



BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(as per SEP 2024)

Syllabus for I & II Semester B.Sc. Physics

2024-25

Board of Studies in Physics (UG) Members

Dr. B . Eraiah	Chairman	Dept. Physics, Bangalore University, Bengaluru-56
Sri G.Ramesha	Member	PES College, Hanumanth Nagar, Bengaluru-50
Dr. K.S.Suresh	Member	Vijaya College, R.V. Road, Basavanagudi, Bengaluru -04
Dr. V.S.Rohini	Member	Nrupathunga University, Nrupathunga Road, Bengaluru-01
Dr. D. Usharani	Member	MES College of Arts, Commerce and Science, Malleswaram, Bengaluru-03
Dr. Mohan Kumar B. V	Member	GFGC, Yelahanka, Bengaluru-64
Dr. Manjula S N	Member	SJR College for Women, Rajajinagar, Bengaluru-03
Dr. Ramakrishna Gowda	Member	GFGC, Yelahanka, Bengaluru-64
Smt. Prathibha K. N	Member	MES College of Arts, Commerce and Science, Malleswaram, Bengaluru-0

Date: 08.07.2024
Bangalore-560001

Proceedings of the BOS Physics (UG) meeting of Bengaluru City University, Bangalore, held on 8th July 2024

The Chairman welcomed all the BOS members and presented the following agenda for discussion.






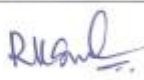

Agenda:


- i) To approve the BSc Physics syllabus, I and II semester (prepared in accordance with state education policy SEP).
- ii) To finalise the panel of Examiners (UG) for the year 2024-25.

After elaborate discussions, the members approved:

1. Syllabus for I and II semester BSc Physics Course (UG) to be implemented from the academic year 2024-25 following SEP guidelines.
2. The UG panel of examiners has been updated by including teachers from all the affiliated colleges. The BOS unanimously approves the panel of examiners for UG program for the academic year 2024-25.

Members of the BOS (UG) Physics

Sl. No	Names	Members	Signature
01	Dr. B. Eraiah Professor PG Department of Physics, Bangalore University, Bengaluru-560056.	Chairman	
02	Dr. K.S.Suresh Associate Professor Department of Physics, Vijaya College, R.V.Road, Bengaluru-560004.	Member	Absent
03	Dr. G.Ramesha Associate Professor Department of Physics, PES College 50 Feet Road, Mysore bank colony, Hanumantha Nagar, Bengaluru- 560050	Member	Absent
04	Dr. Manjula S N Associate Professor, Department of Physics, SJR College for Women, Rajajinagar, Bengaluru-560003.	Member	
05	Dr. V S Rohini Professor, Department of Physics, Nrupathunga University (Govt. Science College) Nrupathunga Road, Bengaluru-560 001.	Member	
06	Dr. D. Usharani Professor, Department of Physics, MES College of Arts, Commerce and Science, Malleswaram, Bangalore	Member	
07	Dr. Mohan Kumar B V Associate Professor, Department of Physics, GFGC, Yalahanka, Bangalore-64	Member	
08	Dr. Ramakrishna Gowda Associate professor GFGC, Yalahanka, Bangalore	Member	
09	Smt. Prathibha K. N Assistant Professor MES College, Bangalore	Member	


(Dr B. Eraiah)

Dr. B. ERAIAH
M.Sc.M.Phil.Ph.D.,
Professor, Department of Physics
Bangalore University, Bangalore - 560056

Program Name	B.Sc.	Semester	I
Course Title	Mechanics-I, Properties of Matter and Thermodynamics-I (Theory)		
Course Code	PHY101	No. of Credits	03
Contact Hours	52hours	Duration of SEP Exam	3hours
Formative Assessment Marks	20	Summative Assessment marks	80

Course Objectives:

- To understand and apply the principles of kinematics and dynamics.
- To analyse frictional forces and their effects on motion.
- To understand Kepler's laws of planetary motion and satellite motion.
- To comprehend the concepts of work, energy, and simple harmonic motion.
- To explore the principles of rotational motion angular momentum and Moment of Inertia.
- To study the properties of matter: viscosity and surface tension.
- To understand the basic concepts and laws of thermodynamics.
- To study the working of a Carnot heat engine and its efficiency.
- To understand the working of practical internal combustion engines.
- To understand the concept of entropy.

Bengaluru City University
SEP Syllabus for B.Sc. I Semester in Physics
Paper I-PHY101: Mechanics-I, Properties of Matter and
Thermodynamics-I

UNIT 1

Vector algebra: Scalars and Vectors, vector algebra and operations, graphical and analytical methods, components of vectors, scalars and vector products.

