



**BHARATHIDASAN UNIVERSITY
TIRUCHIRAPPALLI- 620 024**

B.Sc. Physics

(For the candidates admitted from the academic year 2014 -15 onwards offered through Centre for Distance Education)

Course Duration: 3 Years – (Non-Semester System)

Eligibility: Higher Secondary (+2) Pass with Physics, Maths

Year	Paper	Title of the Paper	Exam Hours	Marks
I	Language Paper – I		3	100
	English Paper –I		3	100
	Major Paper I	Mechanics, Properties of matter and Acoustics	3	100
	First Allied	Maths	3	100
	Major Paper II	Major Practical –I	3	100
				500
II	Language Paper II		3	100
	English paper II		3	100
	Major Paper III	Thermal Physics and Statistical Mechanics	3	100
	Second Allied	Chemistry Theory 75 Practical 25	3	100
	Major Paper IV	Major Practical -II	3	100
				500
III	Major Paper V	Electricity, Magnetism and Electromagnetism	3	100
	Major Paper VI	Optics and Spectroscopy	3	100
	Major Paper VII	Atomic and Nuclear Physics	3	100
	Major Paper –VIII	Analog and Digital Electronics	3	100
	Major Paper IX	Major Practical -III	3	100
				500
	TOTAL MARKS			1500

- Note:
1. FOR ALL THEORY AND PRACTICAL PAPERS passing minimum is 40%.
(50 Marks) 20 Marks
 2. Compulsory Record note book should be submitted at the time of practical examination.
 3. Environmental Studies UGC paper is compulsory to study in 1st year

Paper I -Mechanics, Properties of Matter and acoustics

UNIT – I : Dynamics Projectile, Impulse, Impact.

Projectile – range of horizontal and inclined plane – Impulse – Impact – Impulsive force – Laws of impact – Impact of a smooth sphere on a smooth horizontal plane – Direct and oblique impacts – Loss in kinetic energy – Motion of two interacting bodies – reduced mass.

UNIT – II : Dynamics of rigid bodies.

Kinetic energy of rotation – Theory of compound pendulum – Equivalent simple pendulum – Reversibility of centres of oscillation and suspension – Determination of g and radius of gyration of a bar pendulum – period of oscillation of a Bifilar pendulum with and without parallel threads - Centre of mass – Velocity and acceleration of centre of mass – determination of motion of individual particle – system of variable mass – equation for a Rocket – Conservation of linear and angular momentum

UNIT –III : Elasticity :

Stress – strain diagram – Elastic Moduli, Work done per unit volume in shearing strain – Relation between elastic constants – Poisson's Ratio – Expression for Poisson's ratio in terms of elastic constants – Twisting couple on a wire – Work done in twisting – Torsional pendulum – determination of rigidity modulus of a wire.

UNIT – IV : Surface tension & Viscosity

Definition and dimensions of surface tension – Excess of pressure over curved surfaces – Variation of surface tension with temperature – Jaegar's experiment.

Streamlined motion – Turbulent motion – Coefficient of viscosity and its dimension – Rate of flow of liquid in a capillary tube – Poiseuille's formula – Experiment to determine the coefficient of viscosity of liquid.

UNIT – V : Acoustics:

Music and noise – Characteristics of musical sound, quality of tone, consonance and dissonance – musical scale – tempered scale – decibel – noise pollution.

Source in an enclosure – reverberation and time of reverberation – Sabine's formula – Eyring Formula – Optimum reverberation – measurement of reverberation time – absorption coefficient - acoustics design – Ultrasonics – production , properties and applications.

Books for study and reference:

1. Properties of matter – Brijlal and Subramanian
2. Properties of matter – D.S.Mathur.
3. Properties of matter – SubramaniaIyer and Jeyaraman.
4. Oscillations, waves and sound – L.P. Sharma, H.C.Saxena.
5. A text book of sound – R.L.Saigal.
6. A text book of sound – N.Subrahmanyam and Brijlal.

