0,x=2,y=0,y=6,Z=x^2,Z=4.

9. State and Prove Green's theorem in a plane.

Or

10. Verify Stoke's theorem for $\bar{F} = -y^3\bar{\imath} + x^3\bar{\jmath}$ where S is the circular disc $x^2 + y^2 \leq 1, z = 0.$

SECTION – B

Answer any **Five** of the following. Each question carries 3 marks. 5 x 3 = 15 M

11. Change the order of integration, evaluate $\int_0^1 \int_1^{e^x} dy\,dx.$

12. Evaluate $\int_0^{2a} \int_0^{\sqrt{2ax-x^2}} x^2\,dy\,dx$ by changing the polar coordinates.

13. Find the length of the cardioid given by r= a (1-cosθ).

14. Determine the area bounded by the curves xy=2 and x^2=4y and y=4.

15. Find the directional derivative of the function f = x^2- y^2+2 z^2 at the point P(1,2,3) in the direction of the line PQ where Q(5,0,4).

16. If f = x^2yz , g = xy-3z^2 find div(grad f x grad g).

17. Evaluate $\int_C \bar{F}.dr$ where $\bar{F} = 3x^2\,\bar{i} + (2xz - y)\,\bar{j} + z\,\bar{k}$ along the straight line C from (0,0,0) to (2,1,3).

18. Show that $\int_S (ax\,\bar{i} + by\,\bar{j} + cz\,\bar{k}).\bar{N}\,ds = \frac{4\pi}{3}(a+b+c)$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 1.$

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-132**	**TITLE OF THE COURSE** **7B- Integral Transforms with Applications**	III B.Sc. (V Sem) **(Common for MPC; MPG; MGC; MPE; MES; MSAS; MSEM; MCAC; MPReM)**			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Integration	5	1	-	5

Course Objectives:

To describe the ideas of Fourier and Laplace Transforms and indicate their applications in the fields such as application of PDE, Digital Signal Processing, Image Processing, Theory of wave equations, Differential Equations and many others.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Evaluate Laplace transforms of certain functions, find Laplace transforms of derivatives and of integrals.
CO2	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.
CO3	Understand properties of inverse Laplace transforms, find inverse Laplace transforms of derivatives and of integrals.
CO4	Solve ordinary differential equations with constant/ variable coefficients by using Laplace transform method.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit – 1: Laplace transforms- I (12h)

1. Definition of Laplace transform, linearity property-piecewise continuous function.

2. Existence of Laplace transform, functions of exponential order and of class A.

3. First shifting theorem, second shifting theorem and change of scale property.

Unit – 2: Laplace transforms- II (12h)

1. Laplace Transform of the derivatives, initial value theorem and final value theorem. Laplace transforms of integrals.

2. Laplace transform of tn . f (t), division by t, evolution of integrals by Laplace transforms.

3. Laplace transform of some special functions-namely Dirac delta function, error function, Bessel function and Laplace transform of periodic function.

Unit – 3: Inverse Laplace transforms (12h)

1. Definition of Inverse Laplace transform, linear property, first shifting theorem, second shifting theorem, change of scale property, use of partial fractions.

2. Inverse Laplace transforms of derivatives, inverse, Laplace transforms of integrals, multiplication by powers of 'p', division by 'p'.

3. Convolution, convolution theorem proof and applications.

Unit – 4: Applications of Laplace transforms-I (12h)

1. Solutions of differential equations with constants coefficients, solutions of differential equations with variable coefficients.

2. Applications of Laplace transforms to integral equations- Abel's integral equation.

Unit – 5: Applications of Laplace transforms-II & Fourier transforms (12h)

1.Converting the differential equations into integral equations, converting the integral equations into differential equations

2. Integral transforms, Fourier integral theorem , Fourier sine and cosine integrals.

Additional input:

1.Properties of Fourier transforms, change of scale property, shifting property, modulation theorem. Convolution

2. Convolution theorem for Fourier transform, Parseval's Identify, finite Fourier transforms.

(An activity of student *viz*., a study project work etc., for continuous internal evaluation may be conducted from additional input).

III. Reference Books:

1. Dr. S.Sreenadh, S.Ranganatham, Dr.M.V.S.S.N.Prasad, Dr. V.Ramesh Babu, 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, Pragathi Prakashan, Meerut.

