

ENGINEERING PHYSICS

Subject Code 00102	Theory			No of Period in one session : 50		
	No. of Periods Per Week			Full Marks	:	100
	L	T	P/S	Annual Exam.	:	80
	04	—	—	Internal Exam.	:	20

Rationale and Objective:

Knowledge of Physics is so interwoven with engineering studies that one can not think of pursuing engineering studies without the knowledge of Physics. Study of Physics is essential for Diploma holders in engineering and technology to develop in them proper understanding of physical phenomenon, scientific temper and engineering aptitude.

The course covers the basic laws and principles of Physics and its applications. The course contents are so chosen that it should be more relevant to the modern development of science to meet the challenge posed by fast-changing technology.

Keeping these objectives in view the subject has been divided into the following topics:

S.No.	Topics	Periods
1.	General Physics	(22)
2.	Heat	(01)
3.	Electrostatics	(03)
4.	Current Electricity & Magnetism	(12)
5.	Modern Physics	(10)
6.	Environment & Safety	(02)
		(50)

Teachers are advised to use the latest technology of teaching (e.g. use of LRs etc.) and make maximum use of demonstration so that the subject will be interesting to the students. The Engineering applications of the principles of physics should be discussed broadly. Use of S.I. units for all measurements and calculations is recommended.

CONTENTS:

TOPIC: 01 - GENERAL PHYSICS:

[22]

S.No.	Topics	Periods
01.01	<u>Units and Dimensions</u>	[02]
01.01.01	Units of Fundamental and Derived Physical quantities.	
01.01.02	System of Units - C.G.S., M.K.S., F.P.S. & S.I. System and their full forms (Foot Pound Second)	
01.01.03	Basic & Supplementary Units - Names & Symbols	
01.01.04	Advantages of S.I. System - Comprehensive, Coherent & Rational	
01.01.05	Dimensions & Dimensional formula of simple Physical quantities, Dimensionless quantities.	
01.01.06	Dimensional equations and their uses - Conversion of Units from one system to another, to check correctness of equation, establish relation between different physical quantities.	
01.01.07	Limitations of Dimensional analysis.	
01.02	<u>Scales & Measurements</u>	[02]
01.02.01	Vernier Scale & least count.	
01.02.02	Vernier (Slide) Callipers.	
01.02.03	Screw - Pitch & Least Count.	
01.02.04	Screw Gauge (Micrometer Gauge) & Spherometer - their construction and operation.	
01.02.05	Spherometer - Measurement of thickness of a sheet or plate.	
01.03	<u>Scalars & Vectors</u>	[02]
01.03.01	Scalar & Vector quantities, Representation of a Vector.	
01.03.02	Addition & Subtraction of two vectors - triangle method.	
01.03.03	Resolution of vector into two mutually perpendicular components.	
01.04	<u>Linear Motion</u>	[01]
01.04.01	Speed & velocity - Definition, Difference (Distinction), their Units & Dimensions.	
01.04.02	Uniform Velocity, Uniformly accelerated Velocity (Uniform acceleration) & Retardation.	
01.04.03	Derivation of formulas: (i) $v = u + at$ (ii) $s = ut + \frac{1}{2} at^2$ using differentiation & integration method.	
01.05	<u>Motion Under Gravity</u>	[01]
01.05.01	Acceleration due to gravity - Unit & Dimension. Weight and mass.	
01.05.02	Co-ordinate Convention of displacement, Velocity and acceleration.	
01.05.03	Equations of motion of body moving freely under gravity: (i) Downwards (ii) Upwards	

