

	S.R.R. & C.V.R. GOVT. DEGREE COLLEGE (A) VIJAYAWADA, N.T.R. DIST. (NAAC Accredited with 'A' Grade AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM Department of PHYSICS & ELECTRONICS ACADEMIC YEAR 2025-26
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Composition of the Board of Studies (BoS) of PHYSICS as Per UGC Guidelines

Members of Board of studies

Members of the Board of Studies of Department of Physics met on 18-09-2025 at 2.00 PMin the Department of Physics & Electronics staff room.

S.No	Name of the faculty	Designation
1	Smt.P.Sailaja, Lecturer in Electronics SRR & CVR GDC (A),Vijayawada	Board of studies chairperson
2	Dr. Ch. Srinivasa Rao Andhra Loyola College, Vijayawada	University Nominee
3	T.V. Ramababu, Lecturer in Physics CSTS Govt. Kalasala, Jangareddigudem,Eluru(Dt). Mob:9490823654	Subject Expert
4	Dr.P.GopiKrishna,Asst. Professor, Dept of ECM K.L.EducationFoundation,Vaddeswaram, Guntur.	Subject Expert
5	N. Vara Prasad, CEO, ARETE IT Services Pvt. Ltd Mob:8885591199	Industrialist
6	T.Pujitha, M.Sc – Physics Alumni member, Mob: 7799467493	Alumni
7.	1. Smt. T.V.Vakula Priya, Lecturer in Physics 2. Dr.J.Nageswara Rao, Lecturer in Physics 3. Dr.A. Asirvadam, Lecturer in Physics 4. Sri T Devendara Reddy, Lecturer in Physics 5. Sri G.V.Gangadhara Rao, Lecturer in Physics 6. Smt. SK. Jubeda, Lecturer in Physics 7. Smt. S. Kiranmayi, Lecturer in Electronics	Members of the Department
8.	1. D. Lakshmi, II B.Sc Physics (Honours) 2. R. Abhishek, II B.Sc Physics (Honours)	Students



S.R.R. & C.V.R. GOVT. DEGREE COLLEGE (A) VIJAYAWADA, N.T.R. DT.
(NAAC Accredited with 'A' Grade)
AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM
Department of PHYSICS & ELECTRONICS
ACADEMIC YEAR 2025-26

Members of the Board of Studies of Department of Physics met on 18 -09-2025 at 2.00 PM in the Department of Physics & Electronics staff room Under the chairmanship of Smt. P.Sailaja, In charge of the Department, with the following agenda.

AGENDA:

1. Review of minutes of BOS.
2. To apprise and approve Departmental Vision and mission.
3. To discuss and approve curriculum structure suggested by APSCHE and from feedback of students and different stakeholders with modifications not exceeding 20% on demand of local needs and to be implemented from the year 2025-26.
4. To approve blue print and Model Question paper for theory and practical examinations.
5. Review on evaluation of Internal and External Examinations.
6. To Suggest Methodologies and innovative teaching practices.
7. To discuss and approve panel of Examiners.
8. To suggest and approve student study projects, Extension activities, curricular, co-curricular activities and to discuss about certificate course - Hardware and Networking.
9. Any other academic matters with the permission of the chairman.

**Syllabus for 4-Year UG Honours in B.Sc.(Physics) as Major in consonance with
Curriculum framework w.e.f. AY 2025-26
COURSE STRUCTURE (for Semester I & II)**

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Introduction to Mathematical Physics	3	3
			Introduction to Mathematical Physics-Practical	2	1
		2	Mechanics and Properties of Matter	3	3
			Mechanics and Properties of Matter-Practical	2	1
	II	3	Waves and Optics	3	3
			Waves and Optics-Practical	2	1
		4	Heat and Thermodynamics	3	3
			Heat and Thermodynamics-Practical	2	1

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA
SEMESTER-I 25-26
COURSE 1: INTRODUCTION TO MATHEMATICAL PHYSICS

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

To equip students with foundational mathematical techniques—such as vector calculus, linear algebra, complex numbers, probability, and Fourier analysis—essential for understanding and solving problems in physics.

LEARNING OUTCOMES:

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

1. Apply concepts of vector differentiation and integration to analyze physical fields and prove integral theorems.
2. Use matrix operations and eigenvalue techniques to solve linear systems in physics.
3. Represent and manipulate complex numbers in various forms for solving AC circuit problems.
4. Interpret and apply basic probability concepts and distributions to model physical phenomena.
5. Analyze periodic signals using Fourier series and evaluate Fourier coefficients for common waveforms.

UNIT-I - VECTOR ANALYSIS (9. Hrs.)

Part A : Scalar and vector fields, gradient of a scalar field and its physical significance without derivation and example. Divergence of a vector field without derivation and curl of a vector field with derivations and physical interpretation and examples,

Part B : Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems.

UNIT-II – LINEAR ALGEBRA (9. Hrs.)

Part A: Matrices and Operations: Types, Addition and Multiplication, Identity and Inverse, Determinant (2x2 and 3x3), Trace, Transpose, Eigenvalues and Eigen Vectors, Calculation of Eigen values using characteristic equations.

Part B: System of Linear Equations: Solving 2-variable system using matrices, Simple examples from physics (Current, forces) -with electrical circuits

UNIT – III COMPLEX NUMBERS (9. Hrs.)

Part A: Basic Complex numbers: Real and imaginary parts, Graphical representation of complex plane, Conjugate of complex numbers, Modulus and argument (magnitude and phase), Polar and Exponential (Euler) form of complex numbers.

Part B: Multiplication and division of complex numbers. Phasor representation: representation of voltage and current as phasors, Derivation of Impedance of a series LCR circuit.

UNIT – IV PROBABILITY (9. Hrs.)

Part A: Probability Theory Basics, conditional probability, and Bayes' theorem-probability of a defective product. Independence and mutual exclusivity.

Part B: Random Variables and Probability Distributions, Concept of random variables (discrete and continuous). Common distributions and their applications: Binomial, Poisson, and Gaussian.

UNIT V FOURIER ANALYSIS (9. Hrs.)

Part A: Introduction to periodic functions: Concept of periodicity (waves, oscillations, AC current), Graphical understanding of Sine and Cosine functions, Fourier theorem and evaluation of Fourier coefficients,

Part B: Need for Fourier analysis, Real world signals (heartbeat, electrical signal, musical tones), Limitations of Fourier theorem, Analysis of periodic wave functions – Square wave, saw tooth wave.

NOTE: Question paper should prepare from Part A& Part B at least one question from each part.

Reference books

1. Mathematical methods for physics sciences (3rd edition) - Mary. L. Boas
2. First Chapter (Vector analysis) in Introduction to Electrodynamics (3rd edition) – David. J. Griffiths
3. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier

Student Activities:

- Problem-solving sessions using real-life physics applications (e.g., using vector calculus in electromagnetism).
- Group projects on solving physical systems using matrix methods and linear algebra tools.
- Mini-lab activity on phasor diagrams and impedance using circuit simulation software (like LTspice or Tinkercad Circuits).
- Data collection and analysis task: Record physical measurements (e.g., decay times, counts) and apply statistical models (Poisson/Gaussian).

