KUVEMPU UNIVERSITY

Bachelor of Science (B.Sc.) Semester

SchemeCurriculumStructureforUndergraduateProgramm

e2024 – 25

Sl. No.	Course/ PaperCode	Titleof the Paper	Subject Category	Teaching Hours / Week	Semester End Exam.	Internal Assessm	Total Marks	Credits	Duration of examina
1	2	3	4	5	6	7	8	9	10
Semester-I									
	24MCP-T1	Mechanics & properties of matter	Theory	04	80	20	100	03	3 Hrs
1									
	24MCP-P1	Laboratory experiments related to Mechanics and Properties of Matter	Practical	04	40	10	50	02	3 Hrs
	Total			08	120	30	150	05	-----
Semester–II									
	24MCP-T2	Thermal physics, oscillations & sound	Theory	04	80	20	100	03	3 Hrs
2	24MCP-P2	Laboratory experiments related to Thermal Physics, oscillations and sound	Practical	04	40	10	50	02	3 Hrs
	Total			08	120	30	150	05	-----

THEORYPAPER

SEMESTER – I

24MCP-T1: Mechanics and Properties of Matter

CourseLearningObjectives: The learning objectives of this course are

- Gaining a comprehensive understanding of the basic principles of classical mechanics, including Newton's laws of motion, work, energy, and momentum.
- Understanding the principles of conservation of energy and momentum in a system of particles.
- Explaining the behavior of materials under different kinds of stress.
- Describing the motion of fluids under viscous force and the principles governing it.

CourseOutcomes: After completing this course, the students will be able

- ✓ To obtain expressions for areal velocity, centripetal force on a point mass in planar motion and work problems related to it.
- ✓ To describe relative motion in inertial and non-inertial frames, Galilean principle of relativity and solve problems relating to them.
- ✓ To give a comprehensive description of motion under central force and work problems related to it
- ✓ To work on problems related to elastic and inelastic collisions.
- ✓ To describe Newton's law of gravitation, obtain gravitational potential due to solids with different geometry and to arrive at Kepler's laws of motion.
- ✓ To describethe elements of satellite motion and obtain expressions for orbital velocity, escape velocity and time period of a satellite.
- ✓ To explain the concept of moment of inertia and obtain expressions for moment of inertia of objects with different geometry and about different axes of rotation.
- ✓ To have a comprehensive understanding of the effect of different kinds of stress on objects and obtain expressions for elastic constants.
- ✓ To describe viscous flow of fluids and the laws governing the viscous flow.
- ✓ To explain the meaning of surface tension, factors affecting it and obtain expressions for it.

UNITI:

Planar motion: A recap of vector algebra, The position vector of a moving particle, Time derivative of a vector of constant magnitude; Review of polar coordinates, Radial and transverse components of velocity and acceleration (derivation); Application to uniform circular motion—Centripetal force and areal velocity (derivation) **(5 hours)**

Frames of reference: Galilean principle of relativity (statement and explanation), Concept of frames of reference, types and examples, Inertial and Non-inertial frames; Definition and examples of fictitious forces: Measurement of acceleration using plumb line;Rotating frames: Derivation of expression for force, types of forces in rotating frames, qualitative discussion on centrifugal and coriolis forces, conical pendulum-expression for time period with respect to inertial and non-inertial frames, Brief discussion on Foucault pendulum**(10 hours)**

UNIT II:

Mechanics of a system of particles: Newton's laws for a system of particles (qualitative), center of mass, law of conservation of linear momentum with examples, Rocket motion-expressions for instantaneous and final velocities taking into effect earth's gravity (derivation), multistage rockets and their advantages; Angular momentum: Relation between torque and angular momentum, law of conservation of angular momentum—Examples; Work done by a variable force, work-energy theorem (derivation) **(10 hours)**

Collisions: Elastic and inelastic collisions—elastic head on collision—oblique elastic collision of identical masses in a plane (derivation) **(2 hours)**

Motion under a central force: Definition, examples (Simple harmonic motion, uniform circular motion, planetary motion)—characteristics of motion under a central force, constancy of angular momentum and areal velocity, conservative force fields—examples, conservation of energy-verification in simple harmonic motion and oscillations of a loaded spiral spring **(3 hours)**

Unit III

Gravitation: Newton's law of gravitation in vector form, Gravitational potential and field due to thin spherical shell and solid sphere (derivations), Kepler's laws of planetary motion (statement and derivation), conditions for different orbits; Brief account of physics of tides; Elements of satellite motion—orbital velocity, escape velocity and time period (derivation); Geosynchronous satellites **(8 hours)**