01.06	<u>Projectile</u>	[02]
01.06.01	Projectile - Definition & examples.	
01.06.02	Oblique projection - Derivation of equation for trajectory, Range, Maximum height, Time of flight & time for attaining maximum height.	
01.06.03	Angle of projection for maximum range for fixed speed of projection.	
01.06.04	Horizontal & vertical projectiles and their path.	
01.06.05	Simple numericals based on formulas.	
01.07	<u>Friction</u>	[02]
01.07.01	Friction - Definition, Types of friction - Sliding & Rolling, Static & Dynamic (Kinetic).	
01.07.02	Limiting frictional force. Laws of Static & Kinetic friction. Experimental Verification not required.	
01.07.03	Co-efficient of friction - a unitless quantity.	
01.07.04	Equilibrium of a body on rough inclined plane under the effect of its weight & frictional force.	
01.07.05	Angle of Repose & its uses.	
01.07.06	Friction - necessary evil.	
01.07.07	Use of lubricants to reduce friction - solid, liquid & gas.	
01.07.08	Simple numericals based on formulas.	
01.08	<u>Circular Motion</u>	[02]
01.08.01	Circular Motion - Definition.	
01.08.02	Angular Displacement, Velocity and acceleration & their units.	
01.08.03	Relation between linear and angular velocity and acceleration - Differential Calculus method.	
01.08.04	Centripetal Force and its derivation by Vector method.	
01.08.05	Centrifugal force, its presence felt only in rotational systems - Pseudo force.	
01.08.06	Applications of Circular motion: - motion of cyclist on curved path - banking of tracks - principle of working of cream separator, cloth drier, centrifuge machine	
01.08.07	Simple numericals based on formulas.	
01.09	<u>Simple Harmonic Motion</u>	[02]
01.09.01	Periodic motion & S.H.M. - Definitions.	
01.09.02	Expressions for displacement, velocity, acceleration and time period of S.H.M. Derivation not required.	
01.09.03	Phase & Epoch - Definition.	
01.09.04	Equation of S.H.M. starting from equilibrium position and another point. $y = a \sin \omega t$ & $y = a \sin (\omega t + \phi)$.	
01.09.05	Elastic spring & spring constant.	
01.09.06	Motion of a block tied to a massless spring moving on a horizontal frictionless table.	
01.09.07	Time period of a Simple pendulum - derivation.	
01.09.08	Simple numericals based on formulas.	
01.10	<u>Gravitation</u>	[02]
01.10.01	Newton's law & formula for force between two bodies.	
01.10.02	Units & Dimensions of 'G' and 'g'.	
01.10.03	Relation between 'G' and 'g' and their values.	
01.10.04	Value of 'g' at earth's surface, above and below earth's surface - maximum value. No Derivation required.	
01.10.05	Satellite - Orbital Velocity and time period.	
01.10.06	Parking Orbit - Definition	
01.10.07	Escape Velocity - Definition & expression in terms of 'g'. Derivation not required.	
01.10.08	Simple numericals based on formulas.	
01.11	<u>Rotational Motion and Moment of Inertia</u>	[03]
01.11.01	Moment of Inertia & Radius of Gyration - Definition, units and dimension.	
01.11.02	M.I. of Uniform ring & Uniform Disc about their natural axes.	
01.11.03	M.I. of Solid Sphere about its diameter - derivation of expression.	
01.11.04	Rolling on inclined smooth plane without slipping - Expression for acceleration along the plane to be derived.	
01.11.05	Sliding motion of a body down a rough inclined plane under its own weight only - No external force - derivation of expression.	
01.11.06	Torque and angular momentum - definition & expression.	
01.11.07	Principle of Conservation of angular momentum and its examples. No derivation required.	
01.11.08	Simple numericals based on formula.	
01.12	<u>Fluids</u>	[01]
01.12.01	Surface Tension & Surface Energy - Introduction, Unit & Dimension.	
01.12.02	Capillary rise - expression and its applications. No Derivation required.	
01.12.03	Laminar Flow & Co-efficient of Viscosity - Unit & Dimension.	

- 01.12.04 Streamline & Turbulent flow - Definition.
 01.12.05 Motion of Spinning ball in air (a viscous medium) and free fall of rain drops - Qualitative Discussion.

TOPIC: 02 - HEAT: [01]

02.01 Heat [01]

- 02.01.01 Heat form of energy. Unit of heat - Joule & Calorie.
 02.01.02 Modes of heat transfer and their examples.

TOPIC: 03 - ELECTROSTATICS: [03]

03.01 Field & Potential [01]

- 03.01.01 Electric Field, Intensity and Potential due to a point charge.
 03.01.02 Units & Dimensions of electric intensity & potential.
 03.01.03 Derivation of potential at a point due to point charge.

03.02 Capacity & Condenser [02]

- 03.02.01 Capacity of a Single Conductor and Condenser (Capacitor).
 03.02.02 Capacity of a Parallel Plate Condenser - Expression only.
 No derivation required.
 03.02.03 Series & Parallel grouping of Condensers and expressions for equivalent capacities.
 No derivation required.

TOPIC: 04 - CURRENT ELECTRICITY AND MAGNETISM: [12]

04.01 E.M.F. & P.D. [01]

- 04.01.01 Definition - Units
 04.01.02 Internal resistance of cell.
 Expression for current $I = E/(R+r)$.

04.02 Kirchoff's Laws [02]

- 04.02.01 Kirchoff's Laws and Wheatstone bridge - Condition for balance.
 No derivation required.

04.03 Magnetic Effect [02]

- 04.03.01 Biot-Savart's Law, Expression for magnetic induction & direction of magnetic induction.
 04.03.02 Expression for magnetic induction due to an infinitely long conductor carrying electric current.
 No derivation required.
 04.03.03 Expression for magnetic induction due to Circular Coil carrying electric current,
 - at centre of the coil &
 - at a point on the axis of the coil.
 No derivation required.

04.04 Heating Effect [02]

- 04.04.01 Heat developed in a current carrying conductor - expression.
 04.04.02 Electrical Power & energy and their units.
 04.04.03 Specifications marked on electrical appliances - Wattage & Voltage.
 04.04.04 Resultant power (Total power) consumed in parallel combination of electrical appliances.
 Kilo watt hour (Kwh) and electrical unit.
 Expressions only.
 No derivation required.
 04.04.05 Simple numericals based on formulas.