SEMESTER-I
COURSE 1: INTRODUCTION TO MATHEMATICAL PHYSICS
Practical Credits: 1 2 hrs/week

COURSE OBJECTIVE:

To develop foundational computational and analytical skills through hands-on exercises that prepare students for understanding and solving problems in various realms of physics.

LEARNING OUTCOMES:

1. Graphing and Visualization: Students will be able to plot mathematical functions and visualize physical phenomena using Excel, Python, or MATLAB.
2. Vector and Matrix Computations: Students will perform operations on vectors and matrices and represent them both analytically and graphically.
3. Numerical Methods: Students will apply numerical techniques like Newton-Raphson, Bisection, and Euler's method to solve equations and differential equations.
4. Data Analysis and Fitting: Students will analyze experimental data using tools like least squares fitting and compute statistical quantities such as mean, standard deviation, and error.
5. Fourier and Complex Number Representation: Students will approximate functions using Fourier series and graphically represent complex numbers.

List of Practical

Minimum of 6 experiments to be conducted and recorded

1. Graphing standard functions: $\sin(x)$, $\cos(x)$, e^x , $\ln(x)$, x^2 , $\sqrt{x}$ etc. using Excel/Python/Graph paper
2. Experimental determination and vector diagram verification of vector addition and scalar product using graphical methods.
3. Using MATLAB/Python to visualize vector fields and compute gradient, divergence, and curl.
4. Solve simple non-linear equations (e.g., $x^3 - x - 1 = 0$) using graphical methods and bisection/newton-raphson method (Python or Excel).
5. Fit experimental data (e.g., Hooke's law) to a straight line using least squares method in Excel or Python.
6. Linear equation Solution and System of linear equation solution using MATLAB/OCTAVE
7. Fourier approximation of a square wave up to 5 terms using Python/MATLAB and plotting the result.
8. Numerical solution of $\frac{dy}{dx} = x + y$, given initial condition using Euler's method.
9. Single coin tossing and four-coin tossing using MATLAB/OCTAVE and verification of statistical laws
10. Use Python/Excel to perform addition, multiplication, and finding inverse of 2x2 and 3x3 matrices.
11. Simulate and plot s-t, v-t graphs using $s = ut + 0.5gt^2$, using Excel or Python.
12. Calculate mean, standard deviation, and percentage error for a given data set using Excel/Python/Manual calculations
13. Represent the given complex numbers on graph paper
14. Determine the Eigen Values of the given matrix using characteristic equation

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SEMESTER-1B.Sc (PHYSICS) Honors 25-26
BLUE PRINT
INTRODUCTION TO MATHEMATICAL PHYSICS

Unit no	Essay answer questions	Short answer questions	Numerical problem
Unit I	2 (with internal choice)	1	1
Unit II	2 (with internal choice)	0	2
Unit III	2 (with internal choice)	0	2
Unit IV	2 (with internal choice)	1	1
Unit V	2 (with internal choice)	2	0

NOTE: Question paper should prepare from Part A & Part B at least one question from each part.

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SEMESTER-1B.Sc (PHYSICS) Honours 25-26
INTRODUCTION TO MATHEMATICAL PHYSICS
QUESTION BANK

UNIT I – VECTOR ANALYSIS

Essay Questions (8 Marks Each)

1. State and prove Gauss divergence theorem. Use an example from electromagnetism to illustrate its application.
2. Explain divergence and curl of a vector field. Discuss their physical interpretations with examples from physics.
3. State and prove Stokes' theorem and use any example

Short Answer Questions (4 Marks Each)

1. Define gradient of a scalar field and explain its physical significance.
2. Calculate the divergence of the vector field $A = x^2i + y^2j + z^2k$.
3. Explain the line, surface and volume integrals.
4. Show that the curl of a gradient of any scalar field is zero.

UNIT II – LINEAR ALGEBRA

Essay Questions (8 Marks Each)

1. Define eigenvalues and eigenvectors. Derive the characteristic equation for a 2×2 matrix and calculate its eigenvalues.
2. Explain matrix operations (addition, multiplication, inverse, transpose) with examples. Discuss their significance in physics problems.
3. Solve a system of two linear equations using matrix methods and explain its application in analyzing electrical circuits.

Short Answer Questions (4 Marks Each)

1. Find the determinant of the matrix $\begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$
2. Write the identity and inverse for the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$
3. Explain trace and transpose of a matrix with examples.
4. Solve $2x + 3y = 8$ and $x - y = 1$ using the matrix method.

UNIT III – COMPLEX NUMBERS

Essay Questions (8 Marks Each)

1. Represent a complex number in polar and exponential forms. Prove Euler's formula and explain its applications in AC circuits.
2. Derive the impedance of a series LCR circuit using phasor representation.
3. Explain the multiplication and division of complex numbers and solve $(3 + 4i)(2 - 5i)$

Short Answer Questions (4 Marks Each)

1. Convert $3 + 4i$ into polar form and find its magnitude and argument.
2. Write the conjugate, modulus, and argument of $z = -5 + 5i$.
3. Divide $(5 + 2i)$ by $(3 - i)$.
4. Represent $4 - 3i$ graphically on the complex plane.

UNIT IV – PROBABILITY

Essay Questions (8 Marks Each)

1. State and derive Bayes' theorem. Solve a problem to find the probability of a defective product coming from one of two machines.
2. Explain Binomial, Poisson, and Gaussian distributions. Mention one physical application

for each.

3. Define random variables (discrete and continuous). Explain probability distributions and their significance in physics.

Short Answer Questions (4 Marks Each)

1. A coin is tossed 5 times. Find the probability of getting exactly 3 heads.
2. Define conditional probability and give one example.
3. In a physics lab, the probability of a detector recording an event is 0.2. Find the probability of exactly 2 detections in 5 trials (Binomial).
4. State two properties of Gaussian distribution.

UNIT V – FOURIER ANALYSIS

Essay Questions (8 Marks Each)

1. State and explain Fourier theorem. Derive the expressions for Fourier coefficients of a periodic function.
2. State Fourier theorem? Analyze a square wave using Fourier theorem.
3. State Fourier theorem? Analyze a Sawtooth wave using Fourier theorem.

Short Answer Questions (4 Marks Each)

1. Define a periodic function with an example.
2. Write the first two non-zero Fourier coefficients for a sawtooth wave.
3. Explain how Fourier analysis is used to analyze electrical signals.
4. Find the Fourier coefficients for a function $f(x) = x$ in the interval $(-\pi, \pi)$

S.R.R & C.V.R. GOVERNMENT DEGREE COLLEGE (A) VIJAYAWADA
B.Sc (PHYSICS) Honours 25-26
SEMESTER-1

MODEL QUESTION PAPER

COURSE 1: INTRODUCTION TO MATHEMATICAL PHYSICS

Time: 3 hours

Max marks: 60M

SECTION-A

Answer any Five of the following questions

5x 4M = 20M

1. Define gradient of a scalar field and explain its physical significance.
2. Calculate the divergence of the vector field $A = x^2i + y^2j + z^2k$.
- 3 Find the determinant of the matrix $\begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$
4. Solve $2x + 3y = 8$ and $x - y = 1$ using the matrix method.
5. Convert $3 + 4i$ into polar form and find its magnitude and argument
6. Divide $(5 + 2i)$ by $(3 - i)$.
7. A coin is tossed 5 times. Find the probability of getting exactly 3 heads.
8. Define conditional probability and give one example.
9. Define a periodic function with an example
10. Explain how Fourier analysis is used to analyze electrical signals

SECTION-B

Answer all the following questions.

