VIJAYANAGARA SHREEKRISHNADEVARAYA UNIVERSITY

JNANASAGARA CAMPUS, BALLARI-583105

DEPARTMENT OF STUDIES IN PHYSICS

B.Sc. (PHYSICS) SYLLUBUS

Effective From

2021-22

VIJAYANAGARA SHREEKRISHNADEVARAYA UNIVERSITY

JNANASAGARA CAMPUS, BALLARI-583105

Programme: B.Sc. (Physics)

Programme Outcomes (POs):

Students after completion of this program are able to

1. Apply the knowledge of Physics to analyse physical systems.
2. Design and Perform laboratory experiments for Mechanical, Acoustic, Electrical, Electronic, Thermal, Magnetic and Optical systems, as well as analyse and interpret data using theoretical models.
3. Identify and solve real world problems arising in the domains of Physics.
4. Participate effectively in teams to solve multi/interdisciplinary problems of complex in nature.
5. Evaluate a physical system/model for optimal performance.
6. Communicate effectively the complex information in a concise manner by written, oral and visual means to different groups/audiences of technical or popular nature.
7. Adopt digital literacy for computation and appropriate software for analysis of data.
8. Understand the ethical principles and practice them in scientific and societal contexts.
9. Develop knowledge about contemporary issues in science and technology.
10. Engage in self and life-long learning.
11. Identify a research problem in physics and provide an appropriate scientific solution using basic principles.

B.Sc. Physics First Semester

Course: Mechanics and Properties of Matter
Course Code: DSC1
Teaching Hours/Week (L-T-P): 4 - 0 - 0
No. of Credits: 04
Internal Assessment: 40 Marks
Semester End Examination: 60 Marks

Module 1: Frames of Reference and Special Theory of relativity **11 hours**

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.

Special Theory of relativity: Michelson and Morely experiment and its negative result. Postulates of special theory of relativity. Lorentz transformations. Constancy of speed of light. Length contraction. Time dilation. Relativistic addition of velocities. Variation of mass with velocity. Derivation of Einstein's mass –energy relation.

Module 2: Conservation laws **11 hours**

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, Collision of two particles which stick together (inelastic collision).

Relation between momentum and torque, Explanation of Conservation of angular momentum, Examples of conservation angular momentum - planetary or satellite motion, scattering of alpha particles by heavy nucleus. Explanation of conservation of energy, Applications: Motion of a body near the surface of the earth, Linear restoring force (spring). .

Module 3: Dynamics of Rigid bodies **11 hours**

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 & hallow cylinders, moment of inertia of irregular body, Flywheel – theory. Theory of compound pendulum and bar pendulum.

Module 4: Elasticity **11 hours**

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).

Module 5: Surface Tension and Viscosity **11 hours**

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.

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.

Course Outcomes (CO): After completion of this course student should able to

CO	Statement
1	Explain the basics frames of reference and special theory of relativity.
2	Apply conservation laws to understand physical systems.
3	Apply dynamics of rigid bodies to understand physical systems.
4	Explain elastic behavior of materials.
5	Explain properties of fluids based on surface tension and viscosity.

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B.Sc. Physics First Semester

Course: Mechanics and Properties of Matter Lab **Course Code:** DSC1
Teaching Hours/Week (L-T-P): 0 - 0 - 4 **No. of Credits:** 02
Internal Assessment: 25 Marks **Semester End Examination:** 25 Marks

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 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.

Text Books:

1. Physics through experiments, by B.Saraf, 2013, Vikas Publications.
2. Lab manual of Physics for undergraduate classes, 1st Edition, Vikas Publications.

Reference Books:

3. B.Sc. Practical Physics by CL Arora, Revised Edition 2007, S. Chand & Co.
4. An advanced course in practical physics, D. Chatopadhyay, PC Rakshit, B.Saha, Revised Edition 2002, New Central Book Agency Pvt Ltd.

Course Outcomes (CO): After completion of this course student should able to

CO	Statement
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.

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B.Sc. Physics First Semester

Course: Optical Physics **Course Code:** OEC1
Teaching Hours/Week (L-T-P): 3 - 0 - 0 **No. of Credits:** 03
Internal Assessment: 40 Marks **Semester End Examination:** 60 Marks

Module 1: Basics of Light **8 Hours**

Nature of light, Velocity of light, Optical medium, Homogeneous isotropic medium, Reflection and Refraction of light, Total internal reflection, Reflectivity and Transmissivity, Absorption of light, Wavefront and the ray, Mathematical representation of a plane wave, Intensity of light, Light as an electromagnetic wave, Energy density, Poynting vector, Wave characteristics of light, Electromagnetic spectrum and visible range.

Module 2: Interference of Light **10Hours**

Introduction, Conditions for observing sustained interference, Techniques of obtaining interference, Path difference & phase difference – Relation between them, Fresnel Biprism: Experimental arrangement, Theory, Conditions for bright and dark fringes, Separation between neighboring bright fringes. Thin film interference – Plane parallel film: Theory of Interference due to reflected light, Conditions for maxima and minima, Interference at an air wedge: Theory, Colours in thin films (qualitative), Applications of interference: Testing flatness of surfaces, Thickness of a thin film coatings.

Module 3: Diffraction of Light **08 Hours**

Introduction, Distinction between interference and diffraction, Fraunhofer diffraction at double slit – Interference maxima and minima, Diffraction maxima and minima, Theory, Expression for resultant intensity and conditions for maxima and minima, Plane diffraction grating: Theory, Resolving power, Rayleigh's criterion, Resolving power of a plane transmission grating, Resolving power of telescope.

Module 4: Polarisation of Light **08 Hours**

Introduction, Polarisation by reflection -Brewester's law, Polariation by refraction, selective absorption and double refraction, Polariser and production of linearly polarized light by polarizer, Malus' law, Huygens' explanation of double refraction, Ordinary and extraordinary rays, Positive and negative crystals, Applications of polarized light (qualitative): Sunglasses, photography, Stereoscopic movies and optical microscopy

Module 5: Lasers **08 Hours**

Absorption, Spontaneous emission and Stimulated emissions, Einstein coefficients and their relations, Population inversion, Metastable states, Components of laser: active medium, pump and optical resonator, Steps of lasing action, Pumping schemes : Three level and four level, Threshold condition for laser, Laser beam characteristics, Ruby laser, He-Ne laser, Applications of lasers (qualitative): medical, industry, defense and entertainment.

Text Books:

1. A Text Book of Engineering Physics by M. N. Avadhanulu and P.G. Kshirsagar, S. Chand Publishing, 2014.
2. A Text Book of Optics by Brij Lal, M N Avadhanulu & N Subrahmanyam, S. Chand Publishing, 2012.

Reference Books:

1. Optics by Ajoy Ghatak, McGraw Hill Education (India) Pvt Ltd., 2017.

Course Outcomes (CO): After completion of this course student should able to

CO	Statement
1	Explain the basic properties of light.
2	Apply the principles of optics to interference, diffraction and polarization of light.
3	Explain the principles of laser systems and their applications.

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