5. Shanthi Narayana , 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.

IV. Co-Curricular Activities:

A) Mandatory:

1. For Teacher: Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

1. Demonstrate on sufficient conditions for the existence of the Laplace transform of a function.
2. Evaluation of Laplace transforms and methods of finding Laplace transforms.
3. Evaluations of Inverse Laplace transforms and methods of finding Inverse Laplace transforms.
4. Fourier transforms and solutions of integral equations.

2. For Student: Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following, by choosing any one of the aspects.

1. Going through the web sources like Open Educational Resources on Applications of Laplace transforms and Inverse Laplace transforms to find solutions of ordinary differential equations with constant /variable coefficients and make conclusions. (or)
2. Going through the web sources like Open Educational Resources on Applications of convolution theorem to solve integral equations and make conclusions. (or)
3. Going through the web source like Open Educational Resources on Applications of Fourier transforms to solve integral equations and make conclusions.

3. Max. Marks for Fieldwork/Project work Report: 05.

4. Suggested Format for Fieldwork/Project work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5. Unit tests (IE).

B) Suggested Co-Curricular Activities:

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.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A^{+}" Grade with 3.38 CGPA)

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Vth Semester end examinations

Paper 7B –MAT 132 -INTEGRAL TRANSFORMS WITH APPLICATIONS

(Common for MPC; MPG; MGC; MPE; MES; MSAS; MSEM; MCAC; MPReM)

(For the batches admitted in 2021-22 only)

Duration: $2\frac{1}{2}$ Hrs. **SECTION – A** Total Marks : 50

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or Problem	7
3 or 4	Unit – II	Theorem or Problem	7
5 or 6	Unit – III	Theorem or Problem	7
7 or 8	Unit – IV	Theorem or Problem	7
9 or 10	Unit – V	Theorem or Problem	7

SECTION – B

Answer any Five questions. Each question carries 3 marks. 5X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-II	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-III	Theorem or Problem	3
17	Unit-IV	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A+" Grade with 3.38 CGPA)

MODEL QUESTION PAPER

III rd B.Sc., Mathematics V th Semester

paper 7B::MAT 132- INTEGRAL TRANSFORMS WITH APPLICATIONS

(Common for MPC; MPG; MGC; MPE; MES; MSAS; MSEM; MCAC; MPReM)

(For the batches admitted in 2020-21 only)

Time : $2\frac{1}{2}$ Hrs. Max Marks: 50

Section – A

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M.

1. Using the expansion $sinx = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + - - -$. Show that $L\{sin\sqrt{t}\} = \frac{\sqrt{\pi}}{2p^{\frac{3}{2}}} e^{\frac{1}{4p}}$

(OR)

2. State and prove the First Shifting Theorem on Laplace Transforms.

3. State and prove initial value theorem.

(OR)

4. i) Find $L\left\{\frac{1-cost}{t^2}\right\}$ ii) Show that $\int_0^\infty \frac{e^{-3t}-e^{-6t}}{t} dt = log2$.

5. Find the Inverse Laplace Transform of $\left[\frac{s^2}{s^4+4a^4}\right]$.

(OR)

6. State and prove Convolution Theorem?

7. Solve $Dx + Dy = t, ^2x - y = e^{-t}$ if $x(0) = 3, x^1(0) = -2, y(0) = 0$.

(OR)

8. Solve $(D^2 + 9)y = cos2t$ if $y(0) = 1, y\left(\frac{\pi}{2}\right) = -1$.

9. Solve the integral equation $\int_0^1 \frac{F(u)du}{(t-u)^{\frac{1}{3}}} = t(1+t)$.

(OR)

10. State and prove Fourier integral theorem

SECTION – B

Answer any **five** of the following. Each question carries 3 marks. 5 x 3 = 15 M