5x8M = 40M

11. Explain divergence and curl of a vector field. Discuss their physical interpretations with examples from physics. **(Part A)**

Or

- 12) State and prove Stokes' theorem and use any example **(Part B)**

- 13) Define eigen values and eigenvectors. Derive the characteristic equation for a 2×2 matrix and calculate its eigen values. **(Part A)**

Or

- 14) Solve a system of two linear equations using matrix methods and explain its application in analyzing electrical circuits **(Part B)**

- 15) Represent a complex number in polar and exponential forms. Prove Euler's formula and explain its applications in AC circuits. **(Part A)**

Or

- 16) Derive the impedance of a series LCR circuit using phasor representation. **(Part B)**

- 17) State and derive Bayes' theorem. Solve a problem to find the probability of a defective product coming from one of two machines. **(Part A)**

Or

- 18) Explain Binomial, Poisson, and Gaussian distributions. Mention one physical application for each. **(Part B)**

- 19) State and explain Fourier theorem. Derive the expressions for Fourier coefficients of a periodic function. **(Part A)**

Or

- 20) State Fourier theorem? Analyze a square wave using Fourier theorem. **(Part B)**

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA.
SEMESTER-1- B.Sc PHYSICS MAJOR 25-26
COURSE 2:Mechanics and Properties of Matter-SYLLABUS

Theory	3 hrs/week	Credits: 3
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COURSE OBJECTIVE:

To provide students with a foundational understanding of classical mechanics and the physical properties of matter, including particle dynamics, central forces, elasticity, fluid behavior, and the basic principles of special relativity.

LEARNING OUTCOMES: After successful completion of the course, students will be able to:

1. Apply Newton's laws to variable mass systems and analyze particle collisions using conservation laws and scattering theory.
2. Describe motion under central forces and derive orbital dynamics including Kepler's laws and satellite motion.
3. Explain elastic behaviour of materials using stress-strain relations, and analyze the bending of beams and torsional motion.
4. Interpret fluid dynamics concepts such as streamline flow, Bernoulli's principle, and viscosity with practical applications.
5. Understand the key postulates of special relativity and apply Lorentz transformations to problems involving time dilation, length contraction, and mass-energy equivalence.

UNIT-I: MECHANICS OF PARTICLES (9 hrs.)

Part (A):Newton's Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum.

Part (B):Elastic and Inelastic collisions with examples, concept of impact parameter, scattering cross-section, Rutherford scattering-derivation of equation for scattering angle and scattering cross-section.

UNIT-II: CENTRAL FORCES (9 hrs.)

Part (A):Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equations of motion under a central force.

Part (B): derivation of Kepler's laws, motion of satellites- Concept of Escape and Orbital velocity, Geo-stationary satellites.

UNIT III: ELASTICITY AND BENDING OF BEAMS (9 hrs)

Part (A):Stress and strain, Hooke's Law, Elastic moduli – Young's, bulk, and shear modulus, Poisson's ratio – Physical meaning.

Part (B):Beams-Definition and Examples, Types, point and distributed load, Cantilever and uniform bending – Qualitative treatment, Torsional pendulum – working principle and uses.

UNIT IV: FLUID MECHANICS

(9 hrs)

Part (A): Fluids – Properties and classification, Streamline vs turbulent flow, Reynolds number, Bernoulli's theorem – Statement, simple derivation and applications (Venturimeter, airplane lift)

Part (B): Equation of continuity – derivation and explanation, Viscosity – Poiseuille's law (statement and qualitative explanation), Surface tension – Examples and qualitative ideas.

UNIT V: SPECIAL THEORY OF RELATIVITY

(9 hrs.)

Part (A): Galilean relativity, absolute frames, Michelson-Morley experiment, negative result, postulates of special theory of relativity, Lorentz transformation

Part (B): Time dilation, length contraction, relativistic addition of velocities, mass-energy relation-Derivation of the expression, Mass energy equivalence and examples.

NOTE: Question paper should prepare from Part A & Part B at least one question from each part.

REFERENCE BOOKS:

1. BSc Physics -Telugu ACademy, Hyderabad
2. Mechanics - D.S. Mathur, Sulthan Chand & Co, New Delhi
3. Mechanics - J.C. Upadhyaya, Ramprasad & Co., Agra
4. Properties of Matter - D.S. Mathur, S. Chand & Co, New Delhi ,11th Edn., 2000
5. Physics Vol. I - Resnick-Halliday-Krane ,Wiley, 2001
6. Properties of Matter – Brijlal&Subramanyam, S. Chand & Co. 1982
7. Mechanics-EM Purcell, Mc Graw Hill
8. University Physics-FW Sears, MW Zemansky & HD Young, Narosa Publications, Delhi
9. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
10. Mechanics, S. G. Venkatachalapathy, Margham Publication, 2003.
11. Fluid Mechanics – Frank M. White, McGraw Hill.
12. Textbook of Fluid Dynamics – M. D. Raisinghania, S. Chand & Co.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA.
SEMESTER-1- B.Sc PHYSICS MAJOR
COURSE 2:Mechanics and Properties of Matter

Practical: 2 hrs/week

Credits: 1

COURSE OBJECTIVE:

To develop practical skills in the use of laboratory equipment and experimental techniques for measuring properties of matter and analyzing mechanical systems.

LEARNING OUTCOMES:

1. **Demonstrate a practical understanding of classical mechanics** by performing experiments on momentum, collisions, and motion under force.
2. **Analyze physical systems involving elasticity, fluid flow, and torsion** through hands-on measurements and data interpretation.
3. **Apply fundamental physics principles** to explain satellite motion, scattering phenomena, and beam bending using experiments and simulations.
4. **Use scientific simulations and digital tools** to visualize and investigate abstract concepts such as rocket motion, central forces, and relativity.
5. **Develop experimental, observational, and analytical skills** including data recording, graph plotting, and error estimation in real and virtual environments.

Minimum of 6 experiments to be conducted and recorded

1. Young's modulus by uniform bending
2. Young's modulus by non-uniform bending
3. Rigidity modulus using torsional pendulum
4. Surface tension by capillary rise method
5. Flywheel – Determination of moment of inertia
6. Bifilar suspension – moment of inertia of a rectangular body
7. Radius of capillary tube by Hg thread method
8. Simulation of rocket motion using water rocket or computer simulation.
9. Verification of Kepler's third law using orbit simulation.
10. Simulation-based study of Rutherford scattering.
11. Determination of modulus of rigidity using Maxwell's needle.
12. Measurement of Poisson's ratio of a rubber tube.

