VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in Physics

I & II Semester Syllabus

Bachelor of Science

With effect from 2024-25 and onwards

29/06/24

Name of the Department: Physics

Semester-I

Course Title: Mechanics and Properties of Matter	**Course code: 24MJPHYS1L**
Total Contact Hours: 55	**Course Credits: 04**
Internal Assessment Marks: 20 marks	**Duration of SEE: 03 hours**
Semester End Examination Marks: 80 marks	

Course Outcomes (CO's):

At the end of the course, students shall be able to:

- Apply conservation laws to physical systems.
- Apply dynamics of rigid bodies to physical systems.
- Explain elastic behaviour of materials.
- Explain properties of fluids based on surface tension and viscosity.

MECHANICS AND PROPERTIES OF MATTER

Unit	Description	Hours
Unit 1	**Frames of reference**: Inertial frames, Galilean transformation equations – position, velocity & acceleration, non-inertial frames of reference. Concept of Fictitious force, rotating frame of reference – relation between acceleration in inertial frame and rotating frame, concept of Coriolis force. **Gravitation:** Newton's Law of Gravitation, Kepler's laws of planetary motion (derivation). Principle of launching of satellites, expressions for orbital velocity, period & altitude of satellites (derivation). Escape velocity (derivation), Geostationary satellites (brief). Remote Sensing Satellites (brief explanation & applications)	**11 hr**
Unit 2	**Conservation Laws**: Explanation of conservation of linear momentum, Center of mass – System of N particles, Motion of centre of mass, Centre of mass of a thin uniform rod and a thin triangular plate. Collision: Types of collision, Collision of two particles, Elastic head on collision between two particles (Expression for Final Velocities), Collision of two particles which stick together (inelastic collision- Expression for Loss of kinetic energy). Relation between momentum and torque, Explanation of Conservation of angular momentum, Examples of conservation angular momentum - planetary or satellite motion. Explanation of conservation of energy, Applications: Motion of a body near the surface of the earth, Linear restoring force (spring).	**11 hr**
Unit 3	**Dynamics of Rigid bodies**: Equation of motion for a rotating rigid body, Radius of gyration, Moment of inertia, Perpendicular and parallel axis theorem with proof, Moment of inertia of a rectangular thin uniform rod, rectangular lamina, circular disc, solid & hollow cylinders, moment of inertia of irregular body, Flywheel – theory. Theory of compound pendulum and bar pendulum.	**11 hr**

Unit 4 **Elasticity**: Hooke's law - Stress-strain diagram, elastic moduli-relation between elastic constants, Poisson's Ratio-expression for Poisson's ratio in terms of elastic constants. Work done in stretching and work done in twisting a wire-Twisting couple on a cylinder. Determination of Rigidity modulus by static torsion, Torsional - pendulum-Determination of Rigidity modulus and moment of inertia. Young's modulus by Searle's method, light cantilever method and uniform bending method (beam loaded at the centre and at the two ends). **11 hr**

Unit 5 **Surface tension:** Definition of surface tension. Surface energy, relation between surface tension and surface energy, pressure difference across curved surface, excess pressure inside spherical liquid drop, angle of contact, capillarity, determination of surface tension by drop weight method. **11 hr**

Viscosity: Streamline flow, turbulent flow, equation of continuity, determination of coefficient of viscosity by Poisulle's method, Stoke's method.

Text books:

1. Mechanic by J. C. Upadhya, 2003, Ram Prasad and Sons publications.
2. Mechanics by D. S. Mathur, New Edition 2000, S. Chand & Co.
3. Mechanics and Relativity by Vidwan Singh Soni, 3 Edition, PHI Lcarning Pvt. Ltd.
4. Mechanics Berkeley Physics Course, Vol.l: Charles Kittel, et.al. 2007, Tata McGraw-Hill.
5. Engineering Mechanics, Basudeb Bhattacharya, 2 Edn, 2015, Oxford University Press.
6. Elements of properties of matter by D.S.Mathur, 2010, S.Chand & Co.

Reference books:

1. Physics: Resnick, Halliday & Walter, 9th Edn, 2010, Wiley.
2. Physics by Halliday and Resnick, Vol 1.
3. University Physics, Ronald Lane Reese, 2003, Thamson Brooks/Cole.