Major Practical – I

(Any 10 experiments only)

1. Non-uniform bending – Pin and Microscope.
2. Uniform bending – Optic lever.
3. Surface tension – Capillary rise.
4. Sonometer – Verification of laws and determination of frequency
5. Melde's Experiment – Transverse and longitudinal.
6. Compound pendulum – g and k .
7. Cantilever depression – scale and telescope.
8. Specific heat capacity of a liquid – Newton's law of cooling.
9. Thermal conductivity of a bad conductor – Lee's disc.
10. Long focus convex lens – f , R , μ .
11. Newton's Rings – ' R ' determination, μ of liquid.
12. Spectrometer – μ of solid prism.
13. Air wedge – thickness of insulation.
14. P.O.Box – Temperature coefficient.
15. Meter Bridge – Specific Resistance

Paper III - THERMAL PHYSICS AND STATISTICAL MECHANICS

Unit I: Thermodynamics

Zeroth law of thermodynamics – First law of thermodynamics – Heat engines – Reversible and irreversible process of Carnot's theorem – Second law of thermodynamics, Thermodynamic scale of temperature – Entropy – Change of entropy in reversible and irreversible processes – Temperature – entropy diagram (T.S) – Law of increase of entropy – Maxwell thermo dynamical relations – Clausius's Claypeyron's latent heat equations.

Unit II: Low Temperature

Joule – Thomson's effect – Porous plug experiment – Liquefaction of gases – Linde's method – Adiabatic demagnetization – Liquefaction of He – Practical applications of low temperature – Refrigerating mechanism – Air conditioning machines.

Unit III Radiation

Radiation – Stefan's law Deduction of Newton's law from Stefan's law – Boltzmann law – Black body radiation – Wein's law – Rayleigh – Jean's law – Planck's law – Angstrom Pyroheliometer – Solar constant – Surface temperature of sun Sources of solar energy – Some everyday applications.

Unit IV: Specific Heat

Specific heat of solids – Einstein's theory of specific heat – Debye's theory – Specific heat of gases – Mayer's Relation – Quantization of various contributions to energy of diatomic molecules – Specific heat of diatomic gases – (Quantum Theory)

Unit V: Statistical Physics

Phase space – Statistical Equilibrium – Microstates and Macrostates – Maxwell – Boltzmann statistics – Application of M.B statistics to molecular energies in an ideal gas – B-E statistics- Application of B-E statistics to photon gases – F-D statistics – Application of F.D statistics to electron gas – Comparison of three statistics.

Books for Study:

1. Brijlal, and Subramaniam, Heat and Thermodynamics, S.Chand & Co. (2007)
2. J.B.Rajam and C.L Arora, Heat and Thermodynamics.

MAJOR PRACTICAL – II

(Any 10)

1. Static Torsion – Determination of n
2. Torsional pendulum – n and I
3. Coefficient of viscosity of highly viscous liquid
4. Stoke's method – Viscosity of highly viscous liquid
5. Characteristics of junction and Zener diodes
6. Joule's calorimeter – Specific heat capacity of liquid (Barton's correction)
7. Carey Foster's Bridge – R and p
8. Potentiometer – Ammeter calibration
9. Spectrometer – I - d curve
10. CRO – Study of wave forms – Lissajous figures – f determination
16. Construction of Full wave rectifier – Using two diodes
17. Potentiometer – low range voltmeter calibration
18. Lees' disc – Thermal conductivity of poor conductor.

Paper V - ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

Unit I Electrostatics

Coulomb's inverse square law – Gauss theorem and its applications (Intensity at a point due to a charged sphere & cylinder) – Principle of a capacitor – Capacity of a spherical and cylindrical capacitors – Energy stored in a capacitor – Loss of energy due to sharing of charges.

Unit II Current Electricity

Ampere's circuital law and its applications - Field along the axis of a circular coil and Solenoid – Force on a conductor in a magnetic field – Theory of Ballistic Galvanometer – Figure of merit – Damping Correction – Wheatstone network – Carey Foster's Bridge – Potentiometer - Measurement of current, resistance and low voltage.

Unit III Magnetism

Intensity of magnetization - Susceptibility – Types of magnetic materials – Properties para, dia and ferro magnetic materials – Cycle of magnetization – Hysteresis – B-H curve – application of BH curve– Magnetic energy per unit volume.