13. Verification of Bernoulli's theorem using a horizontal tube setup.
14. Demonstration of lift on an airfoil using airflow setup.
15. Simulation of Michelson-Morley experiment.
16. Visualization of time dilation and length contraction using simulation.

STUDENT ACTIVITIES

Unit I: Mechanics of Particles

Activity: Collision Experiments

Students can set up simple collision experiments using marbles, carts, or other objects. They can measure the initial and final velocities, masses, and analyze the momentum conservation. By varying the conditions (e.g., masses, initial velocities), they can observe the effects on the collision outcomes.

Unit II: Central Forces

Activity: Pendulum Motion Students can investigate the motion of a simple pendulum by varying its length and measuring the time period. They can analyze the relationship between the period and the length, and discuss the concept of centripetal force and its role in circular motion.

Unit III: Elasticity and Bending of Beams

Activity: Beam Bending Experiment

Use rulers or meter sticks on supports to apply loads and measure deflection. This hands-on demo helps visualize how elasticity and loading affect real-world structures.

Unit IV: Lagrangian Mechanics

Activity: Apply Lagrangian mechanics to various physical systems

Unit V: Special Theory of Relativity

Activity: Time Measurement Students can perform a time measurement experiment using simple devices like water clocks or sand timers. They can compare the measured time between two events at different relative speeds and discuss the concept of time

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SEMESTER-1- B.Sc PHYSICS MAJOR 25-26

COURSE 2:Mechanics and Properties of Matter

BLUE PRINT

Time: 3 Hours

Max. Marks: 60 M

Unit	Essay Answer Questions	Short Answer Questions	Numerical Problems
Unit I	2 (with internal choice)	2	0
Unit II	2 (with internal choice)	2	0
Unit III	2 (with internal choice)	1	1
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	1	1

NOTE: Question paper should prepare from Part A& Part B at least one question from each part.

SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA
B.Sc PHYSICS MAJOR 25-26
SEMESTER-I
COURSE 2: MECHANICS AND PROPERTIES OF MATTER

MODEL QUESTION PAPER

Time: 3 Hours

Max. Marks: 60M

Section-A

Answer any FIVE of the following Questions

5X4=20 Marks

1. Write a short note on conservation of Energy and Momentum. **(Part A)**
2. Define impact parameter and Scattering cross-section. **(Part B)**
3. Show that conservative force as negative gradient of potential energy? **(Part A)**
4. Write a short note on Geo-stationary satellites? **(Part B)**
5. Calculate the Poisson's ratio of a material when it's Young's modulus $Y = 7.25 \times 10^{10} \frac{N}{m^2}$ and bulk modulus $K = 11 \times 10^{10} \frac{N}{m^2}$ are given. **(Part A)**
6. Explain the Cantilever beam? **(Part B)**
7. What is Reynolds number? Explain it. **(Part A)**
8. Discuss about Equation of continuity? **(Part B)**
9. What is absolute frame? Explain the negative result obtained in Michelson-Morley experiment. **(Part A)**
10. If a rod travels with a speed of $V = 0.6C$ along its length, then calculate the percentage of contraction. (C is velocity of light) **(Part B)**

Section-B

Answer ALL of the following questions

5X8=40 Marks

11. What is a variable mass system? Derive an expression for the motion of a rocket. **(From Part A)**

OR

12. Obtain the equation for the angle of Scattering of alpha particle in Rutherford scattering? **(Part B)**
13. Define central force. Derive the equation of motion of a particle under the central force? **(Part A)**

OR

14. State Kepler's laws and hence deduce Kepler's first law? **(Part B)**
15. Define the three elastic moduli. Derive the relation among them. **(Part A)**

OR

16. What is Torsional pendulum? Discuss working Principle and Uses? **(Part B)**
17. State and derive the Bernoulli's theorem? Mention the applications of the theorem. **(Part A)**

OR

18. What is Viscosity? Explain the Poiseuille's law with necessary theory? **(Part B)**
19. Describe the construction and working of Michelson-Morley experiment. **(Part A)**

OR

20. Derive an equation for Mass-Energy relation. **(Part B)**

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SEMESTER-1- B.Sc PHYSICS MAJOR 25-26
COURSE 2:Mechanics and Properties of Matter

Question Bank

UNIT-I
Mechanics of Particles

Essay Questions

1. What is a variable mass system? Derive an expression for the motion of a rocket.
2. Derive an equation for scattering cross section in Rutherford scattering?
3. Obtain the equation for the angle of scattering of alpha particle in Rutherford scattering.

Short Answer Questions

1. Define impact parameter and Scattering Cross-section.
2. Write a short note on conservation of Energy and Momentum.
3. Derive the equation for the motion of a variable mass system.
4. Distinguish between elastic and inelastic collisions. Give examples.

UNIT II
Central forces
Essay Questions

1. Define central force. Derive the equation of motion of a particle under the central force?
2. State Kepler's laws and hence deduce Kepler's first law?
3. What is Conservative Force? Show that central forces are conservative in nature?

Short Questions

1. Derive Kepler's second law and third law?
2. Write a note on motion of a satellite?
3. Write a short note on Geo-stationary satellites?
4. Show that conservative force as negative gradient of potential energy?

UNIT III
Elasticity and Bending of Beams
Essay Questions

1. Define the three elastic moduli. Derive the relation among them.
2. What is a beam? Explain different types of beams with examples?
3. What is Torsional pendulum? Discuss working Principle and Uses?

Short Questions

1. What is Hook's law? Explain it.
2. Explain the Poisson's ratio?
3. Explain the Cantilever beam?
4. Discuss uniform bending with examples?

UNIT IV
Fluid Mechanics
Essay Questions

1. State and derive the Bernoulli's theorem? Mention the applications of the theorem.
2. What is Viscosity? Explain the Poiseuille's law with necessary theory?
3. What is Surface tension? Explain with examples.

Short Questions

1. Explain the Properties and classification of Fluids?
2. What is Reynolds number? Explain it.
3. Discuss about Equation of continuity?
4. Write the differences between Streamline flow and turbulent flow?

UNIT- V
Special theory of Relativity
Essay Questions

1. State the postulates of special theory of relativity. Derive Lorentz transformation equations?
2. Describe the construction and working of Michelson-Morley experiment.
3. Derive an equation for Mass-Energy relation.

Short Answer Questions

1. What is absolute frame? Explain the negative result obtained in Michelson-Morley experiment.
2. What is Length contraction? Derive an equation for it.
3. Derive an equation for the Time dilation?
4. Write a short note on addition of velocities.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA.

B.Sc PHYSICS MAJOR

SEMESTER-II

COURSE3: WAVES AND OPTICS

Theory

Credits: 3

3hrs/week

COURSE OBJECTIVE:

The course aims to develop a foundational understanding of oscillatory motion, wave behavior in strings and bars, and optical phenomena like interference, diffraction, and polarization. Students will learn to mathematically analyze vibrations and light behavior through theoretical and experimental approaches.