Name of the Department: Physics
Semester-I

Course Title: Mechanics and Properties of Matter-Lab	Course code: 24MJPHYS1P
Total Contact Hours: 56	Course Credits: 02
Internal Assessment Marks: 10	Duration of SEE: 03 hours
Semester End Examination Marks: 40	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1 Setup experiments for the determination of moment of inertia of bodies.
2 Setup experiments for the determination of elastic properties of solids.
3 Setup experiments to verify laws in mechanics and elasticity.
4 Setup experiments for the determination of surface tension, viscosity and other properties of liquids.

MECHANICS AND PROPERTIES OF MATTER-LAB

List of Experiments

1. Determination of g using bar pendulum (L versus T and L versus LT graphs).
2. Determination of moment of inertia of a Fly Wheel.
3. Determination of moment of inertia of an irregular body.
4. Determination of rigidity of modulus using torsional pendulum.
5. Verification of parallel axis theorem.
6. Verification of perpendicular axis theorem.
7. Determine the Young's Modulus of a wire by bar bending method.
8. Determination of elastic constants of a wire by Searle's method.
9. Young's modulus by cantilever-Load versus Depression graph
10. Young's modulus by Koenig's method.
11. Young's modulus by stretching (Searle's apparatus).
12. Modulus of rigidity (twisting).
13. Viscosity of liquid by Stoke's method.
14. Radius of capillary tube by mercury pellet method.
15. Verification of Hook's law of elasticity.
16. Surface tension of liquid by drop weight method.
17. Critical pressure for stream line flow.

Note:

1. Minimum of EIGHT experiments must be carried out.
2. Experiments may be added as and when required with the approval of BoS.

Reference Books:

1. Physics through experiments, by B. Saraf, 2013, Vikas Publications.
2. Lab manual of Physics for undergraduate classes, 1st Edition, Vikas Publications.
3. B.Sc. Practical Physics by CL Arora, Revised Edition 2007, S. Chand & Co.
4. An advanced course in practical physics, D. Chattopadhyay, PC Rakshit, B. Saha, Revised Edition 2002, New Central Book Agency Pvt Ltd.

Name of the Department: Physics

Semester-II

Course Title: Thermal Physics and Waves	**Course code: 24MJPHYS2L**
Total Contact Hours: 55	**Course Credits: 04**
Internal Assessment Marks: 20 marks	**Duration of SEE: 03 hours**
Semester End Examination Marks: 80 marks	

Course Outcomes (CO's):

At the end of the course, students shall be able to:

1. Apply laws of thermodynamics to the thermodynamical situations.
2. Use thermodynamical potentials to understand physical systems.
3. Explain kinetic theory of gases and laws of radiation.
4. Analyse superposition of harmonic waves sound waves using fundamentals of waves.
5. Identify the formation of standing waves in physical systems.
6. Identify the physical parameters and materials for good acoustics.

THERMAL PHYSICS AND WAVES

Unit	Description	Hours
Unit 1	**Introduction:** Review of the concepts of Heat and Temperature. Zeroth Law of thermodynamics (1 Hour) **First Law of Thermodynamics:** Differential form, Internal Energy. Equation of state for an adiabatic process, Work Done during Isothermal and Adiabatic Processes. (4Hours) **Second Law of Thermodynamics:** Kelvin-Planck and Clausius Statements and their Equivalence. Reversible and Irreversible processes with examples. Heat Engines: Carnot engine & efficiency (no derivation). Refrigeration & coefficient of performance, Applications of Carnot engine in locomotion, Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. Concept of Entropy, Second Law of Thermodynamics in terms of Entropy (6 Hours)	**11 hr**
Unit 2	**Third Law of Thermodynamics:** Statement, Significance and Unattainability of Absolute Zero. (3 Hours) **Thermodynamic Potentials:** Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Properties and Applications. (2 Hour) **Maxwell's Thermodynamic Relations:** Derivations and applications of Maxwell's Relations (1) First order Phase Transitions with examples, Clausius - Clapeyron Equation (2) Values of Cp-Cv (3) Joule-Thomson Effect and Joule-Thomson coefficient and derive an equation for Vander Walls gas. Attainment of low temperature by liquefaction of gases(Helium gas) and adiabatic demagnetization. (6 Hours)	**11 hr**

