

4. Syllabus of subject

Faculty: Science and Technology

Programme: B.Sc. (Physics) Syllabus

POs:

At the time of graduation, Students will be able to

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the Programme successfully, students would be able to

1. Acquire a comprehensive knowledge and sound understanding of fundamentals of Physics

2. Develop laboratory skills, enabling them to take measurement in a physics laboratory and analyze the measurements to draw valid conclusions.
3. Be prepared to acquire a range of general skills, to solve problems, to evaluate information, to use computers productively, to communicate with society effectively and learn independently.
4. Develop good oral and written scientific communication skill.

B. Sc. I (Sem I)

Mechanics, Properties of matters, Oscillations & Relativity

Unit	Content	Periods
Unit I	Rotational Dynamics: Rigid body, Torque, Rotation about fixed axis, Kinetic Energy of rotation, moment of inertia and its physical significance, Radius of gyration, Perpendicular and parallel axes theorem (Statement Only), Fly-wheel, Moment of inertia of different bodies (Rod, Disc, cylinder and sphere) about different axes, Rolling motion. Principle of Conservation of Angular momentum. Principle and working of Gyroscope. Numericals	12
Unit II	SHM and its solution, time period of simple pendulum, compound pendulum, kater's pendulum & Torsional pendulum; Bifilar pendulum (Qualitative). Damped Oscillations: Differential equation of damped harmonic oscillator and its solution, Energy equation of damped oscillations, Power dissipation and Quality factor. Forced Oscillations: Differential equation of forced oscillation (Qualitative), Resonance (Amplitude). Numericals	12
Unit III	Superposition of two mutually perpendicular SHM of same frequency, Lissajous figures. Velocity of longitudinal waves (Newton's formula), Laplace correction, velocity of transverse waves in stretched string, Standing waves, Organ Pipe, harmonics and overtones. Velocity of waves by Kundt's tube. Ultrasonic waves: Production (piezoelectric crystal and Magnetostriction) and detection of ultrasonic waves and its applications in medical and industrial field. Numericals	12

Unit IV	Elasticity: Different types of elasticity, Twisting couple on a cylindrical rod or wire, Determination of modulus of rigidity by Maxwell needle, Torsional pendulum, Torsional oscillations, Modulus of rigidity of a material of wire by torsional pendulum, Beam, Bending of beam, Bending moment, External and internal bending moments, Cantilever, Expression for depression of a beam (i) loaded at one end and (ii) loaded at the center. Numericals	12
Unit V	Gravitation and Special Theory of Relativity: Kepler's laws of planetary motion (Statements only), Newton's law of gravitation, Variation of "g" with altitude and depth, weightlessness, Satellite in circular orbit and applications, Geosynchronous orbit, basic idea of Global Positioning System(GPS). Frame of reference, Inertial and Non-inertial frame of reference, Galilean transformation, Postulates of special theory of relativity, Lorentz transformation, length contraction, Time dilation, Einstein's mass energy relation. Numericals	12
Skill Enhancement Module Basics of Measurement Technique Measurements: Significance of measurements, methods of measurements, Static and dynamic characteristics: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements: Types of errors: i) Gross errors ii) Systematic errors iii) Random errors and loading effects. Statistical evaluation of measurement data: Arithmetic mean & median, Average deviation: Measurement with Screw Gauge, Vernier Caliper, Travelling Microscope, Spectrometer.		12
COs: After completion of this course students will able to 1. Apply the principles of measurement and error analysis. 2. Develop the skills to handle various instruments with precision.		
Activities	1. Measurement of dimension of solid block, volume of cylindrical objects, diameter of thin wire. 2. Measurement of length and diameter of capillary tubes.	

