

BSc - 3rd Year

Unit V : Applications in Ecological and Environmental subject areas. Urban waste water management planning.

Reference Books :

1. Vol. 1 Differential equation models, Eds. Martin Barun, C. S. Coleman D. A. Drew.
2. Vol. 2 Political and Related Models. Steven J. Brams, W. F. Lucas, P. D. Straffin (Eds.)
3. Vol. 3 Discrete and System models. W. F. Lucas, F. S. Roberts, R. M. Thrall.
4. Vol. 4 Life Science Models. H. M. Roberts & M. Thompson.
5. All Volumes published as modules in Applied Mathematics, Springer-Verlag, 1982.

BSc - III sem - V & VI

PHYSICS
SYLLABUS

BSc - PART - III

SEM - V

Unit I : Origin of Quantum Mechanics (12 L)

upto - 2022 - 23 - 24
*summer
(old)
or onward.*

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

**2 : PHYSICS
Semester-V
SS PHYSICS**

Sem - 5

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 Gamov'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 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.

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
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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.

- ✓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 Hartley oscillator.
- 5. To study Colpits oscillator.
- ✓6. To determine 'c' by Millikan's oil drop experiment.
- ✓7. To determine 'e' by Thomson's 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 Planck's Constant by using LED.
- ✓18. To study characteristics of zener diode
- ✓19. To study of LED characteristics

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 STATISTICAL MECHANICS AND SOLID STATE PHYSICS

UNIT-I : Statistical Mechanics

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.

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.

SYLLABUS - BSc PART-III

SEM-VI

upto - 2022-23-²⁴
Summer
(old)
or onward

UNIT-V:

Band structure : Electron in periodic potential, nearly free electron model (qualitative), energy band, energy gap, metals, isulators and semiconductors.

UNIT-V: Magnetic Properties of Materials

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.

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:

Practical
sem - VI
sem - 6

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

- REFERENCE BOOKS:**
- Thermodynamics and Statistical mechanics-Brijjal Subramanian
 - Statistical Mechanics - An Elementary Outline - Avijit Lahiri - Universities Press
 - Statistical and Thermal Physics - By Lakshmanan, R.S. Gambhir, Fundamentals of statistical and thermal physics - By A. Beiser
 - Fundamentals of Statistical Mechanics - By B.B. Laud A primer of Statistical Mechanics - By R.B. Singh
 - Statistical Mechanics - By Gupta, Kumar Statistical mechanics - By Kaka and Hemrajani, S. Chand Publication.
 - Solid State Physics - S.O. Pillai, 3rd Edition, New Age Internation (P) Ltd.
 - To determine energy gap of semiconductor using reverse bias method.
 - To determine activation energy of Thermistor.
 - To determine energy gap of semiconductor using four probe method.
 - To determine Planck's constant using photocell
 - To study characteristics of Photocell
 - To study crystal models and identification of crystal planes.
 - To determine activation energy of Thermistor.
 - To determine energy gap of semiconductor using reverse bias
 - To measure magnetic susceptibility of solids.
 - To study hysteresis losses in transformer core and plot B-H curve.
 - To measure energy gap of semiconductor using thermocouple.
 - To study thermo emf using thermocouple.
 - To determine temperature coefficient of resistance of platinum using platinum resistance thermometer.
 - Determination of dislocation density in alkali halide crystals.
 - Mini project equivalent to 2 experiments.
 - Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)
 - To study characteristics of Photo diode.
 - To study Zener regulated power supply.
 - Study of transistorized regulated power supply, series pass transistors.
 - Determination of velocity of sound by using sonometer wire.
 - Determination of velocity of ultrasound wave in liquids.
 - Determination of band gap energy of a pn junction / zener diode.

- LIST OF EXPERIMENTS:**
- To determine crystal models and identification of crystal planes.
 - To study characteristics of Photocell
 - To determine Planck's constant using photocell
 - To determine energy gap of semiconductor using four probe method.
 - To determine activation energy of Thermistor.
 - To measure magnetic susceptibility of solids.
 - To study hysteresis losses in transformer core and plot B-H curve.
 - To measure energy gap of semiconductor using reverse bias
 - To determine energy gap of semiconductor using thermocouple.
 - To study thermo emf using thermocouple.
 - To determine lattice parameter using X-ray diffraction pattern.
 - To determine half life period of radioactive substance by GM counter
 - Determination of dislocation density in alkali halide crystals.
 - Mini project equivalent to 2 experiments.
 - Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)
 - To study characteristics of Photo diode.
 - To study Zener regulated power supply.
 - Study of transistorized regulated power supply, series pass transistors.
 - Determination of velocity of sound by using sonometer / wire.
 - Determination of velocity of ultrasound wave in liquids.
 - Determination of band gap energy of a pn junction / zener diode.

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