Rotational motion: Concept of moment of inertia-theorems on moment of inertia with proof, Moment of inertia of a rectangular plate, circular disc and solid sphere about different axes (derivations), kinetic energy of a rotating body, motion of a cylinder rolling down an inclined plane—expression for velocity.**(7 hours)**

Unit IV:

Elasticity: Concept of Stress&Strain, Hooke's law, Stress-Strain diagram, elastic moduli, relation between elastic moduli (derivation); Poisson's ratio, expression for Poisson's ratio in terms of elastic constants--Work done in stretching and twisting a wire, torsion of a cylinder, couple per unit twist (derivation), torsional pendulum-frequency expression (derivation), Bending of beams-expression for bending moment, Theory of single cantilever, I-section girders
(9 hours)

Viscosity: Streamline and turbulent motion, coefficient of viscosity, Poiseuille's equation (derivation), Stoke's law, (derivation from dimensional formulae), variation of viscosity with temperature, Archimedes' principle and Bernoulli's theorem (statement and applications) **(3 hours)**

Surface tension; Definition, relation between surface tension and surface energy, excess pressure within a curved surface (derivation), application to spherical, cylindrical drops and bubbles; factors affecting surface tension of a liquid **(3 hours)**

ReferenceBooks:

1. Mechanics—J.C. Upadhyaya, RamPrasad Publications, Agra.
2. Classical Mechanics, J. C. Upadhyaya, Himalaya Publishing House,Mumbai.(2003).
3. Mechanics—D.S. Mathur (Revised by P.S.Hemme), S Chand Publications, New Delhi(2013).
4. Classical Mechanics—K.N. Srinivasa Rao, Universities Press (2003).
5. Mechanics, Berkeley Physics Course (Vol I), 2nd edition, Charles Kittel et.al., 2017, McGraw Hill Education.
6. Properties of matter, R. Murugeshan, , S. Chand & Co. Pvt Ltd, New Delhi (2010).
7. Elements of properties of matter, D. S Mathur, S Chand & Co. Pvt.Ltd, New Delhi (2001).
8. Properties of Matter, Brij Lal, N. Subrahmanyam, Eurasia Publishing House Limited, (1993).
9. Physics for degree students (B.Sc., 1st year), C.L. Arora and P.S. Hemme, S Chand publications, New Delhi.
10. College Physics (1st B.Sc.,)—N. Sundararajan, George Thomas, United Publishers.
11. PHYSICS –VOL-I, Robert Resnick , David Halliday, Kenneth S Krane, 5th edition, John Wiley & Sons Inc, New York (2002).
12. Fundamentals of Physics—Robert Resnick, David Halliday, 10th edition, WileyIndia.

PRACTICALPAPER
SEMESTER– I

24MCP-P1: Mechanics and Properties of matter

PracticalHours:4 Hours/Week Credits:2

Each experiment is of 4 hour duration. Minimum of 8 experiments must be performed in the Semester. Suitable error analysis of the experimental results is to be carried out.

1) Determination of acceleration due to gravity (g)using bar pendulum
2) Determination of acceleration due to gravity (g) using spiral spring
3) Determination of Young's modulus (q)by the method of stretching
4) Determination of Young's modulus (q) by the method of uniformbending
5) Determination of Young's modulus (q) using single cantilever
6) Determination of Young's modulus (q), rigidity modulus (n) and Poisson's ratiousing Searle's double bar
7) Determination of Young's modulus (q) by Koenig's method
8) Determination of rigidity modulus using static torsion method.
9) Determination of rigidity modulus using torsional pendulum (moment of inertia of regular and irregular bodies)
10) Determination of moment of inertia,massanddensityofflywheel.
11) Verification of parallel axes and perpendicular axes theorem of moment of inertia
12) Determination of surfacetensionof ----- bycapillaryrisemethod.
13) Determination of surfacetensionandinterfacialtension of ---------bydropweightmethod.

