REVISED

JABALPUR ENGINEERING COLLEGE, JABALPUR (M.P.)

Scheme of M.Sc. Examination w.e.f. July, 2017 batch

SECOND SEMESTER (M.Sc. Applied Physics)

S.NO.	SUBJECT CODE	SUBJECT	Periods Per Week				Maximum Marks (Theory Slots)			Maximum marks (Practical Slots)		Total Marks	Remarks
			L	T	P	TOTAL Credits	End Sem. Exam	Mid Sem Exam	Assignment/ Quiz	End Semester Practical/ Viva	Practical Record/ Assignment/ Quiz/ Presentation		
1	AP2001	Nanophysics & Nanotechnology-I	4	1	...	5	70	20	10	...	.....	100	
2	AP2002	Electronics – II	4	1	...	5	70	20	10	...	...	100	
3	AP2003	Solid State Physics – II	4	1	...	5	70	20	10	...	.....	100	
4	AP2004	Classical Mechanics & Electromagnetic Theory	4	1	...	5	70	20	10	...	.....	100	
5	AP2005	LAB-I (Electronics lab)	....	...	5	5	...	...	...	60	40	100	
6	AP2006	LAB-II (Nano Science lab)	...	...	5	5	...	...	...	60	40	100	
7	AP2007	Industrial Training /Seminar			2	2					50	50	
		TOTAL	**16**	**4**	**12**	**32**	**280**	**80**	**40**	**120**	**130**	**650**	

L-Lecture T-Tutorial P-Practical

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M.Sc. Applied Physics SEMESTER – II
SUBJECT CODE - AP 2001
PAPER - NANOPHYSICS AND NANOTECHNOLOGY - I

TOTAL MARKS: 70 **TOTAL CREDITS: 5**

UNIT – I

Background and definition of Nanoscience and Nanotechnology: Introduction to Nanocrystalline material. Basic science behind Nanotechnology, Quantum confinement in Nanomaterials. Nanomaterials: Natural and manmade: Semiconductor nanomaterials (Zinc Oxide and Titanium Dioxide); Ceramic Nanomaterials (Aluminum oxide and Aluminum Hydro oxide); Metal Nanoparticles (Gold, Silver, Iron and Copper).

UNIT – II

Unique properties of Nanomaterials: Microstructure and defects in Nanostructured materials, Dislocations, Twin Stacking faults and voids, Grain boundaries, Triple junctions and Disclinations.

UNIT – III

Effects of Nanodimensions on Material behavior: Elastic properties, Melting point, Diffusivity, Grain Growth and characteristics, Enhanced solid solubility, Magnetic properties, Giant Magneto Resistance (GMR), Electrical properties, Optical Properties,Thermal properties and Mechanical Properties.

UNIT – IV

Tools to characterize Nanomaterials: X – Ray Diffraction, Small Angle X- Ray Scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM): Advanced techniques of TEM, Functioning of TEM, TEM specimen preparation, Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM): Modes of Operation, STM configuration. Nanoindentation.

UNIT – V

Nano fabrication: Synthesis of Nanopowder using Top-Down Fabrication methods: Arc Discharge methods, Laser Ablation method, Ball Milling, Inert Gas condensation. Bottoms Up Fabrication methods: Homogeneous Nucleation, Chemical Vapor Deposition method, Molecular Beam Epitaxy, Sol Gel method, Hyodrothermal synthesis and Microwave methods.

Recommended books: 1. Introduction to Nanotechnology: Charles P. Poole & Frank J. Owens
2. Text Book of Nanoscience and Nanotechnology: B.S.Murthy, P. Shankar et al. (Univ Press)
3. Nanotechnology The Science of Small: M.A. Shah and K.A. Shah (Wiley)
4. Introduction to Nanoscience and Nanotechnology:K.K. Chattopadhyay and A.N. Banerjee(PHI)

M.Sc. Applied Physics SEMESTER – II
SUBJECT CODE - AP 2002
PAPER – ELECTRONICS-II

TOTAL MARKS: 70 **TOTAL CREDITS: 5**

UNIT -I

TRANSISTOR AMPLIFIER – Classification of amplifiers, Distortion in amplifiers, Choice of transistor configuration in cascade amplifier, Frequency response and step response of an amplifier, Band pass of cascaded stage, RC coupled amplifier, its is frequency response transformer coupled amplifier, its frequency response, Gain band width product, Class A Power amplifiers, Class B Push pull amplifier, Feed back amplifier using voltage feedback and current feedback. (9 lectures)

UNIT - II

OSCILLATORS – L.C. oscillators, Hartley and Colpitt oscillators, R.C. Phase shift oscillators, Wienbridge oscillators, Crystal oscillators, Frequency stability in oscillators, Method of frequency stabilization, Transistor as a switch, Turn-on and Turn-off time (8 lectures)

UNIT – III

OPERATIONAL AMPLIFIERS – Difference amplifier, Emitter coupled difference amplifier, Basic operational amplifier parameters: offset voltage and current and their measurement, CMRR and slew rate, input and output impedances, operations: basic arithmetic operations, differentiator, and integrator, Clipping and Clamping circuits. Active filters: low pass, high pass, band pass and band reject circuits (7 lectures)

UNIT - IV

NUMBER SYSTEM & COMBINATIONAL LOGIC CIRCUITS – Binary numbers, Binary to decimal conversion, Decimal to binary conversion, Octal numbers, Hexadecimal numbers, BCD code, and basic arithmetic operations using binary numbers, 1's complement and 2's complement representation of negative numbers, Boolean laws and theorems, Duality theorem, sum of products, methods, truth table to Karnaugh's map, pairs, quads and Octets, Karnaugh's map simplifications, don't care conditions, product of sums method, product of sums simplification. (9 lectures)