11. Find L$\{cos^3 3t\}$.

12. State and prove second shifting theorem.

13. Evaluate L$\{t^2 e^{-2t}\}$.

14. Find L$\left\{\frac{sin3t\ cost}{t}\right\}$.

15. Find $L^{-1}\left\{\frac{4s+5}{(s-1)^2(s+2)}\right\}$ by using partial fractions.

16. Find the inverse Laplace transform of $log\left(\frac{p+1}{p-1}\right)$.

17. Solve $\frac{d^2y}{dx^2} + y = 0$ under the conditions that $y = 1, \frac{dy}{dx} = 0\ when\ t = 0$.

18. Define Fourier sine and cosine transform of a function .

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-133**	**TITLE OF THE COURSE** **6C- Partial Differential Equations & Fourier Series**	III B.Sc. (V Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Ordinary differential equations	5	1	-	5

Course Objectives:

Partial differential equations are used to mathematically formulate, and thus aid the solution of, physical and other problems involving functions of several variables, such as the propagation of heat or sound, fluid flow, elasticity, electrostatics, electrodynamics, etc.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Classify partial differential equations, formation of partial differential equations and solve Cauchy's problem for first order equations.
CO2	Solve Lagrange's equations by various methods, find integral Surface passing through a given curve and Surfaces orthogonal to a given system of Surfaces.
CO3	Find solutions of nonlinear partial differential equations of order one by using Charpit's method and Jacobi's method.
CO4	Understand Fourier series expansion of a function f(x) and Parseval's theorem.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit – 1: Introduction of partial differential equations (12h)

1. 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 Ø(u, v) = 0 where u and v are functions of x, y and z.

3. Cauchy's problem for first order equations .

Unit – 2: Linear partial differential equations of order one (12h)

1. 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 Pdx = Qdy = Rdz ,type 2 based on Rule II for solving Pdx = Qdy = Rdz .

2. Type 3 based on Rule III for solving Pdx = Qdy = Rdz , type 4 based on Rule IV for solving Pdx = Qdy = Rdz.

3. Integral Surface passing through a given curve, the Cauchy problem, Surfaces orthogonal to a given system of Surfaces.

Unit – 3: Non-linear partial differential equations of order one-I (12h)

1. 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.

2. Charpit's method, Standard form I, only p and q present.

3. Standard form II, Clairaut's equations.

Unit – 4: Non-linear partial differential equations of order one-II (12h)

1. Standard Form III, only p, q and z present.

2. Standard Form IV, equation of the form $f_1(x, p) = f_2(y, q)$.

3. 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.

Unit – 5: Fourier series (12h)

1. Introduction, Euler's formulae for Fourier series expansion of a function f(x), Dirichlet's conditions for Fourier series, convergence of Fourier series.

2. Functions having arbitrary periods. Change of interval, Half range series.

3. Parseval's theorem, illustrative examples based on Parseval's theorem, some particular series.

III. 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.Ramesh Babu, 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.

IV. Co-Curricular Activities:

A) Mandatory:

1. For Teacher: Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

1. On classification of first order partial differential equations, formation of partial differential equations.
2. Various methods of finding solutions of partial differential equations.
3. Integral Surface passing through a given curve and Surfaces orthogonal to a give system of Surfaces.

2) For Student: Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the Following, by choosing any one of the aspects.

1. Going through the web source like Open Educational Resources to find solutions of partial differential equations by using Lagrange's method, Charpit's method and Jacobi's method and make conclusions. (or)
2. Going through the web source like Open Educational Resources to find Integral Surface passing through a given curve and Surfaces orthogonal to a given system of Surfaces and make conclusions. (or) 3. Going through the web source like Open Educational Resources to find Fourier series expansions of some functions and applications of Parseval's theorem and make conclusions.

3. Max. Marks for Fieldwork/Project work Report: 05.

4. Suggested Format for Fieldwork/Project work Report: Title page, Student Details, Index page, stepwise work-done, Findings, Conclusions and Acknowledgements.

5. Unit tests (IE).

B) Suggested Co-Curricular Activities

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.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

(Accredited by NAAC "A+" Grade with 3.38 CGPA)

BLUE PRINT

Vth Semester end examinations

Paper 6C –MAT 133 - PARTIAL DIFFERENTIAL EQUATIONS & FOURIER SERIES

(For the batches admitted in 2021-22 only)

Duration: $2\frac{1}{2}$ Hrs. **SECTION – A** Total Marks : 50

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or Problem	7
3 or 4	Unit – II	Theorem or Problem	7
5 or 6	Unit – III	Theorem or Problem	7
7 or 8	Unit – IV	Theorem or Problem	7
9 or 10	Unit – V	Theorem or Problem	7

SECTION – B

Answer any Five questions. Each question carries 3 marks. 5X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-II	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-III	Theorem or Problem	3
17	Unit-IV	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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MODEL QUESTION PAPER

III rd B.Sc., Mathematics V th Semester

Paper 6C – MAT 133 - PARTIAL DIFFERENTIAL EQUATIONS & FOURIER SERIES

(For the batches admitted in 2021-22 only)

Time : $2\frac{1}{2}$ Hrs. Max Marks: 50

Section – A

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M.