2 hours

Newton's Laws of Motion (Statements and illustration), Motion in a resistive medium; concept of terminal velocity, drag force and Drag Coefficient, Drag force with velocity $[v]$ dependence (only vertical) – derivation for velocity and position- graphs with and without resistance.

Friction as a self-adjusting force, Coefficient of Static and dynamic friction; Expression for acceleration of a body moving along an inclined plane with and without friction, Free Body Diagrams for two masses connected by a string hanging over a frictionless pulley.

6 hours

Gravitation and Planetary motion: Law of Gravitation, Gravitational field and Potential – relation between them, Gravitational field and Potential due to a solid sphere (derivation), Kepler's laws (statements), Satellite motion, Orbital and Escape Velocity (derivation). Geostationary and Geosynchronous orbits. Motion of a rocket (qualitative).

5 hours

UNIT 2

Work and Energy: Conservative and non-conservative forces, Work done by a constant and variable force; Work-energy theorem: Work done by gravitational force, Work done by a spring force.

Elastic and inelastic collisions: Expressions for final velocities in elastic collisions.

Concept of a system of particles, general expression for Centre of mass, Newton's law for a system of particles. **7 hours**

Simple harmonic motion (SHM): Definition of simple harmonic motion, Differential equation of SHM and its solutions, different forms of the wave equation, expressions for amplitude, period, frequency of oscillations, Kinetic, potential and total energy. Simple pendulum and compound pendulum; damped oscillations; forced oscillations, concept of resonance. Coupled oscillations - in phase and out of phase, Energy transfer (qualitative).

6 hours

UNIT 3

Dynamics of Rigid bodies: Rotational motion about an axis, Definition of MI, Torque, angular momentum and radius of gyration. Theorems on Moment of inertia; MI of a circular disc, sphere, rectangular lamina and flywheel (derivations). Relation between torque and angular momentum (derivation), Conservation of angular momentum with illustrations, rotational energy (derivation).

6 hours

Surface tension of fluids: Molecular interpretation of surface tension; Surface energy (derivation); Angle of contact, Pressure difference across a curved surface – derivation. Interfacial tension (qualitative), factors affecting surface tension.

4 hours

Viscosity of fluids: Laminar flow, coefficient of viscosity, Poiseuille's method of measuring viscosity (no derivation), Stokes' law (derivation), factors affecting viscosity.

3 hours

UNIT 4

Introduction to Thermodynamics: Concepts of Heat and Temperature, Thermodynamic variables - intensive and extensive, Microscopic and macroscopic description of a system, thermodynamic equilibrium, zeroth law of thermodynamics, equations of state, PV diagrams.

2 hours

First Law of Thermodynamics: Sign Convention of Heat and Work, Differential form of the First Law of Thermodynamics, Application of the first law for (i) Cyclic Process (ii) Adiabatic Process (iii) Isochoric Process (iv) Isobaric Process and (v) Isothermal Process. Equation of state for an adiabatic process (derivation). Work done in an isothermal and adiabatic process for an ideal gas, Internal Energy as a state function.

5 hours

Second Law of Thermodynamics: Reversible and irreversible processes with examples; Second law of thermodynamics (Kelvin's & Clausius' statements and their equivalence); Carnot Engine: Carnot Cycle and its efficiency(derivation), Refrigerator - Coefficient of performance. Practical internal combustion engines - Otto and Diesel Cycles, Carnot theorem, (statement only).

4 hours

Entropy: Basic concept of entropy, Change in entropy in Reversible and Irreversible Process - Relation between entropy and second law, Clausius inequality, T-S diagram of a Carnot cycle.

2 hours

Formative Assessment Theory	
Assessment Occasion/Type	Marks
One Internal Test	10 marks
Assignment/Activities	10 marks
Total	20
Formative Assessment as per UNIVERSITY Guidelines are Compulsory	