LEARNING OUTCOMES:

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

1. Describe the basic characteristics of waves such as frequency, wavelength, amplitude, period, and speed and utilize mathematical relationships related to wave characteristics.
2. Distinguish between Longitudinal and Transverse waves.
3. Understand the phenomenon of interference of light and its formation in Thin films and Newton's rings.
4. Distinguish between Fresnel's diffraction and Fraunhofer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating and to describe the construction and working of zone plate and make the comparison of zone plate with convex lens
5. Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.

UNIT-I: SIMPLE HARMONIC, DAMPED & FORCED OSCILLATIONS (9 Hrs.)

Part (a): Simple Harmonic Oscillator: Solution of differential equation, and physical characteristics, Principle of superposition, Combination of two mutually perpendicular SHMs (1:1 frequencies), Lissajous figures.

Part (b): Damping, Damped Harmonic Oscillator: Solution of differential equation, Energy considerations, Logarithmic decrement, relaxation time, quality factor, Forced Oscillations: Solution of differential equation, Amplitude resonance.

UNIT-II VIBRATING STRINGS AND BARS (9Hrs.)

Part (a): Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Laws of transverse vibrations of strings.

Part (b): Energy transport and transverse impedance, longitudinal vibrations in bars- wave equation and its general solution. Special cases (i) bar fixed at both ends (iii) bar fixed at one end.

UNIT-III: INTERFERENCE (9hrs)

Part (a): Introduction – Coherent sources and coherence, Conditions for interference of light. Fresnel's biprism determination of wavelength of light, change of phase on reflection, colors of thin films.

Part (b): Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Determination of wavelength of monochromatic light using Newton's rings.

UNIT-IV: DIFFRACTION(9 hrs.)

Part (a): Introduction, distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction pattern with N slits (diffraction grating), Dispersive of the grating, Resolving power of grating, Determination of wavelength of light in normal incidence using diffraction grating.

Part (b): Fresnel's half period zones-area of the half period zones-zone plate, Difference between interference and diffraction.

UNIT-V: POLARIZATION (9 hrs.)

Part (a): Polarized light: methods of polarization by reflection, refraction, double refraction, Brewster's law, Malus law, Nicol prism polarizer and analyzer, Quarter wave plate, Half wave plate

Part (b): optical activity - Determination of specific rotation by Laurent's half shade Polarimeter. Idea of elliptical and circular polarization

REFERENCEBOOKS:

1. BSc Physics Vol.1, Telugu Academy, Hyderabad.
2. BSc Physics Vol.2, Telugu Academy, Hyderabad
3. Fundamentals of Physics. Halliday/Resnick/Walker, Wiley India Edition 2007.
4. Waves & Oscillations. S. Badami, V. Balasubramanian and K.R.Reddy, Orient Longman.
5. College Physics-I.T. Bhimasankaram and G.Prasad. Himalaya Publishing House.
6. Optics– Ajoy Ghatak, Tata McGraw Hill
7. Fundamentals of Optics –Jenkins and White, McGraw Hill
8. Wave Optics and Vibrations–N. Subrahmanyam & Brijlal, S.Chand & Co.
9. Vibrations and Waves–H. J.Pain, Wiley

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA.
B.Sc PHYSICS MAJOR
SEMESTER-II
COURSE 3: WAVES AND OPTICS

Practical

Credits: 1

2hrs/week

COURSE OBJECTIVE:

The Course Objective for a practical course in electricity and magnetism may include to develop practical skills in handling electrical and electronic components, such as resistors, capacitors, inductors, transformers, and oscillators.

LEARNING OUTCOMES:

1. Determine fundamental mechanical quantities like acceleration due to gravity and spring constant using compound pendulum and spring-based experiments, applying principles of oscillatory motion.
2. Apply statistical methods to analyze experimental data, estimate errors, and understand the importance of precision in repeated time-period measurements using a simple pendulum.
3. Explore wave phenomena through sonometer experiments, verifying laws of vibrations in stretched strings, and understand the relationship between frequency, tension, and length.
4. Analyze interference patterns in Newton's rings and wedge method to determine lens curvature and wire thickness, demonstrating coherence and phase concepts in light.
5. Examine diffraction effects using grating and prisms to determine wavelength and dispersive power, and assess optical resolving capabilities of telescopes and gratings.
6. Investigate polarization phenomena through polarimetry and understand optical activity by determining specific rotation of optically active substances.

Minimum of 6 experiments to be conducted and recorded

1. Determination of 'g' by compound/bar pendulum
2. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis.
3. Solving equation of motion for DHO & FHO using MATLAB/OCTAVE/Python
4. Determination of the force constant of a spring by static and dynamic method.
5. Verification of laws of vibrations of stretched string –sonometer.
6. Determination of radius of curvature of a given convex lens-Newton's rings.
7. Resolving power of grating.

8. Study of optical rotation–polarimeter.
9. Fourier transform simulation of single slit diffraction
10. Fourier transform simulation of diffraction at circular, rectangular aperture, edge
11. Dispersive power of a prism.
12. Determination of wavelength of light using diffraction grating-normal incidence method.
13. Determination of wavelength of laser light using diffraction grating.
14. Resolving power of a telescope.
15. Refractive index of a liquid-hallow prism.
16. Determination of thickness of a thin wire by wedge method.

STUDENT ACTIVITIES

UNIT-I: SIMPLE HARMONIC, DAMPED & FORCED OSCILLATIONS

Activity: Measuring the period of a simple pendulum and verifying the relationship between the period and the length of the pendulum. Students can use a stopwatch and a ruler to measure the time for a fixed number of oscillations and calculate the period.

Activity: Measuring the damping coefficient of a mass-spring system and calculating the quality factor. Students can measure the amplitude of the system as it undergoes damped oscillations and use the logarithmic decrement formula to calculate the damping coefficient.

UNIT-II VIBRATING STRINGS AND BARS

Activity: Measuring the speed of sound in a metal rod and comparing it with the theoretical value. Students can use a microphone and an oscilloscope to measure the time delay between two reflections of a sound pulse in the rod. They can then use the formula for the speed of sound in a solid to calculate the speed and compare it with the theoretical value

UNIT-III: INTERFERENCE

Ask students to measure the diameter of the central bright spot and the diameter of the n th ring for different values of n , and then calculate the wavelength of light

UNIT-IV: DIFFRACTION

Build a simple diffraction grating using a piece of cardboard and some sewing needles. Ask students to measure the distance between the needles, count the number of lines per unit length, and then calculate the grating spacing and the wavelength of light.

UNIT-V: POLARIZATION

Ask students to measure the angle of rotation of the polarized light before and after passing through the sample, and then calculate the specific rotation of the sample.