	3. Comparison of diameter of a thin wire using screw gauge and travelling microscope. 4. Measurement and estimation of errors in any one of the above activities.
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➤ **Text books & Reference Books:**

1. A Course in electrical & Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai & Company (Pvt.) Ltd. Educational & Technical Publishers,
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
3. Measurement, Instrumentation And Experiment Design In Physics And Engineering by Michael Sayer, Abhai Mansingh, Phi Learning Private Ltd. New Delhi.
4. Electronic Instrumentation by H.S. Kalsi
5. Elements of Electronic Instrumentation and Measurement by Joseph J. Carr
6. A text book in Electrical Technology - B L Theraja - S Chand and Co.
7. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
8. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
9. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
10. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
11. Feynman Lectures, Vol. I, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education
12. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
13. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
14. University Physics. F.W. Sears, M.W. Zemansky, H.D. Young 13/e, 1986, Addison Wesley

➤ **Weblink to Equivalent MOOC on SWAYAM if relevant:**

<https://nptel.ac.in>

➤ **Weblink to Equivalent Virtual Lab if relevant:**

<https://vlab.amrita.edu/>

<https://www.vlab.co.in>

<http://vlabs.iitb.ac.in/vlab/labsps.html>

➤ **Any pertinent media (recorded lectures, YouTube, etc.) if relevant:**

<https://youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e>

(Laboratory/Practical/practicum/hands-on/Activity)

List of Practical/Laboratory Experiments/Activities etc.

It is necessary to perform **TEN** Experiments from the list given below.

Sr. No.	List of Practical/Laboratory Experiments/Activities etc.
1.	To determine acceleration due to gravity by Bar pendulum.
2.	To determine acceleration due to gravity by Kater's reversible pendulum.
3.	To study oscillations in bifilar suspension arrangement
4.	To determine Moment of Inertia of a body by a torsion pendulum.
5.	To study the theorem of parallel axes of Moment of Inertia
6.	To study the theorem of perpendicular of Moment of Inertia
7.	To determine the Moment of Inertia of a body using bifilar suspension method (with parallel threads)
8.	To determine the moment of inertia of a fly-wheel.
9.	To determine the i) equivalent length, ii) radius of gyration, iii) moment of inertia of a compound pendulum by method of coincidences.
10.	To study the oscillations of a mass in combinations of two springs and hence determination of force constant.
11.	To show that the frequency of a Helmholtz resonator varies inversely as the square root of its volume and to estimate the neck correction.
12.	To determine Young's modulus of the material of a beam by method of vibration.
13.	To determine Young's modulus of the material of a beam by method of bending.
14.	To determine Young's modulus of the material of a beam by a cantilever.
15.	To determine the Young's Modulus of a Wire by Optical Lever Method.
16.	To determine modulus of rigidity of material of a given wire by Maxwell's needle.
17.	To determine the modulus of rigidity of material of a given wire by using Torsional pendulum.
18.	To determine coefficient of restitution for inelastic collision.

19.	To determine the surface tension of mercury by Quinke's method
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➤ **Text books & Reference Books:**

15. B.Sc. Practical Physics by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.

16. A Textbook of Practical Physics by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.

17. B.Sc. Physics Practical by C. L. Arora, 2010, S. Chand and Company Limited.

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B. Sc. I (Sem - II)

Electrostatics, Magneto-statics, Ultrasonic Waves and Acoustics,

Network Theorems

Unit	Content	Periods
Unit I	Vector Analysis: Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors. Numericals.	12
Unit II	Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Relation between electric field and	12

	electric potential. Numericals.	
Unit III	Capacitors: Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. Numericals.	12
Unit IV	Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. Numericals	12
Unit V	Network Theorems : Series circuit, Series voltage dividers, Parallel circuits, Series Parallel circuits, Resistances in series and parallel, Kirchhoff's Current and Voltage laws, Wheatstone's Bridge, Ideal constant voltage source, Ideal constant current source, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Milliman's theorem, Numericals.	12
Skill Enhancement Module Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Introduction to electrical components: Resistor- Types of Resistors, Color coding - Applications of a Resistor as a heating element in heaters and as a fuse element. Capacitor- Types of Capacitor, Color coding, Applications of Capacitor in power supplies, motors (Fans) etc. Inductor- Types of Inductors, EMF induced in an Inductor, Applications of Inductor in a fan, radio tuning circuit and Series resonance circuit. Energy audit: Unit of electricity, power of domestic appliances.		12
COs: After completion of this course students would be able to 3. Make use of Multimeter for the measurement of electrical parameters and get the knowledge of electronic components and their applications. 4. Estimate the power consumption of domestic appliances and carry out energy audit.		
Activities	1. Use of Multimeter for the measurement of ac voltage & dc voltage in different domestic appliances. 2. Use of Multimeter for the measurement of Resistance, Capacitance. 3. Estimate the values of Resistor & capacitor by color code method. 4. Connect two or three resistors or capacitors or inductors and measure the Series, Parallel Combination values using a Multimeter. 5. Identification of electronic components in mobile charger and to estimate their values. 6. Estimate and compare the power consumptions of different domestic appliances. 7. Energy audit of your home and compare it with monthly electric bill (for three months).	