1. Find a partial differential equation by eliminating a, b, c from $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$.

(OR)

2. Eliminate the arbitrary function $\emptyset$ from $\emptyset(x^2+y^2+z^2, z^2-2xy)=0$.

3. Solve $(x^2-yz)p+(y^2-zx)q=z^2-xy$.

(OR)

4. Find the surface which intersects the surfaces of the system z(x+y)=c(3z+1) orthogonally and which passes through the circles $x^2+y^2=1$, z=1.

5. Find a complete and singular integral of $(p^2+q^2)y=qz$ by Charpit's method.

(OR)

6. Show that the equations $xp-yq=x \; and \; x^2p+q=xz$ are compatible and solve them.

7. Solve $z^2(p^2x^2+q^2)=1$.

(OR)

8. Find a complete integral of $p_1p_2p_3=z^3x_1x_2x_3$ by Jacobi's method.

9. Obtain the Fourier series for $f(x)=e^{-x}$ in the interval $0<x<2\pi$.

(OR)

10. Obtain the Fourier series for the function $f(x)=\begin{cases}\pi x, & 0\le x\le 1\\ \pi(2-x), & 1\le x\le 2\end{cases}$

Hence deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots+\infty=\frac{\pi^2}{8}$.

SECTION – B

Answer any **five** of the following. Each question carries 3 marks. 5 x 3 = 15 M

11. Form a partial differential equation from the equation $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$.

12. Form a partial differential equation from the equation $xyz = \emptyset(x + y + z)$.

13. Solve $y^2p - xyq = x(z - 2y)$.

14. Solve xp-yq=xy.

15. Find a complete integral of $p^2 + q^2 = 1$.

16. Find a complete integral of $zpq = p + q$.

17. Find a complete integral of $p^2 + q^2 = x + y$.

18. Express $f(x) = \frac{x}{2}$ as a Fourier series in the interval $-\pi < x < \pi$.

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code **MAT-134**	**TITLE OF THE COURSE** **7C- Number Theory**	III B.Sc. (V Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on number system	5	1	-	5

Course Objectives:

The main goal of number theory is to discover interesting and unexpected relationships between different sorts of numbers and to prove that these relationships are true.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Find quotients and remainders from integer division, study divisibility properties of integers and the distribution of primes.
CO2	Understand Dirichlet multiplication which helps to clarify interrelationship between various arithmetical functions.
CO3	Understand the concepts of congruencies, residue classes and complete residues systems.
CO4	Comprehend the concept of quadratic residues mod p and quadratic non residues mod p.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Course Syllabus:

Unit – 1: Divisibility (12h)

1. Introduction, Divisibility, Greatest Common Divisor.

2. Prime numbers, The fundamental theorem of arithmetic, The series of reciprocals of the primes.

3. The Euclidean algorithm, The greatest common divisor of more than two numbers.

Unit – 2: Arithmetical Functions and Dirichlet Multiplication (12h)

1. Introduction, The Mobius functionμ(n), The Euler totient function φ(n), A relation connecting φ and μ , A product formula for φ(n).

2. The Dirichlet product of arithmetical functions, Dirichlet inverses and Mobius inversion formula, The Mangoldt function⋀(n).

3. Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function λ(n), The divisor functions $\sigma\alpha(n)$.

Unit – 3: Averages of Arithmetical Functions (12h)

1. Introduction, The big oh notation. Asymptotic equality of functions, Euler's summation formula, some elementary asymptotic formulas.