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B.Sc PHYSICS MAJOR

SEMESTER-II

COURSE 3: WAVES AND OPTICS

BLUE PRINT

Unit no	Essay answer questions	Short answer questions	Numerical problem
Unit I	1 essay from Part A 1 essay from part B (with internal choice)	2	0
Unit II	1 essay from Part A 1 essay from part B (with internal choice)	2	0
Unit III	1 essay from Part A 1 essay from part B (with internal choice)	2	1
Unit IV	1 essay from Part A 1 essay from part B (with internal choice)	1	0
Unit V	1 essay from Part A 1 essay from part B (with internal choice)	1	1

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA.
B.Sc PHYSICS MAJOR
SEMESTER-II
COURSE 3: WAVES AND OPTICS
MODEL QUESTION PAPER

Time: 3 hours

Max marks: 60M

SECTION-A

Answer any Five of the following questions

5x 4M = 20M

1. Write a short note on Lissajous figures.
2. What is logarithmic decrement? Give its physical significance.
3. Obtain the equation for transverse wave propagation along a stretched string.
4. Explain the phenomenon of energy transport
5. Explain colors of thin films.
6. Find the minimum thickness of a film of refractive index 1.25, which will strongly reflect the light of wavelength 589 nm. Also find the minimum thickness of the film to be anti-reflecting.
7. Distinguish between the interference and diffraction.
8. Obtain the formula of resolving power of a grating?
9. Write a short note on optical cavity.
10. Two polaroids are kept with their transmission axes inclined at 30° . Unpolarised light of intensity I falls on the first polaroid. Find out the intensity of light emerging from the second polaroid.

SECTION-B

Answer all the following questions.

5x8M = 40M

11. What is a simple harmonic oscillator? Derive the equation of motion of a simple harmonic oscillator and find its solution.

Or

12. What are Forced Oscillations and also find the solution for it.
13. Give the solution of the differential wave equation when longitudinal vibrations are produced in a Bar. Hence, discuss the nature of the harmonics produced in a bar clamped at both ends.

Or

14. Deduce the frequencies of transverse vibrations of a bar clamped at one end and free at the other. Explain the physical characteristics of these vibrations.
15. Describe Newton's rings method for measuring the wavelength of monochromatic light. Give necessary theory.

Or

16. Determine wavelength of light using Fresnel's biprism
17. Explain Fraunhofer diffraction pattern with N slits or plane diffraction grating.

Or

18. Explain Fresnel's half period zones with neat diagram?
19. Explain the construction and working of Nicol's Prism. How Nicol prism works as a

polarizer and an analyzer?

Or

20. Explain the production and detection of circularly and elliptically polarized light?

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA.
B.Sc PHYSICS MAJOR
SEMESTER-II
COURSE 3: WAVES AND OPTICS
Question Bank

Time: 3 hours

Max marks: 60M

UNIT-I: SIMPLE HARMONIC, DAMPED & FORCED OSCILLATIONS (9 Hrs.)

Long Answer Questions

1. What is a simple harmonic oscillator? Derive the equation of motion of a simple harmonic oscillator and find its solution.
2. Describe the resultant motion of the superposition of two mutually perpendicular SHMs with equal frequencies in various cases.
3. Explain the Damped Harmonic Oscillator with its solution
4. What are Forced Oscillations and also find the solution for it.

Short Answer Questions

1. Write a short note on Lissajous figures.
2. What is logarithmic decrement? Give its physical significance.
3. What is amplitude resonance in case of forced vibrations? State its condition.
4. Define the terms (i) relaxation time (ii) quality factor

UNIT-II VIBRATING STRINGS AND BARS (9Hrs.)

Long Answer Questions

1. Prove that the string clamped at both ends has all possible harmonics.
2. Give the solution of the differential wave equation when longitudinal vibrations are produced in a Bar. Hence, discuss the nature of the harmonics produced in a bar clamped at both ends.
3. Deduce the frequencies of transverse vibrations of a bar clamped at one end and free at the other. Explain the physical characteristics of these vibrations.

Short Answer Questions

1. Obtain the equation for transverse wave propagation along a stretched string.
2. Explain the phenomenon of energy transport
3. Write a note on transverse impedance
4. What are the laws of transverse waves along stretched string?

UNIT-III: INTERFERENCE(9hrs)

Long Answer Questions:

1. Determine wavelength of light using Fresnel's biprism
2. Describe Newton's rings method for measuring the wavelength of monochromatic light. Give necessary theory.

3. Discuss the formation and localization of interference fringes in a thin wedge – shaped film. Describe an interference experiment to determine diameter of a wire of an extremely small diameter.

Short Answer Questions

1. Discuss coherence conditions for interference of light.
2. What is meant by phase change on reflection?
3. Explain colors of thin films.

UNIT-IV: DIFFRACTION(9 hrs.)

Long Answer Questions:

1. Explain Fraunhofer diffraction pattern with N slits or plane diffraction grating.
2. Explain Fresnel's half period zones with neat diagram?
3. Explain the construction and working of Zone Plate?

Short Answer Questions

1. Determine the wavelength of light in normal incidence method using diffraction grating.
2. Distinguish between Fresnel and Fraunhofer diffractions
3. Obtain the formula of resolving power of a grating?
4. Write a short note on dispersive power of a grating.
5. Compare zone plate with convex lens.
6. What are the differences between interference and diffraction

UNIT- V POLARISATION(9 hrs.)

Long Answer Questions:

1. Analyse the construction and working of Laurent's half shade polarimeter. How would you use it to determine the specific rotation?
2. Explain the construction and working of Nicol's Prism. How Nicol prism works as a polarizer and an analyzer?
3. Explain the production and detection of circularly and elliptically polarized light?

Short Answer Questions

1. Explain the concept of double refraction?
2. Explain Malus law and Brewster's law?
3. Explain the construction and working of Quarter wave plate?
4. Explain the construction and working of half wave plate?
5. Write a short note on optical cavity.

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DEPARTMENT OF PHYSICS & ELECTRONICS

SEMESTER-II- PHYSICS (MAJOR)25-26

COURSE 4: HEAT AND THERMODYNAMICS

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

The course on Heat and Thermodynamics aims to provide students with a fundamental understanding of the principles of heat and energy transfer and their applications in various fields

LEARNING OUTCOMES:

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

1. Understand the basic aspects of kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path of molecular collisions and the transport Phenomenon in ideal gases
2. Gain knowledge on the basic concepts of thermodynamics, the first and the second law of thermodynamics, the basic principles of refrigeration, the concept of entropy, the thermodynamic potentials and their physical interpretations. Understand the working of Carnot's ideal heat engine, Carnot cycle and its efficiency
3. Develop critical understanding of concept of Thermodynamic potentials, the formulation of Maxwell's equations and its applications.
4. Differentiate between principles and methods to produce low temperature, liquefy air, and understand the practical applications of substances at low temperatures.
5. Examine the nature of black body radiations and the basic theories.

UNIT-I: KINETIC THEORY OF GASES (9 hrs)

Part A: Kinetic Theory of gases- Introduction, Lammert's toothed wheel method; Mean free path, Principle of equipartition of energy,

Part B: Transport phenomenon in ideal gases: viscosity and Thermal conductivity.

UNIT-II: THERMODYNAMICS (9 hrs)

Part A: Introduction- Reversible and irreversible processes, Carnot's engine and its efficiency, Thermodynamic scale of temperature, Second law of thermodynamics Entropy: Physical significance,

Part B: Change in entropy in reversible and irreversible processes; Change of entropy when ice changes into steam. Temperature- Entropy (T-S) diagram and its uses.