04.05 Electromagnetic Induction [02]

- 04.05.01 Magnetic Flux - Definition & Unit.
 04.05.02 Electromagnetic Induction - definition.
 04.05.03 Faraday's Law & Lenz's Law of Electromagnetic Induction.
 04.05.04 Eddy (Focault's) Current & its used in induction furnace and braking (stopping) of rotating wheels.

04.06 Alternating Current [03]

- 04.06.01 Uniform rotation of a coil in uniform magnetic field - Derivation of expression for e.m.f. induced.
 04.06.02 Peak Value & R.M.S. Value of A.C.
 Rated Value - R.M.S. Value.
 04.06.03 Expressions for e.m.f. and current in A.C. Circuit containing:
 - resistance only
 - Inductance only
 - capacitance only
 Expressions only. No Derivation required.
 04.06.04 Choke Coil - Simple introduction.
 04.06.05 Transformer & losses in it - Simple ideas.

<u>TOPIC: 05 - MODERN PHYSICS:</u>		[10]
05.01	<u>Atomic Structure</u>	[01]
05.01.01	Bohr's atomic model.	
05.01.02	Stationary orbits & energy levels.	
05.01.03	Transition of electron between two orbits - emission of electromagnetic radiation, Expression for wavelength of emitted radiation. No derivation required.	
05.01.04	Simple numericals based on formulas.	
05.02	<u>Thermionic Emission</u>	[01]
05.02.01	Thermionic emission and Diode Valve.	
05.02.02	Half Wave rectifier.	
05.03	<u>X-Rays</u>	[01]
05.03.01	Simple ideas of production of X-ray (No Diagram needed), Soft & hard X-rays.	
05.03.02	Expression of minimum wavelength.	
05.03.03	Use of X-ray in medicine & industry.	
05.03.04	Simple numericals based on formulas.	
05.04	<u>Photoelectric Effect</u>	[02]
05.04.01	Definition, Photon and its energy.	
05.04.02	Threshold frequency	
05.04.03	Effect of Intensity & Energy of incident light on Photoelectric effect.	
05.04.04	Use of Photoelectric effect: <ul style="list-style-type: none"> - medical use in Glucometer (Blood Sugar Measurement) - Exposure meter - Density measurement of exposed X-ray & photo films - Television telecasting 	
05.04.05	Simple numericals based on formulas.	
05.05	<u>Radioactivity</u>	[01]
05.05.01	Definition, Radioactive Decay and its formula - Half life time.	
05.05.02	Types of radiations emitted from radioactive materials	
05.05.03	Fission and Fusion - Simple ideas.	
05.05.04	Principle of nuclear reactor and Stellar energy (energy from star)	
05.05.05	Simple numericals based on formulas.	
05.06	<u>Ultrasonics</u>	[01]
05.06.01	Definition	
05.06.02	Piezo electric effect - Simple ideas (No diagram).	
05.06.03	Uses in medicine and industry - simple ideas.	
05.07	<u>Laser & Optical Fibre</u>	[01]
05.07.01	Introduction & Working principle - simple ideas.	
05.07.02	Uses in medicine & industry - simple ideas.	
05.08	<u>Semiconductor</u>	[02]
05.08.01	Intrinsic & Extrinsic Semiconductor - simple ideas.	
05.08.02	Tetravalent Structure of intrinsic semiconductor. Doping material (Impurity) trivalent & pentavalent.	
05.08.03	PN junction & simple introduction of forward and reverse bias.	

TOPIC: 06 - ENVIRONMENT & SAFETY: **[02]**

06.01	<u>Environment & Safety</u>
06.01.01	Noise pollution and its effect on human health.
06.01.02	Radiation Hazards and Safety thereof.
06.01.03	Non conventional Energy- Solar Energy, Solar battery Cell, Wind Energy, Geothermal Energy.

Books Recommended for Engineering Physics:

Text Books:

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|---|------------------------------------|---|-------------------------------------|
| 1 | Introductory Physics (Vol. I & II) | - | By N.N. Ghosh |
| 2 | Intermediate Physics (Vol. I & II) | - | By Durga Pd. Singh |
| 3 | Physics for Class XI & XII Part I | - | By N.K. Bajaj
(Tata McGraw Hill) |

Reference Books:

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| 4 | University Physics | - | By Sears & Zeemansky |
| 5 | Physics Part I & Part II | - | By Halliday & Resnik |
| 6 | Applied Physics Vol. I & II | - | By TTTI Chandigarh,
(Tata McGraw Hill) |
| 7 | Concepts of Physics Vol. I & II | - | By H.C. Verma |
| 8 | Intermediate Physics | - | By S.C. Roy Chowdhary & Dr. D.B. Singh |
| 9 | Intermediate Physics | - | By Lakhmer Singh & Subramaniam |
| 10 | I.Sc. Physics Vol. I & II | - | By V.P. Bhatnagar
(Pitambar Publishing Co., New Delhi) |