2. The average order of d(n), The average order of the divisor functions$\sigma\alpha(n)$, The average order of φ(n).

3. The average order of μ(n) and ⋀(n), The partial sum of a Dirichlet product, Applications of μ(n) and ⋀(n).

Unit – 4: Congruences (12h)

1. Definition and basic properties of congruences, Residue classes and complete residue systems.

2. Linear congruences, reduced residue systems and the Euler-Fermat theorem, Polynomial congruences modulo p, Lagrange's theorem.

3. Applications of Lagrange's theorem, Simultaneous linear congruences, The Chinese remainder theorem, Applications of the Chinese remainder theorem.

Unit – 5: Quadratic Residues and the Quadratic Reciprocity Law (12h)

1. Quadratic Residues, Legendre's symbol and its properties, Evaluation of (-1/p) and (2/p), Gauss lemma.

2. The Quadratic reciprocity law, Applications of the reciprocity law, The Jacobi Symbol.

3. Gauss sums and the quadratic reciprocity law, the reciprocity law for quadratic Gauss sums. Another proof of the quadratic reciprocity law.

III. 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.

IV. Co-Curricular Activities:

A) Mandatory:

1. For Teacher: Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

1. Finding quotient and numbers from integer division and the method of solving congruences. Further problems related to the theory of quadratic residues.

2. Applications of Lagrange's theorem.

3. Applications of the Chinese remainder theorem.

4. Applications of the reciprocity law.

2.For Student: Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following, by choosing any one of the aspects.

1. Going through the web sources like Open Educational Resources and list out Applications of Lagrange's theorem, and make conclusions.(or)

2. Going through the web sources like Open Educational Resources and list out Applications of the Chinese remainder theorem and make conclusions.(or)

3. Going through the web sources like Open Educational Resource and list out Applications of the reciprocity law and make conclusions.

3. Max. Marks for Fieldwork/Project work Report: 05.

4. Suggested Format for Fieldwork/Project work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5. Unit tests (IE).

B) Suggested Co-Curricular Activities

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1													
CO2													
CO3													
CO4													

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Vth Semester end examinations

Paper 7C –MAT 134 – NUMBER THEORY

(For the batches admitted in 2021-22 only)

Duration: $2\frac{1}{2}$ Hrs. **SECTION – A** Total Marks : 50

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M

Question	Topics	Nature	Weightage
1 or 2	Unit – I	Theorem or Problem	7
3 or 4	Unit – II	Theorem or Problem	7
5 or 6	Unit – III	Theorem or Problem	7
7 or 8	Unit – IV	Theorem or Problem	7
9 or 10	Unit – V	Theorem or Problem	7

SECTION – B

Answer any Five questions. Each question carries 3 marks. 5X 3 = 15 M

Question	Topic	Nature	Marks
11	Unit-I	Theorem or Problem	3
12	Unit-I	Theorem or Problem	3
13	Unit-II	Theorem or Problem	3
14	Unit-II	Theorem or Problem	3
15	Unit-III	Theorem or Problem	3
16	Unit-IV	Theorem or Problem	3
17	Unit-IV	Theorem or Problem	3
18	Unit-V	Theorem or Problem	3

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

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MODEL QUESTION PAPER

III rd B.Sc., Mathematics V th Semester

Paper 7C –MAT 134 – NUMBER THEORY

(For the batches admitted in 2021-22 only)

Time : $2\frac{1}{2}$ Hrs. Max Marks: 50

Section – A

Answer all questions. Each question carries 7 marks. 5 X 7 = 35 M.

1. State and prove Fundamental theorem of arithmetic.

(OR)

2. Let d = (826, 1890). Use the Euclidean algorithm to compute d, then express d as a linear combination of 826 and 1890.

3. a) If n≥1, prove that $\sum_{d/n} \mu(d) = [1/n] = \begin{cases} 1, if\ n = 1 \\ 0, if\ n > 1 \end{cases}$.

b) State and Prove Mobius Inversion Formula.