UNIT-III: THERMODYNAMIC POTENTIALS AND MAXWELL'S EQUATIONS (9 hrs)

Part A: Thermodynamic Potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials.

Part B: Clausius-Clayperon's equation, Joule-Kelvin coefficient for ideal gases.

UNIT-IV: LOW TEMPERATURE PHYSICS (9 hrs)

Part A: Methods for producing very low temperatures, Critical temperature, Inversion

temperature, Joule Kelvin effect, Porous plug experiment, Joule expansion, Expression for Joule Thomson cooling,

Part B: Distinction between adiabatic and Joule Thomson expansion, Production of low temperatures by adiabatic demagnetization (qualitative), Applications of low temperature physics.

UNIT-V: QUANTUM THEORY OF RADIATION (9 hrs)

Part A: Black body, Ferry's black body, Wein's displacement law and Rayleigh-Jean's law (No derivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh- Jean's law from Planck's law,

Part B: Solar constant and its determination using Angstrom pyro heliometer, Estimation of surface temperature of Sun.

NOTE: Question paper should prepare from Part A & Part B at least one question from each part.

REFERENCE BOOKS

1. BSc Physics, Vol.2, Telugu Academy, Hyderabad
2. Thermodynamics, R.C. Srivastava, S.K. Saha & Abhay K. Jain, Eastern Economy Edition.
3. Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath & Co. Ltd., Meerut
4. Fundamentals of Physics. Halliday/Resnick/Walker. C. Wiley India Edition, 2007
5. Heat and Thermodynamics - N Brij Lal, P. Subrahmanyam, S. Chand & Co., 2012
6. Heat and Thermodynamics - MS Yadav, Anmol Publications Pvt. Ltd, 2000
7. University Physics, HD Young, MW Zemansky, FW Sears, Narosa Publishers, New Delhi

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA
HEAT AND THERMODYNAMICS 2025-26

BLUE PRINT

Unit	EssayAnswer Questions	ShortAnswer Questions	Numerical Problems
UnitI	2(withinternalchoice)	2	0
UnitII	2(withinternalchoice)	1	1
UnitIII	2(withinternalchoice)	2	0
UnitIV	2(withinternalchoice)	1	0
UnitV	2(withinternalchoice)	1	1

NOTE: Question paper should prepare from Part A& Part B at least one question from each part.

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA
HEAT AND THERMODYNAMICS 2025-26

QUESTION BANK

Theory Credits: 3

3hrs/week

UNIT-I – KINETIC THEORY OF GASES

Long Answer Questions:

1. Describe experimental verification of Maxwell's Law of distribution of molecular speeds in a gas- Toothed wheel experiment.
2. Derive the coefficient of thermal conductivity of a gas on the basis of kinetic theory of gases.
3. Derive the coefficient of viscosity of a gas on the basis of kinetic theory of gases.

Short answer Questions

1. What is meant by mean free path? Explain in brief.
2. Write a short note on the principle of equipartition of energy.
3. What do you understand by transport phenomenon in ideal gases?
5. Explain briefly the Maxwell's distribution of molecular speeds.

UNIT-II - THERMODYNAMICS

Long Answer Questions:

1. Explain the working of Carnot's engine and derive an expression for its efficiency.
2. What is Temperature-Entropy (T-S) diagram? Obtain the relation for the efficiency of a Carnot Cycle. Write its uses.
3. Write a note on change in entropy in reversible and irreversible processes.

Short Answer Questions

1. Write a short note on reversible and irreversible processes.
2. Calculate the efficiency of a reversible engine that operates between 427°C and 138°C.
3. Write a short note on second law of thermodynamics.
4. What is entropy and give its physical significance.
5. Derive an expression for change of entropy when ice changes into steam.

UNIT-III –THERMODYNAMIC POTENTIALS AND MAXWELLS EQUATIONS

Long Answer Questions:

1. Derive Maxwell's thermodynamic equations using thermodynamic potentials.
2. Derive Clausius- Clapeyron's equation and write its applications.
3. Derive an expression for Joule-Kelvin coefficient for ideal gas.

Short Answer Questions

1. What are thermodynamic potentials and write their significance.
2. Derive Clausius-Clapeyron's equation.
3. State and explain Joule – Kelvin Effect.

UNIT-IV – LOW TEMPERATURE PHYSICS

Long Answer Questions:

1. Describe the Joule-Thomson experiment (porous plug experiment) and explain the results.
2. Derive an expression for Joule Thomson Cooling.
3. What is adiabatic demagnetization? Describe the production of low temperatures by adiabatic demagnetization.

Short Answer Questions

1. Write the differences between adiabatic and Joule Thomson expansion.
2. Describe various methods of producing very low temperatures.
3. What are different applications of low temperature physics?

UNIT-V - QUANTUM THEORY OF RADIATION

Long Answer Questions:

1. Derive Planck's Law for the distribution of energy in black body radiation.
2. Show that Wien's displacement law is a special case of Planck's Radiation law.
3. What is solar constant and how to determine Solar constant using Angstrom Pyrheliometer?

Short Answer Questions:

1. Estimate the surface temperature of the sun.
2. Explain construction of Fery's black body.
3. State and explain Wein's displacement Law.
4. Deduce Rayleigh-Jean's Law from Planck's law.

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA
HEAT AND THERMODYNAMICS 2025-26

MODEL PAPER

SECTION-A

Answer any Five of the following Questions 5X4=20 Marks

1. Write a short note on mean free path. **(Part A)**
2. Write a short note on transport phenomenon in ideal gases. **(Part B)**
3. Calculate the efficiency of a reversible engine that operates between 327°C and 127°C **(Part A)**
4. Derive an expression for change of entropy when ice changes into steam. **(Part B)**
5. What are thermodynamic potentials and write their significance. **(Part A)**
6. Derive Clausius-Clapeyron's equation. **(Part B)**
7. Describe various methods of producing very low temperatures. **(Part A)**
8. What are different applications of low temperature physics? **(Part B)**
9. Find the wavelength at which maximum energy radiated by a black body at a temperature 327°C. Wein's constant 3×10^{-3} m-K. **(Part A)**
10. Estimate the surface temperature of the Sun. **(Part B)**

SECTION-B

Answer all questions 5X8=40 Marks

1. Describe experimental verification of Maxwell's Law of distribution of molecular speeds in a gas- Toothed wheel experiment. **(Part A)**

OR

Derive the coefficient of viscosity of a gas on the basis of kinetic theory of gases. **(Part B)**

2. Explain the working of Carnot's engine and derive an expression for its efficiency. **(Part A)**

OR

What is Temperature-Entropy (T-S) diagram? Obtain the relation for the efficiency of a Carnot Cycle. **(Part B)**

3. Derive Maxwell's thermodynamic equations using thermodynamic potentials. **(Part A)**

OR

Derive an expression for Joule-Kelvin coefficient for ideal gases. **(Part B)**

4. Describe the Joule-Thomson experiment (porous plug experiment) and explain the results. **(Part A)**

OR

What is adiabatic demagnetization? Describe the production of low temperatures by adiabatic demagnetization. **(Part B)**

5. Show that Wien's displacement law is a special case of Planck's Radiation law. **(Part A)**

OR

What is solar constant and how to determine Solar constant using Angstrom Pyrheliometer? **(Part B)**

SEMESTER-II

COURSE 4: HEAT AND THERMODYNAMICS

Practical Credits: 1

2 hrs/week

COURSE OBJECTIVE:

The objectives for practical's in Heat and Thermodynamics can vary depending on the specific course or program, but here are some general objectives that may apply, to develop practical skills in the use of laboratory equipment and experimental techniques for studying heat and thermodynamics.

