JABALPUR ENGINEERING COLLEGE, JABALPUR (M.P.)

Scheme of M.Sc. Examination

FORTH 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	AP4001	Nanophysics & Nanotechnology-III	4	1	...	5	70	20	10	...	.....	100	
2	AP4002	Quantum Mechanics - II and Modern Physics	4	1	...	5	70	20	10	...	...	100	
3	AP4003	Material Science	4	1	...	5	70	20	10	...	.....	100	
4	AP4004	Major Project	...	....	5	5	....	....	....	100	.....	100	
5	AP4005	LAB-I (Material Science Lab)	....	...	5	5	...	...	...	60	40	100	
6	AP4006	LAB-II (Nano Science Lab)	...	...	5	5	...	...	...	60	40	100	
7	AP4007	Industrial Training /Seminar			2	2					50	50	
		TOTAL	**12**	**3**	**17**	**32**	**210**	**60**	**30**	**220**	**130**	**650**	

L-Lecture T-Tutorial P-Practical

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Jabalpur Engineering College, JBP

Department of Applied Physics, Jabalpur Engineering College, Jabalpur (MP)

M.SC. APPLIED PHYSICS

AP-4001

FOURTH SEMESTER

Nanophysics & Nanotechnology-III

Max Mks Theory: 70 Min Pass Mks: 28

UNIT – I

Nanomachines and Nanodevices: Microelectromechanical Systems (MEMs) NanoElelectromechanical system (NEMs).
Nanodevices and Nanomachines.

UNIT – II

Assembly of Anisotropic Nanostructure: Gold Nano Rod assembly.
Assembly of anisotropic structure of CdS/CdSe.
Applications.

UNIT –III

Optical Non linearity in Nanoscale materials: Optical Field Induced Polarization in Media.
Classification of Optical Non linearties. Non linear refraction. Non Linear Absorption. Surface Plasmon Resonance.
Experimental Techniques: Z - Scan; Degenerate Four Wave Mixing (DFWM). Pump Probe Experiments.

UNIT – IV

Nanomaterials for Environmental Remediation: Chemical Degradation / Removal of contaminants. Nanomaterials as Sorbents. Nano filtration of water. Dendrimers: The Nano reactors for remediation.

UNIT – V

Short notes on major topics from all the Four Units.

Dr. S.K. Tiwary
Prof. & Head
Deptt. of App. Phy.
JEC, Jabalpur (M.P.)

M.Sc. APPLIED PHYSICS SEMESTER-IV

SUBJECT CODE – AP4002

PAPER – QUANTUM MECHANICS-II AND MODERN PHYSICS

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

UNIT – I

Matrix Form (representation) of an operator, Column representation of the two wave function, Normalization & Orthogonality of wave functions in Matrix form, average value of an operator in matrix form, Dirac's Bra & Ket vectors & its applications in Harmonic oscillator problem, Theory of Scattering, Physical concept, Born Approximation.

UNIT – II

Perturbation theory of degenerate levels, Application to Hydrogen atom & Normal Zeeman Effect, Time Dependent perturbation theory, Applications of time dependent perturbation theory to Alpha scattering, Einstein transition probabilities by perturbation theory, Selection Rules for Simple Harmonic Oscillator.

UNIT – III

Variation method & its application to ground state of Helium, WKB approximation, Connection formula for penetration of a potential barrier, Transmission through a barrier, Theory of Alpha Decay, Geiger - Nuttel Law.

UNIT – IV

Schrodinger relativistic equation, Klein-Gordon equation, Dirac's matrices, Magnetic moment & Electron Spin, Negative energy state & their interpretation, Application of Dirac's equation to Hydrogen atom.

UNIT – V

Basics of string theory ,Feynman rules and diagrams ,quantum teleportation (without derivation) Bose Einstein condensate ,dark energy and dark matter ,Higgs boson .

Books Recommended:

Quantum Mechanics: Kumar, Gupta & Sharma Quantum Mechanics:
Schiff
Quantum Mechanics: Ghatak & Loknathan
Source Book on Atomic Energy: Samuel Glasstone Feynman
Lectures: Part III
Modern Physics: Arthur Beiser

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M.Sc. APPLIED PHYSICS SEMESTER-IV

SUBJECT CODE – AP4003

PAPER – MATERIAL SCIENCE

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

UNIT –I Crystal Structure And Crystallography:

Crystal lattice — primitive and unit cell — crystal systems — Bravais lattice — Miller indices ~ Structure of Crystal - Simple Cubic, Body Centered Cubic, Face centered Cubic and Hexagonal Close Packed structure. Sodium chloride Structure, X ray Spectrum — Moseley's law — diffraction of X-rays by crystals — Bragg's law in one dimension — Experimental methods in X-ray diffraction — Laue's method, rotating crystal method — powder photograph method — point defects- line, surface and volume defects — effects of crystal imperfections, Applications.

UNIT – II Magnetic Properties of Materials:

Basic concepts — magnetic moment, susceptibility, permeability; Types of materials ~— Diamagnetic, paramagnetic, ferromagnetic, anti ferromagnetic and ferrimagnetic materials, Weiss theory of ferromagnetism, domain theory of ferro magnetism, Ferrites, Hysteresis effect; Soft and hard magnetic materials; Applications- Fabrication of transformers, motors, magnetic Storage devices- magnetic memories, magnetic tapes, magnetic recorder, relays and sensors

UNIT - III Electrical Properties of Materials:

Introduction to electrical materials — Band theory of solids. conducting materials -Ohm's law, electrical conductivity, electrical resistivity —, semiconducting materials, types — properties and effects of impurities and temperature. Insulating materials —. Requirements of good insulating materials: Some insulating materials — glass, mica, ceramics, asbestos, resins, rubber, transformer oil.

UNIT – IV Properties of Dielectric materials:

Introduction to Dielectric materials - Polar and non-polar dielectrics, Dielectric constant, Dielectric Polarization - electronic, ionic, orientation — or dipolar and Space charge polarizations(qualitative treatment), frequency and temperature dependence of polarization, ferro electricity- spontaneous polarization and structure of barium titanate Piezo electricity & Piezo electric materials- applications.

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UNIT – V Mechanical and Thermal Properties of Metals:

Definitions — elasticity, plasticity, Stress, Strain, strength, hardness, brittleness, ductility, creep, fatigue, fracture, and toughness. Relationship between stress and Strain; Hardness — Hardness tests, Heat treatment processes (Tempering, Quenching Nitriding, Hardening), specific heat and thermal conductivity.

BOOKS:

1. Materials Science and Engineering by Callister, WILEY Publishers(2008)

2. Introduction to Solid State Physics — C.Kittel, John Wiley(2004)

3. Materials Science for engineering Students-FISCHER, Elsevier Publishing.USA

REFERENCE BOOKS:

1. Material Science by V.Raghavan (TMH)

2. Solid State Physics, 6! Kdition, S.O.Pillai, New age International Publishers

3. Material Science — M. Arumugam, Anuradha Agencies, (2004)

4. Solid State Physics — A.J.Deckker(2004)

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