Unit IV Electromagnetic Induction

Laws of electromagnetic induction – Self and mutual induction – Self inductance of a solenoid – Mutual inductance of a pair of solenoids – Coefficient of coupling – Experimental determination of self and mutual inductance (Rayleighs method) Growth decay of current in circuit containing L and R – Growth and decay of charge in circuit containing C and R – High resistance by leakage – Charging and discharging of capacitor through L and R.

Unit V AC Circuits

Alternating EMF – Alternating EMF applied to circuits containing L and R – C and R – Alternating EMF applied to circuits containing L, C and R – Series and Parallel resonance circuits – Sharpness of resonance – Q factor – Power in AC circuits – Power factor – Wattless current

Books for Study

1. Brijlal and Subramaniam – Electricity and Magnetism – S.Chand& Co.
2. R.Murugesan, Electricity and Magnetism, S.Chand& Co.

Books for Reference:

1. Narayanamoorthy and Nagaratnam, Electricity and Magnetism NPC, Chennai.

Paper VI - OPTICS AND SPECTROSCOPY

Unit I Interference

Air wedge – Newton's rings – Haidinger's fringes – Brewster's fringes – Michelson Interferometer and its applications – Fabryperot Interferometer – Interference filter – Stationary waves in light – colour photography (ideas only) – Holography – Construction and reconstruction of a hologram – applications.

Unit II Diffraction

Fresnel's diffraction – Diffraction at a (1) circular aperture (2) Straight edge (3) narrow wire. - Fraunhofer diffraction at a single slit – Double slit – Missing orders in a Double slit, Diffraction pattern – Grating with theory – Oblique incidence – Overlapping of spectral lines – Diffraction pattern – Grating with theory – Oblique incidence – Overlapping of spectral lines

Unit III Resolving power of optical instruments

Resolving power – Rayleigh's criterion of resolution. Resolving power of a (1) Telescope (2) Grating – Dispersive power and resolving power of a grating.

Unit IV Polarization

Nicol prism – Nicol prism as an analyzer and polarizer – Huygens's explanation of Double refraction in uniaxial crystals – Double Image polarizing prisms – Elliptically and circularly polarized light – production and detection – quarter wave and half wave plate – Babinet's compensator – optical activity – Fresnel's explanation of optical activity – Laurent's Half shade polarimeter.

Unit V: Spectroscopy and Lasers

Types of spectra – Emission and absorption spectra – Continuous, band and line spectra – Solar spectrum – Fraunhofer lines – Raman effect – Characteristics of Raman lines – Experimental verification – IR and uv spectroscopy – sources – Detectors and applications – induced absorption – spontaneous emission – optical pumping – Ruby laser – He – Ne Laser – Applications of lasers.

Books for Study:

1. Optics by Brijlal and Subramaniam, S.Chand & Co
2. Optics by Khanna and Gulati.
3. Optics – Murugesan, S.Chand & Co

Books for Reference

1. Optics – Jenkins and White, McGraw Hill.
2. Optics – Ajoy Chatak (TMH).

Paper VII - ATOMIC AND NUCLEAR PHYSICS

Unit I Cathode Rays and Positive Rays.

Cathode rays – properties – e/m of cathode rays – Milliken's oil drop method – Positive rays – Properties – e/m of Positive rays: Thomson's parabola method – Aston's & Bain's bridge - Determination of critical Potential – Franck and Hertz's experiment – Davison's and Germer method.

Unit II Vector Atom model

Various quantum numbers, L-S and j-j Couplings – Pauli's exclusion principle – electronic configuration of elements and periodic classification – magnetic dipole moment of electron due to orbital and spin motions – Bohr magneton, Stern and Gerlach experiment.

Unit III Fine structure of spectral lines

Special terms and notations – selection rules- intensity rule and interval rule – Fine structure of sodium D lines – Alkali spectra – Fine structure in Alkali spectra – spectrum of Helium – Zeeman effect - Larmor's theorem – Debye's quantum mechanical explanation of the normal Zeeman effect – Anomalous Zeeman effect – theoretical explanation, Lande factor.