Reference books

1. Fundamentals of Physics- Resnick, D. Halliday and Walker; Wiley 12th edition (2021)
2. Concepts of Physics Vol (1)-H C Verma, Bharathi Bhavan Publishers, 2004 Edition
3. Mechanics- Berkeley Physics Course Vol (1)- SI units Charles Kittel Walter D. Knight, and Malvin A. Ruderman McGraw-Hill Education (India)
4. The Feynman Lectures on Physics, Vol. 1: Mainly Mechanics, Radiation, and Heat" by Richard P. Feynman, Robert B. Leighton, and Matthew Sands
5. Mechanics- J C Upadhaya, Himalaya publishing House (2014 ed)
6. Elements of Properties of matter – D S Mathur, S.Chand and Co (2010)
7. Properties of Matter – Brijlal & Subramanyam, S. Chand & Co, (2002)
8. University Physics - D.C. Tayal
9. Heat and Thermodynamics- MM Zemansky, McGrawHill Education (India), 8th edition 2011
10. Heat and Thermodynamics- Brijlal and Subramanyam S Chand & Co, New Delhi 1985
11. Heat and Thermodynamics- DS Mathur, S Chand & Co, New Delhi, 5th edition
12. Thermal Physics - SC Garg, RM Bansal, CK Ghosh, McGraw-Hill education, 2nd edition 2013
13. Thermo dynamics, Kinetic Theory of gases & Statistical Thermodynamics, FW Sears 7 GL Salinger, Narosa Publishing House, 3rd edition, 1998.
14. Thermodynamics & Statistical Physics, Sharma & Sarkar, Himalaya Publishing House, 3rd edition, 1991.

Course Title	Mechanics-I and Properties of Matter, Thermodynamics-I (Practical)	Practical Credits	02
Course Code	PHY -102	Contact Hours	03
Formative Assessment	10 marks	Summative Assessment	40

Bengaluru City University
SEP Syllabus for B.Sc. I Semester in Physics
Paper I-PHY 102: Mechanics-I and Properties of Matter,
Thermodynamics-I

List of Experiments (A minimum of eight experiments to be performed)

1. Determination of coefficients of static, kinetic and rolling frictions.
2. Determination of **g** using bar pendulum.
3. Determination of **g** using simple pendulum and show that time period is independent of mass.
4. Determination of **g** using simple pendulum and show the dependency of time period on length.
5. Determination of spring constant and mass of a spiral spring.
6. Work done by a variable force using a spiral spring.
7. Verification of principle of conservation of energy.
8. Verification of parallel axis theorem.
9. Verification of perpendicular axis theorem.
10. Determination of moment of inertia and mass of a Fly Wheel.
11. Determination of frequency of a Coupled oscillator.
12. Determination of surface tension of water and the interfacial tension between two immiscible liquids using drop weight method.
13. Determination of coefficient of viscosity of a liquid by Stoke's method.
14. Determination of coefficient of viscosity of water by Poiseuille's method.
15. Calibration of Thermistor for temperature measurement.
16. Calibration of Thermocouple for temperature measurement.
17. Variation of thermo-emf across two junctions of a thermocouple with temperature.

Formative Assessment for Practical	
Assessment Occasion/Type	Marks
One Internal Test	05 marks
Assignment /Activity	05 marks
Total	10
Formative Assessment as per UNIVERSITY Guidelines are Compulsory	

References			
1.	B.Sc Practical Physics by C.L Arora		
2.	B.Sc Practical Physics by Harnam Singh and P.S. Hemne		
Program Name	B.Sc. in Physics	Semester	II
Course Title	Mechanics-II, Kinetic Theory of Gases and Thermodynamics-II		
Course Code	PHY 201	No. of Credits	03
Contact Hours	52hours	Duration of SEP/Exam	3hours
Formative Assessment Marks	20	Summative Assessment marks	80

Course Objectives:

- To understand the elastic properties of materials.
- To understand propagation of waves and concepts of phase velocity & group velocity.
- To understand frames of reference and frame-dependent force.
- To understand the basic principles of kinetic theory of gases.
- To understand the behaviour of gases.
- To understand thermodynamic potentials and their significance.
- To understand the methods of producing low temperatures and liquefaction of gases.
- To understand the phase transitions.
- To analyse black body spectrum and understand laws of radiation.
- To understand conduction of heat in solids and convection in fluids.

SEP Syllabus for B.Sc. II Semester in Physics
Paper II-PHY 201: Mechanics- II, Kinetic Theory of Gases,
Thermodynamics-II

UNIT –I

Elasticity: Hooke's law, Stress – Strain diagram, definitions of three elastic moduli; Poisson's ratio; Relationship between three elastic constants (derivation); Work done in stretching a wire, Bending of beams-derivation of bending moment, Theory of single cantilever, Torsional oscillations, Couple per unit twist and time period of oscillations (derivations). **7 hours**

Waves: Wave equation, speed of transverse waves on a uniform string, speed of longitudinal wave in a fluid, group velocity and phase velocity- relation between them ($V_g = V_p - \lambda \frac{dV_p}{d\lambda}$) . **4hours**

Frames of reference: Inertial and non-inertial frames of reference, concept of frame dependent force, derivation of Coriolis force, effects of Coriolis force-trade winds and corrosion of river banks. **2 hours**