THEORYPAPER

SEMESTER – II

24MCP-T2:Thermal Physics, Oscillations, Waves and Sound

CourseLearningObjectives:The learning objectives of this course are

- Gaining a comprehensive understanding of the basic concepts and the laws governing thermodynamic phenomena.
- Understanding the kinetic theory of gases and the meaning of Maxwell-Boltzmann distribution law
- Understanding the phenomena of black body radiation
- Gaining a comprehensive understanding of oscillatory motions and progressive waves
- Understanding the nature of sound waves

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

- To describe the basic concepts of thermodynamics
- To explain the Carnot cycle and the concept of an ideal thermodynamic machine
- To explain the concept of entropy and second law of thermodynamics
- To describe different thermodynamic potentials and identify their physical significance in different kinds of thermodynamic systems and processes
- To deduce Maxwell's thermodynamic relations and apply them for solving thermodynamic problems
- To apply the basic concept of kinetic theory of gases to obtain Maxwell-Boltzmann distribution function
- To arrive at Planck's law of black body radiation and deduce Wien's, Rayleigh-Jean's laws as limiting cases of Planck's law
- To explain the nature of undamped and damped simple harmonic motion
- To analyze the superposition of simple harmonic oscillations and explain the phenomena of beats, Lissajous figures
- To explain the characteristics of wave motion and obtain the general wave equation governing the wave motion
- To describe the nature of sound waves and obtain relations for velocity of sound.

UNITI:

Thermodynamics:Conceptoftemperature,Zerothandfirstlawofthermodynamics; Isothermal and adiabatic processes; Equation of state of a gas in an adiabaticprocess(derivation). Relation between P,V and T, Slopes of isothermal and adiabatic curves, P-V diagram. Carnot cycle: Expressionforefficiency (Derivation).Second law of thermodynamics: Kelvin and Clausiusstatements. Applications of Second lawof Thermodynamics-Refrigerator. Carnot theorem-Statement and proof. Thermodynamicscale of temperature. Clausius-Clayperon equation (derivation)- Application of Clausius-Clayperon equation for evaluation of

meltingpointandboilingpoints.Conceptofentropy,Changeofentropyinreversibleandirreversibleprocesseswith examples.T-Sdiagrams-Carnot'scycle.Changeinentropyduringchangeofstate, Entropy as a measure of disorder; Entropy and second law of thermodynamics. Third law ofthermodynamics-statement andbrief explanation. **(15hours)**

UNITII:

Thermodynamic Potentials: Extensiveandintensivethermodynamicvariables.ThermodynamicPotentials: Definition, Expression for thermodynamic potentialsU,H,FandG (derivation).Maxwell'sthermodynamicrelations(derivation), Applications of Maxwell's thermodynamic relations; C_p-$C_v$relations, TdSequation and Clausius-Clapeyron equation; Joule-Thomson effect, Joule-Thomson coefficients, Real gases; Van der Waal's equation **(8 hours)**

Kinetic theory of gases:Maxwell's law of distribution of velocities (statement and expression), Expression for meanfree path, degrees of freedom, law of equipartition of energy (statement and derivation)Calculationof valueof γformonoatomic,diatomicandtriatomic gases. **(3 hours)**

Radiation:Distribution of energy in the spectrum of a black body, Wien's displacementlaw, Wien's law, Rayleigh- Jeans law;Planck's law of radiation (Derivation)DeductionofWien'slawand Rayleigh– Jeans law from Planck's law, Stefan's law from Planck's law of radiation. Solar constant,Temperatureofthe sunfromsolar constant**(4 hours)**

UNIT III

Oscillations: Review of simple harmonic motion, expression for frequency from the equation f α– x(derivation). Equation for damped simpleharmonic oscillator. Theory of forced vibrationsand resonance; Examples of resonance in mechanical and electrical phenomena. Superposition of harmonic oscillations: Superposition of two collinear oscillations having (i) equal frequencies (ii) different frequencies; Beats: Analytical treatment and applications; Analytical treatment of superposition of two perpendicular harmonic oscillations (Lissajous figures). Qualitative discussion of superposition of two perpendicular harmonic oscillations with unequal frequencies; Uses of Lissajous figures **(15 hours)**

UNIT IV

Waves:Characteristicsofwavemotion-derivationofgeneralequationofonedimensionalprogressivewave– differentialequationofawave;
Phaseofawave,wavefront,expressionforintensityofprogressivewave(Derivation).Wavegroups–phase velocity and group velocity – relation between them. Brief discussion of differenttypesofwaves(mechanical,seismic,waterwavesandmatterwaves).
(7 hours)

Sound: Velocity of longitudinal waves in a gas, Newton's formula and Newton-Laplace formula (derivation), Expression for velocity of transverse waves in a stretched string (derivation), Theory of stationary waves, Doppler effect (brief explanation) **(8 hours)**