(OR)

4. If f is multiplicative then prove that $\sum_{d/n} \mu(d)\, f(d) = \prod_{p/n}(1 - f(p))$.

5. State and prove Euler's summation formula.

(OR)

6. For x ≥ 1, prove that $\sum_{n\leq x} \emptyset(n) = \frac{3}{\pi^2} x^2 + O(x \log x)$.

7. State and Prove Lagrange's Theorem.

(OR)

8. State and prove Fermat's little theorem.

9. Determine whether 219 is a quadratic residue or nonresidue mod 383.

(OR)

10. Let p be an odd prime. Then prove that for all n, $(n/p) \equiv (p-1)/2 \pmod p$.

SECTION-B

Answer any **FIVE** questions. Each question carries **3** Marks. **5 x 3 = 15 M**

11. If (a, b) = 1 then prove that (a+b, a-b) is either 1 or 2.

12. If c/ab and (b, c) =1. Then prove that c/a.

13. If n≥1, prove that $\varphi(n) = n \prod_{p/n} \left(1 - \frac{1}{p}\right)$, where p is prime.

14. If n ≥ 1, Prove that $\sum_{d/n} Ø(d) = n$.

15. For x≥1, Prove that (i) $\sum_{n \leq x} \mu(n) [x/n] = 1$.

16. State and prove Chinese remainder theorem.

17. Solve the congruence 25x ≡ 15 (mod 120).

18. Define the Jacobi symbol.

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SYLLABUS FOR CERTIFICATE COURSE

Paper –mat c1 - BASIC MATHEMATICS (FOR NON-MATHS STUDENTS)

(For the batches admitted in 2022-23 only) 60 Hrs

Theory – 45 hours **Practicals – 15 hours**

Unit-1: Matrix Algebra (12 Hrs)

Introduction - Definition - Types of matrices - Scalar multiplication of matrix - Equality of matrices - Matrix operations - Addition and Subtraction

Unit - 2 : Matrix Multiplication (10 Hrs)

Multiplication of Matrices - Properties - Transpose of Matrix - Determinants of a square matrix - Determinants of order two

Unit-3 : Quadratic Equations (12 Hrs)

Solutions of quadratic equations – Preliminaries - Solving pure quadratic equations - Solving affected quadratic equations - Nature of Roots - Symmetric expression of a roots of a quadratic equation

Unit-4 : Arithmetic Progression (11 Hrs)

Finding general terms of Arithmetic Progression - Sum of finite numbers of terms in Arthematic Progression - Arithmetic means - To insert 'n' terms between two given quantities in Arithmetic Progression.

Prescribed Text Book : Business Mathematics by D.C.Sancheti, V.K.Kapoor, S.Chand & Sons Publications,2000 Edition.

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MODEL QUESTION PAPER

Paper – mat c1 - BASIC MATHEMATICS (For NON-MATHS STUDENTS)

(For the batches admitted in 2022-23 only)

Duration: 2 Hrs **Max.Marks: 50**

Answer any **five** of the following. Each question carries **10** marks. **5 x 10 = 50 M**

1) (i) If A = $\begin{pmatrix} 0 & 2 & 3 \\ 2 & 1 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} 7 & 6 & 3 \\ 1 & 4 & 5 \end{pmatrix}$. Find the value of (2A + 3B).

(ii) Find x and y if $\begin{pmatrix} x+y & 2 \\ 1 & x-y \end{pmatrix} = \begin{pmatrix} 3 & 2 \\ 1 & 7 \end{pmatrix}$.

2) (i) If A=$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and I = $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. Show that $A^2 - (a+d)A = (bc - ad)I$.

(ii) If A = $\begin{pmatrix} 2 & -3 & 1 \\ 4 & 2 & 3 \end{pmatrix}$ and B = $\begin{pmatrix} 3 & -2 & 4 \\ 1 & 3 & -5 \end{pmatrix}$. Show that $(A+B)^T = A^T + B^T$.

3) (i) If A = $\begin{pmatrix} 9 & 1 \\ 4 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 5 \\ 7 & 12 \end{pmatrix}$. Find the matrix X such that 3A+5B+2X = O.

(ii) Define (a) Scalar matrix (b) symmetric matrix and give examples .

4) (i) If A = $\begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ -1 & -2 & -3 \end{pmatrix}$. Show that $A^2 = O$

(ii) If A= $\begin{bmatrix} 8 & 16 & -4 \\ -4 & 0 & 8 \end{bmatrix}$, $B = \begin{bmatrix} 12 & 16 & 20 \\ -4 & 8 & 28 \\ 8 & 4 & 0 \end{bmatrix}$. Compute $(AB)^T$ & $B^T A^T$.

5) (i) Solve the equation $2x^2 - 10x + 5 = 0$.