UNIT- II

Kinetic theory of gases: Assumptions of Kinetic Theory of Gases, derivation of the equation of a perfect gas $PV = \frac{1}{3} nmc^2$, Maxwell's law of distribution of velocities (qualitative), and derivation for most probable velocity, mean velocity and rms velocity. Expression for mean free path, degrees of freedom and principle of equipartition of energy. Specific heats of an ideal gas and atomicity of gases with derivation. **6 hours**

Transport Phenomena: Coefficient of Viscosity and thermal conductivity in gases (derivation) and relation between them. **2 hours**

Real Gases: Derivation of Van der Waal's equation of state, Derivation of critical constants, Andrew's experiment on carbon dioxide, comparison of Van der Waal's isotherms with Andrew's isotherms. **5 hours**

UNIT- III

Thermodynamic potentials: Basic concepts of internal Energy, Enthalpy, Helmholtz Free Energy, Gibbs free Energy and their significance, Derivation of Maxwell's Thermodynamic relations using Thermodynamic potentials, TdS Equations (First and Second TdS relations), Internal Energy Equations and Heat Capacity equations (C_p and C_v). Third Law of thermodynamics.

5 hours

Low Temperature Physics:

Joule Thomson experiment: Derivation of Joule Thomson Coefficient, Inversion Temperature. Adiabatic demagnetisation (Theory)

4 hours

Phase Transitions of First Order: Melting, Freezing, Condensation, Vaporisation, Sublimation. Deposition. Conditions of equilibrium of phases in terms of Gibbs potential. Clausius-Clapeyron equation (derivation), elevation of boiling point and depression of freezing point, triple point.

4hours

Unit IV

Black Body Radiation: Black body radiation and its Spectral energy distribution; Emissive power, Absorptive power, Emissivity, Kirchhoff's law, Stefan's law, Stefan-Boltzmann's law, Wien's displacement law, Wien's fifth power law, Wien's distributive law, Rayleigh- Jeans law (Statements), Derivation of Planck's law, Deduction of Wien's law and Rayleigh- Jeans law from Planck's Radiation law, Solar Constant, Estimation of Surface temperature of Sun.

7 hours

Transmission of heat: Conduction-Coefficient of Thermal Conductivity, Thermal conductivity of a good Conductor by Forbe's method, Thermal Conductivity of a poor conductor by Lee's disc method. Conduction along a bar, Conductivity of liquids and gases, Natural and forced Convection, Reynolds's number.

6 hours

Formative Assessment Theory	
Assessment Occasion/Type	Marks
One Internal Test	10 marks
Assignment/Activities	10 marks
Total	20
Formative Assessment as per UNIVERSITY Guidelines are Compulsory	

References Books

1. Fundamental of Physics- R. Resnik & D. Halliday, Wiley 6th edition 2001
2. Mechanics- J C Upadhaya, Himalaya publishing House (2014 ed)
3. Elements of Properties of matter – D S Mathur, S.Chand and Co (2010)
4. Properties of Matter – Brijlal & Subramanyam, S. Chand & Co, (2002)
5. University Physics - D.C. Tayal
6. Waves and Oscillations - N Subramanyam and Brij Lal Vikas Publishing House Pvt. Ltd., Second Revised Edition 2010
7. Oscillations and Waves - Satya Prakash Pragathi Prakashan, Meerut, Second Edition 2003
8. Heat and Thermodynamics- M M Zemansky, McGrawHill Education (India), 8th edition 2011
9. Heat and Thermodynamics- Brijlal and Subramanyam S Chand & Co, New Delhi 1985
10. Heat and Thermodynamics- D S Mathur, S Chand & Co, New Delhi, 5th edition
11. Thermal Physics - SC Garg, RM Bansal, CK Ghosh, McGrawHill education, 2nd edition 2013
12. Thermodynamics, Kinetic Theory of gases & Statistical Thermodynamics, FW Sears 7 GL Salinger, Narosa Publishing House, 3rd edition, 1998.
13. Thermodynamics & Statistical Physics, Sharma & Sarkar, Himalaya Publishing House, 3rd edition, 1991.