ReferenceBooks:

1. Heat thermodynamics & statistical physics—Brijlal, N. Subrahmanyam& P.S. Hemne, S. Chand & Co. New Delhi (2014).
2. Heat and Thermodynamics--D.S. Mathur, (Revised by M.N. Bapat) Sultan Chand & Co (2008).
3. A Textbook of Heat and Thermodynamics for degree students—J. B. Rajam, Sultan Chand & Co.,(1981)
4. Heat and Thermodynamics--Zemansky.M.W, and Dittman R.H, 6th edition, McGraw Hill International Edition (1981)
5. PHYSICS –Vol-I, Robert Resnick , David Halliday, Kenneth S Krane, 5th edition, John Wiley & Sons Inc, New York.(2002).
6. Fundamentals of Physics— Robert Resnick, David Halliday, Jearl Walker, John Wiley& sons (2013)
7. Sears &Zemansky's University Physics, Hugh D. Young, Roger A Freeman, Vol. 1, 13th Edition,
8. Physics of waves and oscillations –N. K. Bajaj, McGraw-Hill (1988)
9. Accoustics, waves and oscillations—S.N. Sen, John Wiley & Sons
10. A textbook of Sound—D. R. Khanna and R. S. Bedi, Atma Ram & Sons (1962)
11. A text book of Sound— N. Subrahmanyam and Brij Lal, 2nd revised Edition

PRACTICAL PAPER
SEMESTER II
24MCP-P2: Thermal Physics, Oscillations and Sound

PracticalHours:4 Hours/Week Credits:2

Each experiment is of 4 hour duration. Minimum of 8 experiments must be performed in the Semester. Suitable error analysis of the experimental results is to be carried out.

1. Verification of Stefan's 4^{th} power law using meter bridge
2. Determination of frequency of Alternating Current (AC) using sonometer
3. Determination of velocity of sound using Helmholtz resonator
4. Determination of frequency of Alternating Current (AC) using Melde's string method
5. Determination of Specific heat of a liquid by the method of cooling
6. Determination of velocity of sound in a liquid using ultrasonic interferometer
7. Determination of unknown frequency using Lissajous figures
8. Determination of Stefan's constant
9. Study of thermoelectric effect.
10. Thermal conductivity of a bad conductor by Lee and Charlton's method
11. Study of the impact of amplitude of oscillations on the time period of simple harmonic oscillations.
12. Determination of Young's modulus by cantilever oscillations
13. Determination of viscosity of water by capillary flow method
14. Determination of Coefficient of viscosity by Stokes' method

THEORYEXAMINATIONQUESTIONPAPERPATTERN SEMESTERS I AND II

B.Sc.,Semester–IDegreeExamination:2024-25 (Semester Scheme; New Syllabus: 2024-25) SUBJECT: PHYSICS

PAPER: _____: _____

PAPER CODE: _____

Time:3Hours Max.Marks:80

InstructionstoCandidates:

1) AllsectionsareCompulsory.

2) Drawneatlabelleddiagramswherevernecessary.

SECTION–A

1. Answerallthefollowingquestions: 10x2=20

a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

SECTION–B

AnsweranySIXofthefollowing: 6x5=30

1

2.

3.

4.

5.

6.

7.

8.

SECTION–C

AnsweranyTHREEofthefollowing: 3x10=30

9. FromUnit-I

10. FromUnit-II

11. FromUnit-III

12. FromUnit-IV

QuestionPaperPatternforPracticalPaperExamination

(SemestersI–VI) Duration: 3 hours

Experimentation(Major&Minor/Spotters): 35Marks

VivaVoce 05 Marks

Total40 Marks

InternalAssessmentforTheoryPaper

Sl. No.	InternalAssessment	Maximum Marks
01.	TwoSessionTestswithproperrecordforassessment (5+5=10)	10
02.	Assessment ofSkillDevelopmentactivities/Seminars/GroupDiscussion/ Assignment etc., with proper record	05
03.	Attendancewithproperrecord	05
TOTAL MARKS		20

- AttendanceMarks-breakup

<75%	-	00 Marks
75-80%	-	01 Mark
80-85%	-	02Marks
85-90%	-	03Marks
90-95%	-	04Marks
>95%	-	05Marks

InternalAssessmentforPracticalPaperI-IIsemesters

- Attendance - 05Marks
- Record/Journal - 05Marks

Total 10 Marks