➤ **Text books & Reference Books:**

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
6. A Course in electrical & Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai & Sons Educational & Technical Publishers, Delhi.
7. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
8. Physics for degree students (B.Sc.2nd year) by C. L. Arora & P.S. Hemne, S. Chand Publication.
9. Physics for degree students(B.Sc. 1st year)by C. L. Arora & P.S. Hemne, S. Chand Publication.
10. Basic Electronics by B. L. Theraja, S. Shand Publication.
11. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
12. Properties of Matter and Acoustics for B.Sc, Kiruthiga Sivaprasath & R Murugesan, S. Chand & Co. New Delhi.

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<https://www.youtube.com/watch?v=rtlJoXxlSFE&list=PLyQSN7X0ro2314mKyUiOILaOC2hk6Pc3j>

➤ **(Laboratory/Practical/practicum/hands-on/Activity)**

List of Practical/Laboratory Experiments/Activities etc.

It is necessary to perform **TEN** Experiments from the list given below.

Sr. No.	List of Practical/Laboratory Experiments/Activities etc.
1.	Verification of Kirchhoff's Current Law
2.	Verification of Kirchhoff's Voltage Law
3.	To determine unknown resistance by using Wheatstone's bridge
4.	Verification of Thevenin's theorem.
5.	Verification of Norton's theorem.
6.	Verification of Milliman's theorem.
7.	To verify the Superposition theorem
8.	To verify Maximum Power Transfer Theorem.
9.	To determine high resistance by leakage method
10.	To study the charging & discharging of a condenser through resistor.
11.	To compare capacitances using De Sauty's bridge.
12.	To determine capacitance by phaser diagram method
13.	To determine inductance by phaser diagram method
14.	Study of Primary & Secondary coil of Transformer
15.	To determine dielectric constant of a given material
16.	Study of frequency response of series LCR circuit
17.	Comparison of capacities by repeated charge decay method
18.	Measurement of the low resistance by Potentiometer

➤ **Text books & Reference Books:**

18. B.Sc. Practical Physics by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.
19. A Textbook of Practical Physics by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.
20. B.Sc. Physics Practical by C. L. Arora, 2010, S. Chand and Company Limited.

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<http://vlabs.iitb.ac.in/vlab/labsps.html>

- **Any pertinent media (recorded lectures, YouTube, etc.) if relevant:**

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B. Sc. II (Sem III)

3S PHY

Unit	Content	Periods
Unit I	Mathematical background and Electrostatics, Gradient, divergence and curl of a vector fields and their physical significance, line surface and volume integral. Gauss divergence theorem, Stokes theorem. Work done on charge in electrostatic field, flux of electric field, force on moving charge, Lorentz force equation and definition of B. Ampere's force law, Ampere's Law and its applications.	12
Unit II	Magnetostatics and Maxwell's Equations, Faraday's Law, Integral and differential form of Faraday's law, displacement current and Maxwell's Equation, wave Equation satisfied by E and B. Plane electromagnetic wave in vacuum, Poynting vector and Poynting theorem.	12
Unit III	Solid State Electronics Devices-I - Physics of semiconductors : Introduction to semiconductors ; Charge carriers & electrical conduction through semiconductors ; Doping, extrinsic semiconductors ; Fermi level & energy level diagrams ; Drift current in semiconductor, mobility, conductivity ; Hall effect, Hall coefficient, Semiconductor diode & its biasing, LED, Varactor diode.	12
Unit IV	Solid State Electronics Devices-II - Introduction to BJT ; working of BJT ; modes of operation ; Current gains α and β , their relation ; CB & CE characteristics ; JFET- construction & working, characteristics of FET ; Basic concept of Difference amplifier, IC-OP AMP, electrical parameters of OP AMP, inverting & noninverting modes ; OP AMP as adder, subtractor, differentiator & integrator.	12

