SYLLABUS

(Prescribed by Sant Gadge Baba Amravati University, Amravati)

B.Sc. Part-I (Semester-I)

1S-PHYSICS: Mechanics, Properties of Matter, Waves and Oscillation

UNIT-I : Kepler's laws of planetary motion, Newton's law of gravitation, acceleration due gravity, variation with altitude and depth, Gravitational field, Gravitational Potential; Gauss's theorem, gravitational potential and intensity due to uniform solid sphere at a point inside and outside the sphere. Numericals.

UNIT-II : Motion of a Rigid body; rotational motion; moment of inertia; Principle of Perpendicular & Parallel axes, Radius of Gyration; M.I of regular shaped bodies like ring, disc, hollow sphere, solid sphere, cylinder & bar about different axes. Linear momentum, angular momentum, Conservation of Linear Momentum & Angular Momentum Numericals.

UNIT-III: Linear S.H.M, Angular S.H.M, Differential equations and solutions. Displacement, Velocity and acceleration, Kinetic and Potential energy. Simple pendulum, compound pendulum, Kater's Reversible pendulum, Spring and mass system, Vibration of a magnet, bifilar oscillations, Damped and forced harmonic oscillations, Resonance. Numericals.

UNIT-IV: Superposition of two SHM of same frequency along the same line Interference, superposition of two mutually perpendicular SHM of same Frequency, Lissajous figures. Standing waves, velocity of longitudinal waves (Newton's formula) velocity of waves by Kundt's tube, velocity of transverse waves in stretched string, harmonics and overtones. Production and detection of ultrasonic waves and its applications. Numericals

UNIT-V : Introduction of Elasticity; Hooke's Law of Elasticity, Three Elastic constants; Relation between, s, k and h. Bending of beam and Bending moment; Cantilever, Depression of centrally loaded beam, twisting couple, torsional pendulum; Maxwell's needle. Numericals.

UNIT-VI : Kinematics of moving fluids; Streamline and turbulent flow, viscous drag, Coefficient of viscosity, equation of continuity; Euler's equation, Bernoulli's theorem, Poiseulle's equation, Reynold's number, Terminal velocity, Stokes' law, Variation of viscosity with temperature. Surface tension, angle of contact and wetting, Jaeger's method Numericals.

Practical: The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
Total	50 Marks

a) A student will have to perform at least ten experiments per semester.
b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
c) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

List of Experiments:

1) Study of laws of Parallel and perpendiculars axes for moment of inertia.
2) Determination of coefficient of restitution for inelastic collision.
3) Moment of inertia of fly wheel.
4) Study of compound pendulum.
5) To determine moment of inertia of a body using bifilar suspension.
6) Modulus of rigidity by Torsional Pendulum.
7) Acceleration due to gravity by Kater's pendulum.
8) Study of Oscillations of mass under different combinations of springs.
9) Young's modulus by cantilever.
10) Young's Modulus by bending of beam.
11) Modulus of rigidity by statical method.
12) Young's modulus by Vibration Method.
13) Modulus of rigidity by Maxwell's needle.
14) Coefficient of Viscosity by Poiseulle's method.
15) Surface tension by Quincke's method.
16) Determination of Surface tension by Jager's method.

Reference Books:

1) Mechanics – Chadha T.K.
2) Waves and Oscillations – Chaudhary R.N.
3) University Physics I Mechanics of Particles waves and Oscillations –Kamal, Anwar
4) Mechanics – Shukla R.K.
5) Mechanics – Shrivastava P.K.
6) Properties of Matter – Murugeshan R
7) Properties of Matter – Brijlal

9) Barkeley Physics course Vol. I Eno Purcell Ed. (McGraw Hill)
10) The Feymann Lectures in Physics – Vol. I, R.P.Feymann, R.B.Lighton & M. Sands
11) Mechnics & properties of matter – D.S.Mathur
12) Fundamental of Physics – Halliday & Resncik (6th edition)
13) Concepts of Physics Vol I & Vol II by H.C.Varma

SYLLABUS

(Prescribed by Sant Gadge Baba Amravati University, Amravati)

B.Sc. Part-I (Semester-II)

Physics 2S-Physics: Kinetic theory, Thermodynamics and Electric Currents

UNIT I : Ideal Gas - Kinetic theory of Gases (Assumption, equation without derivation), deduction of Boyle's law, interpretation of temp.; Estimation of R M S speed of molecule; Estimation of Avagadro's number; degrees of freedom; equipartition of energy; specific heat of monatomic gas; extension to di & tri-atomic gases. Real Gas-Vander Waals gas equation of state, Comparison with experimental P-V curves, the critical constants; nature of Vander- Waals forces. Transport Phenomena in gases: Molecular Collision, mean free path, Brownian motion and collision cross section. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure. Numericals

UNIT II : The laws of thermodynamics - The zeroth law, P-V indicator diagrams, work done by and on the system; First law of thermodynamics, internal energy as a state function and other applications; Reversible and irreversible changes; Carnot Cycle and its efficiency for perfect gases, The Second law of thermodynamics; different versions of second law, Carnot theorem; Entropy, S-T diagram; Principle of increase of Entropy; The thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero, third law of thermodynamics. Numericals.