LEARNING OUTCOMES:

1. Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for studying heat and Thermodynamics.
2. Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.
3. Accurate recording and analysis of data: Students should be able to accurately record and analyze experimental data, including understanding the significance of error analysis and Statistical methods.
4. Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in Experimental design and analysis.
5. Understanding of physical principles: Students should develop an understanding of the physical principles governing heat and thermodynamics, including the laws of thermodynamics, heat transfer, and thermodynamic cycles.

Minimum of 6 experiments to be done and recorded

1. Energy gap of a semi-conductor
2. Thermal conductivity of bad conductor - Lee's method
3. Thermal conductivity of rubber.
4. Measurement of Stefan's constant.
5. Specific heat of a liquid by applying Newton's law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermoemf- thermo couple - Potentiometer
8. Thermal behavior of an electric bulb (filament/torch light bulb)
9. Study of variation of resistance with temperature - Thermistor.
10. Thermal expansion of solids using metal ball and a ring

STUDENT ACTIVITIES

Unit I: Kinetic Theory of Gases

Activity: Speed Distribution Analysis

Students can conduct a simple experiment using gas molecules (e.g., small balls) in a container. They can measure the speeds of the molecules using a motion sensor or stopwatch and analyze the distribution of molecular velocities. They can compare the observed distribution with the expected Maxwell's law of distribution.

Unit II: Thermodynamics

Activity: Heat Engine Efficiency Calculation

Students can work in groups to design a simple heat engine (e.g., using a syringe and a small turbine). They can measure the temperature changes and calculate the efficiency of their engine. They can compare their calculated efficiency with the theoretical Carnot efficiency to understand the limitations of real heat engines.

Unit III: Thermodynamic Potentials and Maxwell's Equations

Activity: Thermodynamic Relations Verification

Students can solve numerical problems involving different thermodynamic potentials (internal energy, enthalpy, Helmholtz free energy, and Gibbs free energy) and verify the Maxwell's thermodynamic relations. They can compare the calculated values using different relations to ensure consistency.

Unit IV: Low Temperature Physics

Activity: Adiabatic Demagnetization Experiment

They can discuss the distinction between adiabatic and Joule-Thomson expansions.

Unit V: Quantum Theory of Radiation

Activity: Black Body Radiation Spectrum Analysis

They can estimate the surface temperature of the Sun using the solar constant and Angstrom pyro heliometer data



**S.R.R. & C.V.R. GOVT. DEGREE COLLEGE (A) VIJAYAWADA,
N.T.R. DT.
AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM
Department of PHYSICS & ELECTRONICS
Academic Year-2025-26**

**ACADEMIC YEAR 2025-2026
DEPARTMENT OF PHYSICS & ELECTRONICS**

Smt. P. Sailaja, Incharge of the Department of Physics & Electronics request the Academic Council to Consider and approve the changes in the syllabi recommended by the Board of Studies for the academic year 2025-26.

The BOS meeting held on 18-09-2025.

The resolutions were seconded by Dr.Ch.Srinivasa Rao, Member of the Board of studies.

The Academic council is also requested to accord permission to appoint Examiners for theory and Practical for the academic year 2025-26.

Chairman BOS

Members present

1. Smt.P.Sailaja, Assoc.ProfofPhysics(**Board of studies chairperson**) :
2. Dr. Ch. Srinivasa Rao, (**University Nominee**) :
Professor, Andhra Loyola College, Vijayawada
3. SriT. V. Rambabu, Assist. Prof. of Physics (**Subject Expert**) :
4. Dr.P.GopiKrishna, Asst. Prof.of Dept of ECM (**Subject Expert**) :
5. Sri N.Vara Prasad (**Industrialist**) :
6. T. PujithaM.Sc (Physics)(**Alumni**) :

	S.R.R. & C.V.R. GOVT. DEGREE COLLEGE (A) VIJAYAWADA, N.T.R. DT. AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM Department of PHYSICS & ELECTRONICS Academic Year-2025-26
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List of Examiners and Paper Setters:

S.NO	Name of the Lecturer	Address
1.	Sri.K. Ajay Kumar, Asst. Prof. of Physics Mob:9493474612	GDC,Eluru,W.G.Dt
1	Sri M. Aruna, Lecturer in physics, Mob.no-9490881096	GDC, Kanchikacherla, Krishna Dt
2	Smt.Ch.Komala Lakshmi, Lecturer in Physics, Mob.no-9440151266	GDC(A), Rajamahendravaram, E.G.Dt
3	Kum.G.Sirisha, Lecturer in Physics Mob.no-8121925246	GDC(W),Guntur, Guntur Dt.
4	Sri. Ch.Venkatswara Rao, Asst. Prof. of Physics	GDC(A), Rajamahendravaram, E.G.Dt
5	Dr.P. Gopi Krishna, Asst.Prof. of ECM	K.L. Education Foundation, Vaddeswaram, Guntur.
	Dr. K. Jayadev, Asst. Prof. of Physics	PR GDC(A), Kakinada
7	SmtV.Umalakshmi, Lecturer in Physics Mob no.7799985999	GDC, Mylavaram , NTR Dt

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After thorough Discussion the following Resolutions are made:

1. It is resolved to follow the same syllabus(Revised) prescribed by the APSCHE, Andhra Pradesh for UG students of B.Sc (Physics) honors in all semesters with effect from the Academic Year 2025-26 admitted from the academic year 2025-26 under single major programme with some additional inputs and some deletions.
2. It is resolved to approve the syllabus of Semester I & II Course 1,2,3,4 for A.Y 2025-26
3. It is resolved to approve the syllabus of Multi-Disciplinary Course “Basic Electronics” for the third Semester.
4. Resolved and approved the model question paper pattern for all semester examinations.
5. It is resolved to take 40%marks are eligible to treat as pass both in internal and external examinations.
6. It is resolved to take 60% of marks for external examinations and 40% for internal examinations as same as the BOS of last academic year 2024-25.
7. It is approved blueprint for theory and practical examinations.
8. It is resolved to consider 25 Marks for External evaluation and 25 marks for internal evaluation in Practical examination in all semesters from admitted batches 2025-26.
9. It is resolved to suggested student study projects, Extension activities, and Fieldtrips, curricular and co-curricular activities.
10. If necessary any changes can be made with the permission of chair person.