Unit V	Special Theory of Relativity, Postulates of Special Theory of Relativity, Lorentz transformations, Length contraction, Time dilation, relativistic addition of velocities, relativity of mass, Einstein's Mass - energy relation, Numericals.	12
Unit VI	Atmosphere and Geophysics, Structure of earth – The crust, mantle, core. Part of the earth – As a planet; The Atmosphere, The lithosphere, The Hydrosphere Composition of Atmosphere Earthquakes – Causes, terminologies associated with earthquakes. Type of earthquakes scale of intensity, recording of earthquakes. Radiation in the atmosphere, Propagation of energy through vacuum, Intensity of radiation, Scattering, absorption and reflection of solar radiation by the atmosphere. Moisture and clouds: mechanism that produces clouds, Cloud produced by mixing and by cooling.	12

Practical:

It is necessary to perform **TEN** Experiments from the list given below.

Sr. No.	Practical
1.	To determine characteristics of CB transistor
2.	To determine characteristics of CE transistor
3.	Measurement of magnetic field by Hall probe method
4.	To study variation of gain of CE amplifier with load
5.	To study Zener regulated power supply
6.	To determine characteristics of FET
7.	To study FET as a voltmeter
8.	To study Wein bridge oscillator
9.	To study phase shift oscillator
10.	To study Wein bridge oscillator
11.	To study p-n diode as a rectifier
12.	To determine characteristics of p-n junction.
13.	Study of OP AMP as an inverting amplifier
14.	Study of OP AMP as non-inverting amplifier
15.	Study of OP AMP as an adder

16	Study of OP AMP as subtractor
17.	Study of OP AMP as differentiator
18.	Study of OP AMP as an integrator
19.	To determine characteristics of Phototransistor
20.	Measurement of field strength its variation in a solenoid.
21.	To draw the BH curve of iron by using a Solenoid and to determine the energy loss due to Hysteresis.

Reference Books:

1. Solid state Electronics Devices- B.G.Streetman (PHI)
2. Electronics Devices & Circuits – A. Mottershead (PHI)
3. Integrated Electronics—J.Millman ; C.Halkias (TMH)
4. Electronics Devices & circuits – Sanjeev Gupta (Dhanpat Rai Pub.)
5. Electronics Devices & circuits-I & II – Godse & Bakshi (Tech. Pub. , Pune)
6. Solid State Devices & Electronics—Kamal Singh & S.P.Singh (S. Chand & Co.)
7. Electromagnetic theory and holography – satya parakash
8. A text book of geology – G.B. mahapatra
9. Engineering and general geology – parbin singh.
10. The atmosphere – Richard A. Anthes, Hans A. Panotsky, Jhon J Cahir, Albert Rango.
11. Relativity—Goyal and Gupta
12. Text book of Physics --- V. K. Sewane
13. Elements of Special theory of relativity—S.P.Singh and M.K.Bagde
14. A course in Electromagnetic field by S.W.Anwane, B.P.B. Publication, New Delhi

B. Sc. II (Sem IV)

4SPHY

Unit	Content	Periods
Unit I	Geometrical optics and interference, Cardinal points of an optical	12