Unit 3 Kinetic Theory of Gases: Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas: Mean (No derivation), RMS and Most Probable Speeds (Derivation). Degrees of Freedom, Law of Equipartition of Energy. Specific heats of Gases. (5 Hours)

Radiation: Blackbody radiation, spectral distribution, the concept of energy density and pressure of radiation, Statement of - Wien's law, Wien's displacement law, Stefan-Boltzmann law, Rayleigh-Jeans law, Ultraviolet Radiation catastrophe and Planck's law of radiation (Derivation). (6 Hours) **11 hr**

Unit 4 Waves: Plane and Spherical Waves. Longitudinal and Transverse Waves. Characteristics of wave motion, Plane Progressive Wave and its equation, Wave Equation – Differential form (derivation). Particle and Wave Velocities: Relation between them, Energy Transport – Expression for intensity of progressive wave, Newton's Formula for Velocity of Sound. Laplace's Correction (Derivation). Brief account of Ripple and Gravity Waves. (Text Book: 1-4) (5 Hours)

Superposition of Harmonic Waves: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats) – Analytical treatment. Superposition of two perpendicular Harmonic Oscillations: Lissajous Figures with equal and unequal frequency- Analytical treatment. Uses of Lissajous' figures. (Text Book: 1-4) (6 Hours) **11 hr**

Unit 5 Standing Waves: Velocity of transverse waves along a stretched string (derivation), Standing (Stationary) Waves in a String - Fixed and Free Ends (qualitative). Theory of Normal modes of vibration in a stretched string, Energy density and energy transport of a transverse wave along a stretched string. Vibrations in rods – longitudinal and transverse modes (qualitative). Normal Modes of vibrations in Open and Closed Pipes – Analytical treatment. Concept of Resonance, Theory of Helmholtz resonator. (Text Book: 1-4) (8 Hours) **11 hr**

Acoustics: Absorption coefficient, Reverberation and Reverberation time, Sabine's Reverberation formula (derivation), Factors affecting acoustics in buildings, Requisites for good acoustics. (Text Book : 1-4) (3 Hours)

Text Books:

1. The Physics of Waves and Oscillations, N K Bajaj Tata McGraw-Hill 2nd Edition, 1984
2. Waves and Oscillations N Subramanyam and Brij Lal Vikas, 2nd Revised Edition 2010
3. A Text Book of Sound D R Khanna and R S Bedi Atma Ram & Sons, 3rd Edition 1952
4. Oscillations and Waves Satya Prakash, Pragathi Prakashan, Meerut, 2nd Edition 2003
5. Heat and Thermodynamics, Brijlal and Subramanyam,
6. Heat and thermodynamics by A K Saxena and C M Tiwari, Alpha science.

Reference Books:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
3. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988,

Name of the Department: Physics
Semester-II

Course Title: Thermal Physics and Waves Lab	**Course code: 24MJPHYS2P**
Total Contact Hours: 56	**Course Credits: 02**
Internal Assessment Marks: 10	**Duration of SEE: 03 hours**
Semester End Examination Marks: 40	

Course Outcomes (CO's):

At the end of the course, students shall be able to:

1. Design experiments in thermal physics and waves.
2. Execute experiments in thermal physics and waves.
3. Analyse experimental results in thermal physics and waves.

THERMAL PHYSICS AND WAVES LAB

List of Experiments:

1. Mechanical Equivalent of Heat by Callender and Barne's method.
2. Coefficient of thermal conductivity of Copper by Searle's apparatus
3. Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method
4. Determination of Stefan's constant / Verification of Stefan's law
5. Variation of thermo-emf across two junctions of a thermocouple with temperature
6. Verification of Clausius –Clapeyron equation and determination of specific enthalpy.
7. Velocity of sound through a wire using Sonometer.
8. Frequency of AC using Sonometer.
9. Study of Lissajous' Figures
10. To verify the laws of transverse vibration using Melde's apparatus.
11. Helmholtz resonator using tuning fork.
12. Helmholtz resonator using electrical signal generator.