(ii) Discuss the nature of the roots of the following Quadratic Equation $x^2 + 2x + 3 = 0$.

6) (i) For what values of 'm' will the equation $(m+1)x^2+2(m+3)x+(2m+3)=0$ have equal roots.

(ii) If α, β are the roots of the equation $ax^2+bx+c=0$. Find the values of a) $\alpha-\beta$ b) $\alpha^2 + \beta^2$.

7) Find the three numbers in Arithmetic Progression whose sum is 9 and the product is -165.

8) (i) If S_n denotes the sun of first 'n' terms of a series. If $S_n = (2n^2+3n)$.

Show that the series is in Arithmetic Progression.

(ii) Find the sum of the series 72+70+68+--------+40.

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SYLLABUS FOR CERTIFICATE COURSE

Paper –mat c2- competative MATHEMATICS

(For the batches admitted in 2022-23 only) **60 Hrs**

Theory – 45 hours **Practicals – 15 hours**

UNIT-I - **Sequence and Series (10 Hrs)**

Analogies of numbers and alphabets completion of blank spaces following the pattern in a:b::c:d relationship odd thing out; missing numbers in a sequence or a series.

UNIT-II- **Arithmetic Ability (12 Hrs)**

Algebraic operations BODMAS, Fractions, Divisibility rules, LCM &GCD (HCF).Date, Time and Arrangement Problems: Calendar problems, Clock problems, Blood relationship.

UNIT-III- **Quantitative Aptitude (12 Hrs)**

Averages, Ratios and Proportion, Problems an Ages, Time & Distance -Speed.

UNIT-IV- **Businesses Computations (11 Hrs)**

Percentages, Profit&Loss , Partnership , Simple & Compound interest.

References:

1. R.Sagarwal, Quantitative Aptitude for competitive examinations , S.chand publications.
2. R.V.Praveen, Quantitative Aptitude and Reasoning. PHI publishers
3. Pratogitaprakasan ,Kic X, Quantitative Aptitude: Numerical Ability (fully solved) Objective questions , Kiran Prakasan Publishers.
4. Abhijitguha , Quantitative Aptitude for competitive examination ,TMG Hill publications.
5. Old question papers of the Exams conducted by (Wipro, TCS, Infosys etc.) at their Recruitment process, source- internet.

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MODEL QUESTION PAPER

Paper – mat c2 - competative MATHEMATICS

(For the batches admitted in 2022-23 only)

Duration: 2 Hrs **Max Marks:50**

Answer any **FIVE** of the following. Each question carries **10** marks. **5 x 10 = 50 M**

1. i) Find three numbers in Arithmetic Progression (A.P) whose sum is 9 and the product is -165.
   ii) Find three numbers in Geometric Progression (G.P) whose sum is 21 and sum of their squares is 189.
2. i) Find the sum of the series $72 + 70 + 68 + \cdots + 40$.
   ii) Find the sum of 10 terms of the series $1 + 3 + 9 + 27 + \cdots$
3. i) Find the sum of the all odd numbers upto 100?
   ii) What was the day of the week on 15^{th} August, 1947?
4. i) Find the LCM of 72, 108 and 2100.
   ii) Find the HCF of 204, 1190 and 1445.
5. i) The speed of a train is 90 kmph. What is the distance covered by it in 10 minutes?
   ii) Rajeev's age after 15 years will be 5 times his age 5 years back. What is the present age of Rajeev?
6. i) Find the average of first 10 odd numbers?
   ii) A bag contains One Rupee, 50 Paisa, 25 Paisa coins in the ratio 8:9:11. If the total money in the bag is Rs.122. Find the number of coins of each type?
7. i) The cost price of a radio is Rs.1500 and it was sold for Rs.1230. Find the Loss%.
   ii) Find the difference between Simple Interest and Compound Interest on Rs.5000 for 2 years at 10% per annum.
8. i) A candidate got 35% votes polled and he lost to his rival by 2250 votes. How many votes were cast?

   ii) Four milkmen rented a pasture. 'A' grazed 24 cows for 3 months, 'B' 10 cows for 5 months, 'C' 35 cows for 4 months and 'D' 21 cows for 3 months. If A's share of rent is Rs.720, find the total rent of the field.