	system, equivalent focal length and power of coaxial lens system, Interference in thin films due to reflected and transmitted light, interference in wedge shaped thin film, Newton's ring by reflected light, measurement of wavelength of monochromatic light by Newton's, ring, determination of refractive index of liquid by Newton's rings.	
Unit II	Diffraction, Fresnel and Fraunhofer Diffraction, Fresnel half period zone, zone plate construction and theory. Double slit diffraction, Plane diffraction grating; construction and elementary theory, determination of wavelength of monochromatic light by using grating. Resolution of images, Rayleigh's criteria for resolution, R. P. of grating.	12
Unit III	Polarization, Concept of polarization, optic axis, double refraction, polarization by double refraction, phase retardation plate :-Quarter wave plate, half wave plate, (Nicol prism-production and analysis of polarized light). Theory of production of elliptically and circularly polarized light, production and detection of elliptically and circularly polarized light. Half shade polarimeter, blue of the sky.	12
Unit IV	Solid State Electronics Devices-II - Introduction to BJT ; working of BJT ; modes of operation ; Current gains α and β , their relation ; CB & CE characteristics ; JFET- construction & working , characteristics of FET ; Basic concept of Difference amplifier, IC-OP AMP , electrical parameters of OP AMP, inverting & noninverting modes ; OP AMP as adder, subtractor, differentiator & integrator.	12
Unit V	Fiber optics, introduction of fiber optics, total internal reflection, structure and classification of optical fiber. Propagation of light wave in an optical fiber, Acceptance angle and numerical aperture, dispersion, fiber losses, fiber optic communication. Advantages and Disadvantages of optic fibers, application of fiber optics.	12
Unit VI	Renewable Energy Sources, Introduction to various renewable energy sources – Solar energy, Wind energy, ocean energy- Waves & tides, geothermal energy, Hybrid Systems, Hydrogen energy systems, Fuel cells. Solar energy - Solar radiations on earth - availability and seasonal variations, Solar constant, Spectral distribution, Measurement	12

	of solar radiation and sun shine. Solar Energy Storage: - Methods of storage, properties of storage materials. Principle of Solar Thermal Applications, Solar water heater, Solar concentrating collectors - Types, applications. Solar Photovoltaic systems -- Operating principle, Photovoltaic cell concepts , power of a solar cell and solar PV panel ; Applications.	
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Practical:

It is necessary to perform **TEN** Experiments from the list given below.

Sr. No.	Practical
1.	To determine the wavelength of monochromatic light by Newton's rings.
2.	To verify the Brewster's law.
3.	To determine the refractive indices for ordinary and extraordinary rays using double image prism.
4.	To determine the Concentration of sugar solution by half shade polarimeter.
5.	To determine the wavelength of monochromatic light by plane diffraction grating.
6.	To find the number of lines per centimeter of the given grating.
7.	To determine the resolving power of plane diffraction grating.
8.	To determine the resolving power of telescope.
9.	To determine the wavelength of laser light.
10.	Determination of refractive index of a prism by spectrometer.
11.	Determination of dispersive power of prism material
12.	To determine the resolving power of prism.
13.	Study of interference of light by bi-prism experiment and find the wavelength of sodium light.
14.	To verify the law of Malus of plane polarized light.
15.	Polar plots of solar panel
16.	Measurement of direct radiation using Pyrheliometer .
17.	Measurement of global & diffuse radiation using pyranometer
18.	Determination of solar constant
19.	To determine frequency and phase of signal using CRO.
20.	To determine capacitance by Scherring bridge method.

21.	To determine self-inductance by bridge rectifier method.
22.	To determine frequency of AC mains by Sonometer.
23.	To study and plot I-V characteristics of solar cell.
24.	To study time constant of an RC circuit experimentally and verify the result theoretically.
25.	Verification of Stefan's law of radiation by using an incandescent lamp as black body Radiator.
26.	To study (a) Half-wave Rectifier and (b) Full-wave Bridge Rectifier and investigate the effect of C, L and filters.

REFERENCE BOOKS:

1. Laser and non-linear optics – B B Laud.
2. Optoelectronics and fiber optics communication – C.K Sarkar, D.C. Sarkar.
3. An introduction to fiber optics – R. Allen Shotwell
4. Optics – Ajoy Ghatak.
5. Optical fiber Communication – John M. Senior
6. Principles of optics – B.K.Mathur
7. Optics and laser – V.K. Sewane
8. Optics and atomic physics – D.P.Khandelwal.
9. Non-Conventional Energy Sources, G. D. RAI (4th edition), Khanna Publishers, Delhi.
10. Solar Energy, S.P. Sukhatme (second edition), Tata Mc. Graw Hill Ltd, New Delhi.
11. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers, Delhi.
12. Principles of Solar Energy - Kreith Kreider.
13. Renewable Energy - BentSarensen.