UNIT III: Liquefaction of Gases - Joule-Thomson effect, Joule's coefficient, Boyle and inversion temperature; Principle of regenerative cooling and Cascade Cooling, Liquefaction of hydrogen and helium.

Thermodynamic relationships-Thermodynamic Variables, Extensive and intensive, Maxwell's general relationship; application to Joule-Thomson cooling and adiabatic cooling in a general system. Clausius-Clapeyron heat equation, thermodynamic Potentials and equilibrium of Thermodynamical systems, relation with thermodynamical variables.

UNIT-IV: Motion of Charged Particles in Electric and Magnetic fields: (Note: The emphasis should be on Mechanical aspects, and not on the details of the apparatus mentioned which indicated as applications of principles involved.) E as an accelerating field, electron gun, case of discharge tube, linear accelerator (linac), E as a deflecting field, Transverse magnetic field, Mass spectrograph, velocity selector, curvatures of tracks for energy determination of nuclear particles, Principle of cyclotron. Mutually perpendicular E and B fields, velocity selector, its resolution.Numericals.

UNIT-V: Network theorem: Thevenin's theorem, superposition theorem (mesh current analysis), Maximum power transfer theorem, some applications. Ballistic galvanometer (theory, charge sensitivity, effect of damping), Application of B.G: Determination of capacitance and high resistance by method of leakage Varying Currents: Steady currents, current

multi-loop circuits, Rise and decay of currents in LR, Rise and decay & charge in CR circuits, and in LCR circuit, resonating frequency. Numericals.

UNIT-VI : Alternating Currents : A.C. currents, complex numbers and their applications in solving A.C. circuits using J operator, pure R, L, C and their combinations, reactance and impedance, series and parallel resonance, Q-.factor, power consumed by A.C. circuit, power factor. Self and mutual inductance, theory of transformer and energy losses in transformer. Numericals

Practical: The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
Total	50 Marks

a) A student will have to perform at least ten experiments per semester.
b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
c) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

List of Experiments:

1) Heating efficiency of electrical Kettle with varying voltages.
2) Determination of "J" by Callendar and Barne's method.
3) Cp/Cv by Clement and Desorme's method.
4) Thermal conductivity of an insulator by Lee's disc method.
5) Determination of charge sensitivity of ballistic galvanometer.
6) Measurement of low resistance by Carey-foster Bridge.
7) Measurement of low resistance by potentiometer.
8) Measurement of inductance by phasor diagram method.
9) Measurement of capacitance by phasor diagram method.
10) Study of frequency resonance of series LCR circuit and determination of Q-factor.
11) To study behavior of R-C.circuit as a filter.
12) To determine high resistance by leakage method.
13) C1 / C2 by De-Sauty's method.
14) Verification of laws of capacitances.

16) Verification of Kirchoff's law, using electrical network.
17) Verification of Maximum power transfer theorem.
18) Verification of Thevenin's theorem.
19) Verification of Norton's theorem.
20) Verification of Milliman's theorem.

Reference Books:

1) Heat and thermodynamics – D.S.Mathur
2) Text book of Heat – J.B.Rajam
3) Heat and thermodynamics – Rajam & Arora
4) Heat – Rajkumar & Sharma
5) Electricity & Magnetics – Chakraborty P.
6) Foundations of Physics Vol. I & Vol. II – Gambhir R.S.
7) Electromagnetics – Laud B.B.
8) Electromagnetic field & waves – Sarwate V.V.
9) Electricity and Magnetism Vol. II – Berkley Physics Course
10) Electricity and Magnetism – D.N.Vasudeva
11) Electricity and Magnetism – Brijlal & Subramaniam
12) Electrodynamics – S.L.Gupta & R.Singh
13) Electricity & Magnetism – Reitz & Millford
14) Electricity & Magnetism – A.S.Mahajan & A.A.Rangawala (TMH)
15) Principle of electricity & Magnetism – Panofsky & Philips
16) Electricity & Magnetism – S.S.Atwood
17) Electromagnetic waves & radiating systems – E.C. Jordan

DEPARTMENT OF PHYSICS

SYLLABUS

(Prescribed by Sant Gadge Baba Amravati University, Amravati)

B.Sc. Part-II (Semester-III)

3S PHYSICS

Unit I: Mathematical background and Electrostatics (12)

Gradient, divergence and curl of a vector fields and their physical significance, line surface and volume integral. Gauss divergence theorem , Stocks 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.

Unit II: Magnetostatics and Maxwell's Equations (12)

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.

Unit-III: Solid State Electronics Devices-I – (12)

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.

Unit-IV: Solid State Electronics Devices-II – (12)

Introduction to BJT ; working of BJT ; modes of operation; Current gains á and â, 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 & non-inverting modes ; OP AMP as adder, subtractor, differentiator & integrator.

Unit: V: Special Theory of Relativity (12)

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.

Unit: VI: Atmosphere and Geophysics (12)

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.