Course Title	Mechanics-II, Kinetic Theory of Gases and Thermodynamics-II (Practicals)	Practical Credits	02
Course Code	PHY 202	Contact Hours	03
Formative Assessment	10 marks	Summative Assessment	40

Bengaluru City University
SEP Syllabus for B.Sc. II Semester in Physics
**Paper II-PHY 202: Mechanics-II, Kinetic Theory of Gases and
Thermodynamics-II**

List of Experiments (A minimum of eight experiments to be performed)

1. Verification of Hooke's law.
2. Determination of the Young's Modulus of the material of a wire by stretching.
3. Determination of rigidity modulus of the material of a wire - dynamic method.
4. Determination of rigidity modulus of the material of a rod – static torsion method.
5. Determination of the Young's Modulus of the material of a bar by single cantilever method.
6. Determination of the Young's Modulus of the material of a bar by uniform bending.
7. Determination of elastic constants of the material of a wire by Searle's double bar method
8. Determination of Specific heat capacity of liquid by Newton's law of cooling.
9. Verification of Newton's law of Cooling.
10. Determination of Thermal Conductivity of Rubber by heating method.
11. Determination of Thermal Conductivity of bad conductor - Lee's & Charlton's method.
12. Determination of Thermal Conductivity of Copper- Searle's Method.
13. Verification of Stefan's law by electrical method.
14. Determination of Stefan's Constant.
15. Verification of Clausius-Clapeyron Equation using Pressure Cooker.
16. Study of Gaussian distribution using Monte Carlo method.

17. Thermal behaviour of a torch filament-Determination of temperature of the filament of the bulb.

Formative Assessment for Practical	
Assessment Occasion/Type	Marks
One Internal Test	05 marks
Activity	05 marks
Total	10
Formative Assessment as per UNIVERSITY Guidelines are Compulsory	

References
B.Sc Practical Physics by C.L Arora
B.Sc Practical Physics by Harnam Singh and P.S. Hemne

B.Sc. Course for Bengaluru University Frame work in Physics as per Higher Education Council Guidelines (for Three Major)

Sem.	Course Category	Course Code	Course Title	Credits Assigned	Instructional Hours per Week		Duration of Exam (Hrs.)	Marks		
					Theory	Practical		IA	Exam	Total
I	Physics	PHY 101	Mechanics-I, Properties of Matter and Thermodynamics-I (Theory)	03	04	-----	3hrs	20	80	100
I	Physics	PHY 102	Mechanics-I, Properties of Matter and Thermodynamics-I (Practical)	02	-----	03	3hrs	10	40	50
II	Physics	PHY 201	Mechanics-II, Kinetic Theory of Gases and Thermodynamics -II(Theory)	03	04	-----	3hrs	20	80	100
II	Physics	PHY 202	Mechanics-II, Kinetic Theory of Gases and Thermodynamics -II (Practical)	02	-----	03	3hrs	10	40	50

B.Sc. Course Physics Question paper pattern

PART A		Total marks
1 Mark answers		
1x10=10 marks (10 out of 12)	a) True or false b) Fill in the blanks c) One word / one phrase d) MCQs	10
PART B		
2 Mark answers (10 out of 12 questions)		
2x10=20 marks	Short answers (direct and conceptual)	20
PART C		
6 Mark answers (answer any 5 out of 8)	Long answers (Single or Split questions in one main question)	
6x5=30 marks		30
PART D		
4 Mark answers (answer any 5 out of 8)		
4x5=20 marks	Problems	20
	Total	80 marks

B.Sc. Course Physics Question paper pattern

PART A		Total marks
1 Mark answers		
1x10=10 marks (10 out of 12)	a) True or false b) Fill in the blanks c) One word / one phrase d) MCQs	10
PART B		
2 Mark answers (10 out of 12 questions)		
2x10=20 marks	Short answers (direct and conceptual)	20
PART C		
6 Mark answers (answer any 5 out of 8)	Long answers (Single or Split questions in one main question)	
6x5=30 marks		30
PART D		
4 Mark answers (answer any 5 out of 8)		
4x5=20 marks	Problems	20
	Total	80 marks



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Distribution of Marks for the Practical Examination		
Sl. no.	Particulars	Marks
1.	Writing Formulae / Statement with symbols, units and explanation of terms	05
2.	Drawing illustrative diagrams and expected graphs	05
3.	Setting up of the experiment& taking readings	10
4.	Calculations and graphs drawn based on experimental data.	10
5.	Accuracy of results with units	05
6.	Valuation of Practical Record	05
Total		40

Distribution of Marks for the Practical Examination		
Sl. no.	Particulars	Marks
1.	Writing Formulae / Statement with symbols, units and explanation of terms	05
2.	Drawing illustrative diagrams and expected graphs	05
3.	Setting up of the experiment& taking readings	10
4.	Calculations and graphs drawn based on experimental data.	10
5.	Accuracy of results with units	05
6.	Valuation of Practical Record	05
Total		40



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