B. Sc. III (Sem V)**5S PHYSICS**

Unit	Content	Periods
Unit I	Origin of Quantum Mechanics 1. Historical Background: Failure of classical wave theory in explaining Black body radiation and Photoelectric Effect; Compton Effect Qualitative explanation only 2. Assumptions of Planck's Quantum Theory 3. Wave Particle Duality 4. Matter Waves: De Broglie Hypothesis, Davisson Germer experiment 5. Concept of Wave Packet, Phase velocity, group velocity and relation between them. 6. Heisenberg's uncertainty principle: Different forms of uncertainty principle; Thought experiments: single slit diffraction and Gamma ray microscope	12
Unit II	The Schrodinger equation and its applications 1. Wave function and its physical significance 2. Schrodinger time dependent equation 3. Separation in time dependent and time independent parts 4. Operators in quantum Mechanics 5. Eigen functions and Eigen values 6. Particle in one dimensional and three dimensional box (Energy eigen values) 7. Qualitative analysis of potential barrier Tunneling effect) 8. Simple Harmonic Oscillator (Qualitative analysis of Zero point energy)	12
Unit III	Atomic and Molecular Spectroscopy Vector Atom Model: Quantum Numbers, Stern Gerlach experiment; selection rules, l-s and j-j coupling, Types of spectra – Emission & absorption spectra. X-rays: Continuous X-ray spectrum, Duane and Hunt's law,	12

	characteristic X-ray spectra, Mosley's law. Raman Effect: stoke's and anti-stoke's lines, Quantum theory of Raman effect, experimental arrangement for Raman Spectroscopy	
Unit IV	Nuclear Physics Detection of charged particles; G. M. counter, Binding energy and Mass defect, stability of nuclei Alpha Decay: Range of Alpha particles, Geiger – Nuttall law and Gamow's explanation of alpha decay (qualitative) Beta decay: Types and Pauli's Neutrino Hypothesis Nuclear Fission, Nuclear fusion (concepts only), Nuclear reactors	12
Unit V	Hybrid parameters- low frequency equivalent of CE amplifier & its analysis., Bias stability & thermal runaway (qualitative). General principles of amplifier classification, RC coupled amplifier, equivalent circuits & gain at low, medium & high frequency (qualitative), gain-frequency response. Noise & distortion in electronic circuits.	12
Unit VI	Feedback in amplifiers- negative feedback, advantages of negative feedback, positive feedback. Phase shift, Wein bridge, Hartley & Colpits Oscillators. Multi-vibrators – astable, monostable & bistable.	12

Practical:

It is necessary to perform **TEN** Experiments from the list given below.

Sr. No.	Practical
1.	To study RC coupled amplifier- variation of gain with load.
2.	To study phase shift oscillator.
3.	To study Wein bridge oscillator.
4.	To study Hartlay oscillator.
5.	To study Colpits oscillator.
6.	To determine 'e' by Millikan's oil drop experiment.
7.	To determine 'e' by Thomsons method.
8.	Determination of Rydberg's constant
9.	To study absorption spectrum of Iodine vapors.
10.	To study Raman spectrum.

11.	To identify elements in optical line spectrum.
12.	To determine absorption coefficient of material for gamma rays.
13.	Determination of Hybrid parameters.
14.	Study of monostable multivibrator.
15.	Study of astable multivibrator.
16.	Study of an amplifier - with & without feedback.
17.	Determination of Plank's Constant by using LED.
18.	To study characteristics of Zener diode.
19.	Study of LED characteristics.
20.	Study of characteristics of Laser.
21.	Study of Emitter follower.

6S PHYSICS

B. Sc. III (Sem VI)

STATISTICAL MECHANICS AND SOLID STATE PHYSICS

Unit	Content	Periods
Unit I	Phase space, unit cell, microstates, macrostates, energy states, density of energy states, probability & thermodynamic probability, principle of equal a priori probabilities, most probable distribution, Boltzman entropy relation. Maxwell Boltzman statistics, and its application to molecular speed distribution, Average speed, rms speed & most probable velocity.	12
Unit II	Distinguishable & indistinguishable particles, concepts of boson & fermions. Bose – Einstein statistics: Thermodynamic probability, most probable distribution, application of BE statistics to black body radiation. Fermi- Dirac distribution : Thermodynamic probability, Most probable distribution ,Fermi function, Fermi energy & Fermi temperature.	12
Unit III	Amorphous and Crystalline Materials; Unit Cell. Miller Indices, Reciprocal Lattice, Coordination Number. Types of Lattices: Diffraction of x-rays by Crystals. Bragg's Law: Determination of	12