Practical: The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
Total	50 Marks

d) A student will have to perform at least ten experiments per semester.

e) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.

f) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

List of Experiments:

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 Weins bridge oscillator
9) To study phase shift oscillator
10) To study Wein's 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 noninverting 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.

SYLLABUS

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B.Sc. Part-II (Semester-IV)

4S PHYSICS

Unit I: Geometrical optics and interference (12)

Cardinal points of an optical 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 (12)

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.

Unit III: Polarization (12)

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.

Unit IV: Laser (12)

Introduction to Maser, Absorption, spontaneous and stimulated emission, population inversion, pumping characteristics of laser beam. Main components of laser system, three level and four level laser system. Ruby laser, He-Ne laser, semiconductor laser, application of laser. Holography-principle.

Unit V: Fiber optics (12)

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.

Unit VI: Renewable Energy Sources (12)

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 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.

Practical: The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
Total	50 Marks

a) A student will have to perform at least ten experiments per semester.
b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
c) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

Experiments:

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 extra-ordinary 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) To 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 p 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.

SYLLABUS

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B.Sc. Part-III (Semester-V)

5S PHYSICS

Unit I: Origin of Quantum Mechanics (12 L)

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

Unit II: The Schrodinger equation and its applications (12 L)

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)

Unit III: Atomic and Molecular Spectroscopy (12 L)

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, 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 (12 L)

Detection of charged particles; G. M. counter, Binding energy and Mass defect, stability of nuclei Alpha Decay: Range of Alpha particles, Geiger – Nuttal 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.

Unit V: Hybrid parameters- low frequency equivalent of CE amplifier & its analysios., Bais stability & thermal runway (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.

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.

Practical: The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
Total	50 Marks

a) A student will have to perform at least ten experiments per semester.
b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
c) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

Experiments:

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.

Reference Books:

1) Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles- Eisenburg & Resnik (John Wiley)
2) Quantum Mechanics- Gathak, Loknathan
3) A Text Book of Quantum Mechanics- P. M. Mathews, K. Venkatesn
4) Quantum Mechanics- S. P. Singh, M. K. Bagde
5) Quantum Mechanics- G. Aruldas
6) Concept of Modern Physics- Aurther Baiser
7) Introduction to Solid State Physics- C. Kittle
8) Solid State Physics- Kachhava
9) Solid State Physics- S. O. Pilla
10) Elements of Wave Mechanics & Solid State Physics
11) Solid State Physics- Babbar & Puri
12) Solid State Physics- Sexsena & Gupta
13) Introduction to Atomic Physics- H. E. White
14) Atomic & Molecular Physics- Rajkumar
15) The Feynman Lecture on Physics- R. P. Feynman
16) Atomic Physics- J. B. Rajam
17) Atomic and Nuclear Physics- Brijlal & Subrahmanyam
18) Nuclear Physics- R. C. Sharma
19) Basic Nuclear Physics- B. N. Srivastava
20) Nuclear Physics- D.C. Tayal
21) Elements of Electronics- M. K. Bagade & S. P. Singh
22) Basic Electronics- B. L. Theraja
23) Principle of Electronics- V. K. Mehata
24)

SYLLABUS

(Prescribed by Sant Gadge Baba Amravati University, Amravati)

B.Sc. Part-III (Semester-VI)

6S PHYSICS: STATISTICAL MECHANICS AND SOLID STATE PHYSICS

UNIT-I: Statistical Mechanics

Phase space, unit cell, microstates, macrostate, energy states, density of energy states, probability & thermodynamic probability, principle of equal a priori probabilities, most probable distribution, Boltzmann entropy relation. Maxwell Boltzmann statistics and its application to molecular speed distribution, Average speed, rms speed & most probable velocity.

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.

UNIT-III: Crystallography

Solids: - Amorphous and Crystalline Materials; Unit Cell. Millar Indices, Reciprocal Lattice, Coordination Number. Types of Lattices: Diffraction of x-rays by Crystals. Bragg's Law: Determination of lattice parameters of NaCl crystal. Defects in solids – points, line & plane defects.

UNIT -IV: Electrical Properties of Materials

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.

UNIT-V: Magnetic Properties of Materials

Atomic magnetic moment; magnetization vector; magnetic susceptibility; Dia -, Para-, and Ferromagnetic Materials; Classical Langevin's Theory of dia and Paramagnetic Domains; Quantum Mechanical Treatment of Paramagnetism; Curie's law, Weiss's law;. Hysteresis and Energy Loss.

UNIT-VI: Superconductivity & Nano Technology

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.

Practical: The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
Total	50 Marks

a) A student will have to perform at least ten experiments per semester.
b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
c) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

List of Experiments:

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 hysterisis 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.

Reference Books:

1) Thermodynamics and statistical mechanics-Brijlal Subramanium
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 Practices by Sulbha K Kulkarni, Capital Publishing Co. New Delhi.

References:

1) IGNOU: Practical Physics Manual
2) Saraf : Experiment in Physics
3) S.P. Singh : Advanced Practical Physics
4) Melissons : Experiments in Modern Physics