Unit IV Particle detectors and Atom models

Review of basic properties of nuclei – mass, radius, binding energy, nuclear moments – isotopes – isobars – radioactivity. Cyclotron – Betatron – Geiger Muller counter – cloud chamber – Q value of nuclear reaction.

Photo electric effect – Einstein photo electric eqn – Laws of photo electric eqn – Millikan's experiment – Photoelectric cells. Photo voltaic cell – photo conductive cells – photo multiplier.

Unit V

Liquid Drop Model – application to fission, fission fragments, nuclear energy – Carbon – Nitrogen cycle – atom bomb. Shell Model – magic numbers – Basic ideas of a nuclear reactor. Solar energy – hydrogen bomb.

Books for study

1. Murugesan, R., Modern Physics S.Chand & Co., (2006).
2. Modern Physics – B.L. Theraja

Books for Reference

1. Arthur Beiser, Concept of Modern Physics: McGraw Hill Ed. V (1999).
2. Modern Physics – J.B. Rajam

Paper VIII - ANALOG AND DIGITAL ELECTRONICS

Unit I Semiconductors Device

PN junction diode — V-I Characteristics of diode – Rectifiers – Half wave – full wave and bridge rectifiers – Zener diode characteristics– Zener diode as voltage regulator.

Bipolar junction transistor – Basic configurations Relation between α and β – Characteristic curves of transistor – CB, CE mode – h Parameters.

Unit II Amplifiers and Oscillators

Single stage CE amplifier – Power amplifiers – Efficiency of class B Power amplifier – Push – pull amplifier - General theory of feedback – Properties of negative feedback – Criterion for oscillations – Hartley oscillator – Colpitt's oscillator.

Unit III Operational Amplifiers and Special Devices

Differential amplifier - Common mode rejection ratio – Characteristics of an ideal op-amp – Virtual ground – Inverting amplifier – Non inverting amplifier – Applications. Adder – subtractor – Integrator – Differentiator – Unity gain buffer.

FET – JFET – MOS FET – FET parameters – UJT – UJT relaxation oscillator

Unit IV Number Systems, Logic Gates, Boolean Algebra and Simplification of Logic Expressions

Introduction to decimal, binary, octal, hexadecimal number systems – Interconversions – BCD code, Excess – 3 code, Gray code – One's and two's complements – Simple binary arithmetic operations – Addition, subtraction, multiplication and division – Positive and negative logic – Basic and derived logic gates, symbols and their truth tables
– AND, OR, NOT, NAND, NOR, XOR, and XNOR.

Boolean algebra – Basic laws of Boolean algebra – De-Morgan's theorems Reducing Boolean expressions using Boolean laws

Unit V Combinational and sequential digital Systems

Half and full adders – Binary address – Half and full subtractors – Multiplexer – Demultiplexer – counters – mod – 2,8,10,16

Books for study

- 1) Mehta V.K., Principles of Electronics, S.Chand and company Ltd.
- 2) Chattopadhyay, D., Raxshit, P.C., Sara, B.andPurkait, New Age International (P) Ltd.
- 3) Digital Electronics – Vijayendran Viswananth Publishers

Books for Reference

- 1) Theraja .B.L., Basic electronics solid state, S.Chand and Company Ltd (2002).
- 2) Sedha R.S., A text book of applied Electronics, S.Chand& company Ltd (2002).
- 3) Digital Electronics – Malrino Leech.

MAJOR PRACTICAL – III

(Any 12 experiments only).

1. Koenig's method – Uniform bending – Y – Determination
2. Spectrometer – i – ' i ' – curve – μ – determination
3. Spectrometer – Grating minimum deviation and dispersive power.
4. Field along the axis of a coil – determination of M .
5. M and H – Absolute determination using deflection and vibration magnetometer.
6. Potentiometer x of thermistor.
7. Ballistic Galvanometer – Figure of merit.
8. Series and Parallel resonance circuits (CRO can be used).
9. Regulated power supply using Zener, Percentage of regulation.
10. Single stage – RC coupled amplifier – Transistor.
11. Emitter follower amplifier – Frequency response.
12. Hartley oscillator using transistor.
13. FET Characteristics.
14. Logic gates – AND, OR and NOT gates using discrete components – Truth table.
15. Adder and sub tractor – Half and full