	lattice parameters of NaCl crystal. Defects in solids – points, line & plane defects.	
Unit IV	Motion of electron:- Free electrons; conduction electrons, electron collision; mean free path, conductivity & Ohm's law; density of states; concept of Fermi energy Band structure : Electron in periodic potential, nearly free electron model (qualitative), energy band, energy gap, metals, insulators and semiconductors.	12
Unit V	Atomic magnetic moment; magnetization vector; magnetic susceptibility; Dia -, Para-, and Ferromagnetic Materials; Classical Langevin Theory of dia and Paramagnetic Domains; Quantum Mechanical Treatment of Paramagnetism; Curie's law, Weiss's law; Hysteresis and Energy Loss.	12
Unit VI	Superconductivity: Introduction to Superconductors; Critical Temperature; Critical magnetic field; Meissner – effect; Type I and type II Superconductors, Idea of BCS theory (No derivation), Cooper pair; Applications of superconductors. Nano Technology: Introduction to nano size materials, brief History of Nano materials, Effect of reduction of dimensions on physical properties; quantum size effect; Applications of nano materials in different fields.	12

Practical:

It is necessary to perform **TEN** Experiments from the list given below.

Sr. No.	Practical
1.	To study crystal models and identification of crystal planes.
2.	To study Characteristics of Photocell
3.	To determine Planck's constant using photocell
4.	To determine energy gap of semiconductor using four probe method.
5.	To determine activation energy of Thermister.
6.	To determine energy gap of semiconductor using reverse bias method
7.	To study hysteresis losses in transformer core and plot B-H curve
8.	To measure magnetic susceptibility of solids.
9.	To study thermo emf using thermocouple.

10.	To Determination of temperature coefficient of resistance of platinum using platinum resistance thermometer.
11.	To determine lattice parameter using X-ray diffraction pattern.
12.	To determine half-life period of radioactive substance by GM counter
13.	Determination of dislocation density in alkali halide crystals.
14.	Demonstrations- Any 4 demonstrations equivalent to 2 experiments
15.	Mini project equivalent to 2 experiments.
16	Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)
17.	To study characteristics of Photo diode.
18.	To study Zener regulated power supply.
19.	Study of transistorized regulated power supply, series pass transistor.
20.	Determination of velocity of sound by using sonometer wire.
21.	Determination of velocity of ultrasonic wave in liquids.
22.	Determination of Band gap energy of a pn junction / zener diode.

REFERENCE BOOKS:

1. Thermodynamics and statistical mechanics-Brijlal Subramaniam
2. Statistical Mechanics – An Elementary Outline – Avijit Lahiri –Universities Press
3. Statistical and Thermal physics - By Lokanathan, R.S. Gambhir,
4. Fundamentals of statistical and thermal physics - By F.Reif
5. Perspectives of modern physics - By A. Beiser
6. Fundamental of Statistical Mechanics - By B.B. Laud
7. A primer of Statistical Mechanics - By R.B. Singh
8. Statistical Mechanics - By Gupta, Kumar
9. Solid State Physics, S.O.Pillai, 3rd Edition, New Age International (P) Ltd, Publisher, (1999).
10. Solid State Physics – By Kakani and Hemrajani, S. Chand Publication.
11. Solid State Physics - By Saxena, Gupta and Saxena, Pragati Prakation.
12. Introduction to Solid State Physics, Charles Kittel, John Wiley and Sons, 7th Edition.

13. Solid State Physics, A.J.Dekker, Macmillan India Ltd, (1998).
14. Solid State Physics, R.K. Puri, V.K. Babbar, S. Chand Publication.
15. Problems in Solid State Physics, S.O. Pillai, New Age International (P) Ltd.
16. Solid State Physics, Palanyswamy.
17. Solid State Physics, David, Snoke, Pearson Publication.
18. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N.Banerjee, Publisher: PHI Learning and Private Limited
19. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
20. Nanotechnology: Principles and Practi