UNIT -V

REGISTERS AND COUNTERS – Gated flip-flops: RS, D, JK, JK master-slave, Shift registers – all the 4 types, Counters: Binary ripple counter, Up/down counter, synchronous counters, Mode-3 & Mode-5 counters, Presetable counters, Johnson (shift) counter. (9 lectures)

Recommended books:

Integrated Electronics – By Millmann Halkias
Electronic circuits, II Edn, Schilling and Belove, McGraw Hill (1985) Chapter 7
Electronic devivces and circuits – J. Millman and C.C. Halkias, McGraw Hill, 1993).
Op-amp and linear Integrated Circuits, 3rd Edn, Ramakant, Gayakwad, Prentice Hall of India (1995)
Digital Principles and Applications, - D.P. Leach & A.P. Malvino, V Edn. Tata Mc Graw Hill Publishing Co Ltd.

M.Sc. Applied Physics SEMESTER – II
SUBJECT CODE - AP 2003
PAPER – SOLID STATE PHYSICS-II

TOTAL MARKS: 70 **TOTAL CREDITS: 5**

UNIT-1

Diffraction of x-ray by crystals- Diffraction of x-rays by crystals, Laue pattern, Reciprocal lattice, Brillouine Zone, Atomic Scattering factor, Electron and Neutron diffraction method.

UNIT-II

Magnetism and its Applications – Quantum theory of diamagnetism and Para-magnetism, Application of ions for 3d and 4d groups, Theories of Ferro, Ferri and Antiferro magnetic materials, Neel's theory of Ferrimagnetism, Magnetic ordering, Exchange Interaction, Total energy of the system i.e. Anisotropy energy, Magneto-striction energy, Magneto elastic energy, Origin of domains, Magnetic structure and magnetic moments of ferrite molecules, Hard and soft magnetic materials.

Ferrites and garnets for low and high frequency applications, Thin magnetic films, Bubble Domain, Physics of computer memory devices, Physics of square loop materials and their application.

UNIT-III

Plasma Physics : Definition of plasma and criteria, Debye length, Distribution function and related quantities, Charged particles in magnetic and electric fields, Charges particles in a dipole field, Motion of grading carters, Pinch effect, Principle and working of Magneto hydro dynamic generator.

UNIT- IV

Radiation from plasma: Radiation emitted by excited atoms and ions, Bremsstrahlung losses, Cyclotron, Betatron emission, Black body radiation, Probe techniques of gas discharge phenomenon.

UNIT-V

Superconductivity: Facts about Superconductivity, D.C. Electrical resistivity, isotope defect, Meissner effect, Specific heat, theoretical approaches, Thermodynamics of superconductors, Two fluid model, London equation.

Reference Books –

1. Solid State physic by Gupta & Kumar.
2. Solid State Physics by Saxena Gupta Saxena.
3. Introduction to Solid State Physics: by C. Kittel.
4. Introduction to Plasma Physics: By Martin A. Uman.
5. Plasma Physics: S. N. Sen.

M.Sc. Applied Physics SEMESTER – II
SUBJECT CODE - AP 2004
PAPER - CLASSICAL MECHANICS & ELECTROMAGNETIC THEORY

TOTAL MARKS: 70 **TOTAL CREDITS: 5**

UNIT – I

Newtonian formulation, Constraints, Generalized coordinates, Introduction to calculus of variations, Principle of least action, Lagrange's equations and its Applications.

UNIT - II

Free oscillations, System of oscillators, Eigenvalue problem and Normal modes, Damping, Forced oscillations and Resonance, Molecular vibrations, Anharmonic oscillations, Small oscillations, Rotations, Rigid body motion.

UNIT - III

Legendre transformations, Hamilton's equations and examples, Cyclic coordinates, Symmetry, Conservation principles and Noether's theorem, Canonical transformations, Poisson bracket formulation, Hamilton-Jacobi theory.

UNIT - IV

Laws of electrostatics and Methods of solving boundary value problems. Multipole expansion of electrostatic potentials, Spherical harmonics. Electrostatics in material media, Dielectrics. Biot-Savart Law, Magnetic field and the Vector potential. Faraday's Law and time varying fields.

UNIT - V

Maxwell's Equations: Displacement current, Maxwell's equations, Electromagnetic energy – Poynting vector, Wave equation, Boundary conditions, Vector and Scalar potentials, Coulomb and Lorentz gauges, Electromagnetic energy and momentum, Conservation laws, Inhomogeneous wave equation and Green's function solution.

Electromagnetic Waves: Plane waves in a dielectric medium, Plane waves in conducting media, Reflection and refraction at dielectric interfaces.

SUGGESTED BOOKS

1. Herbert Goldstein, Classical Mechanics II Edition, Narosa Publishers (2001).
2. Landau and Lifshitz, Mechanics, (III Ed.), Pergamon press (1976).
3. K. R. Symon, Mechanics, 3rd edition, Addison-Wesley (1971).
4. Spiegl M. R., Theoretical mechanics, (Schaum Series), McGraw Hill (1982).
5. R. G. Takwale and P.S. Puranik, Introduction to Classical Mechanics, Tata McGraw Hill (1979). 6. N. Rana and P. Joag, Classical Mechanics, McGraw Hill (2001).
7. John R. Taylor, Classical Mechanics, University Science Books (2004).
8. D.J. Griffiths, Introduction to Electrodynamics, 4th Edition, PHI Learning, New Delhi (2012).
9. John R. Reitz, Frederic J. Milford and Robert W. Christy, Foundations of Electromagnetic Theory, 3 rd Edition, Narosa Publishing House, New Delhi. (2012).
10. Panofsky, W.K.H., and Phillips, M., Classical Electricity and Magnetism, Second Edn, Dover.