Note:

1. Minimum of EIGHT experiments must be carried out.
2. Experiments may be added as and when required with the approval of BoS.

References:

1. Basic Electronics Lab (P242) Manual 2015-16, National Institute of Science Education and Research, Bhubaneswar, 2015.
2. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e.
3. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e

Evaluation Process:

A. Continuous Assessment Scheme (Major Courses): Internal

Sl. No.	**Component**	Maximum Marks
01	Two Session Tests with proper record for assessment (5+5 = 10)	10
02	Assessment of Skill development activities/Seminars/Group Discussion etc., with proper record	05
03	Assignment with proper record	05
	TOTAL	**20**

B. Elective / SEC Courses: Internal

Sl. No.	Component	Maximum Marks
01	Two Session Tests with proper record for assessment	05
02	Assessment of Skill development activities/Seminars/Group Discussion etc., with proper record	05
	TOTAL	**10**

C. Internal Assessment for Practical: Internal

1	Test with proper record for assessment	05
2	Record / Journal	05
	Total	**10**

D. Practical Semester End Examination External (Duration: 3Hrs)

No	Component	Maximum Marks
1	Circuit Diagram/Ray diagram/Tabular Column with proper labeling and units.	10
2	Experimental Skill (proper readings)	12
3	Graph/calculations/Result with Accuracy	08
4	Viva	10
	Total Marks	**40**

E. Project Work Assessment during VI semester: Internal

1	Regular project progress assessment	05 Marks
2	Presentation	05 Marks
	Total	10 Marks

F. Semester End examination assessment for Project

1	Project Report	20 Marks
2	Final Presentation	10 Marks
3	Viva Voice	10 Marks
	Total	40 Marks

THEORY EXAMINATION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS
(Semesters I –VI)

B.Sc. Semester-I Degree Examination; 2024-25
(Semester Scheme 2024-25)

SUBJECT: PHYSICS

Course Name: _____[Course Code]

Time: 3 Hours **Max. Marks: 80**

Instructions to candidates:

1) All sections are compulsory
2) Draw neat and labeled diagrams wherever necessary.

SECTION-A

[1]. Answer **all** the following questions: **(10×2=20)**

a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

Note for paper setters: Set Two questions from each Unit.

SECTION-B

Answer any **Four** of the following: **(4×5=20)**

[2].

[3].

[4].

[5].

[6].

[7].

Note for paper setters: Set at least One question from each Unit.

SECTION -C

Answer any **Four** of the following: **(4×10=40)**

[8].

[9].

[10].

[11].

[12].

[13].

Note for paper setters: Set at least One question from each Unit.

General Note: Preferably at least 25% of questions must be of numerical type

THEORY EXAMINATION QUESTION PAPER PATTERN FOR ELECTIVE SUBJECTS

B.Sc. Semester-V/VI Degree Examination; 2024-25
(Semester Scheme 2024-25)

SUBJECT: PHYSICS

Course Name: _____[Course Code]

Time: 1.5 Hours **Max. Marks: 40**

Instructions to candidates:

1) All sections are compulsory
2) Draw neat and labeled diagrams wherever necessary.

SECTION-A

[1]. Answer **all** the questions: **(5×2=10)**

a)

b)

c)

d)

e)

Note for paper setters: Set at least ONE question from each Unit.

SECTION-B

Answer any **Two** of the following: **(2×5=10)**

[2].

[3].

[4].

Note for paper setters: Set at least One question from each Unit.

SECTION -C

Answer any **TWO** of the following: **(2×10=20)**

[5].

[6].

[7].

Note for paper setters: Set at least One question from each Unit.

THEORY EXAMINATION QUESTION PAPER PATTERN FOR SKILL ENHANCEMENT SUBJECTS

B.Sc. Semester-III/IV Degree Examination; 2024-25
(Semester Scheme 2024-25)

SUBJECT: PHYSICS

Course Name: _____[Course Code]

Time: 1.5 Hours **Max. Marks: 40**

QUESTION PAPER PATTERNS FOR ALL SKILL PAPERS IS 40 MULTIPLE CHOICE QUESTIONS.