JIWAJI UNIVERSITY, GWALIOR

CBCS Course Details of M.Sc. Physics 2015-2017 (Only for School of Studies)

M. Sc. PHYSICS First SEMESTER (July - December 2015)
(CBCS only for School of Studies in Physics)

Note: Each course shall be of 100 Marks out of which 40 marks are allotted to internal assessment and 60 marks for University examination. Minimum pass marks are 14 for the internal assessment and 21 for the University examination.

	credits	marks
PT – 101 METHODS IN MATHEMATICAL PHYSICS	3	100
Unit – I Tensor Analysis		
Unit – II Elements of Complex Variable		
Unit – III Theory of Fourier and Laplace Transforms		
Unit – IV Special Functions		
PT – 102 CLASSICAL MECHANICS	3	100
Unit – I Lagrangian Mechanics		
Unit – II Variational Principle		
Unit – III Two body central force problem and scattering		
Unit – IV Oscillations		
PT – 103 ELECTROMAGNETISM & NON-LINEAR OPTICS	3	100
Unit – I Maxwell Equations and their applications		
Unit – II Electromagnetic Wave in Isotropic Medium		
Unit - III Electromagnetic Wave Interactions		
Unit - IV Nonlinear Optics		
PT – 104 SEMICONDUCTOR ELECTRONICS	3	100
Unit - I Biasing Techniques And Linear Amplifier		
Unit - II Power Amplifier And Oscillators		
Unit - III Wave Shaping Circuits		
Unit - IV Basics of Differential and Operational Amplifiers		
LABORATORY COURSES		
PL – 105 General Lab.	3	100
Pl – 106 Physics Lab.	3	100
PS – 107 Seminar based on experiments/ theory	1	100
PA – 108 Assignments related to following topics	1	100
(1) Partial Differential Equations		
(2) Transformations and equation of motion		
(3) Elements of Laser Physics		
(4) Application of Operational Amplifier, etc.		
PV - 109 Comprehensive viva-voce	4	100
Total	24	900

PT – 101 METHODS IN MATHEMATICAL PHYSICS

Max. Marks: 60 Pass Marks: 21

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Unit – I Tensor Analysis

Definition of Tensor and its rank, Transformation laws of covariant, contravariant and mixed tensors, Fundamental Operations with tensors (addition, subtraction and multiplication), Inner and outer product, Contraction of tensors, Associated tensors, Christoffel symbols, covariant differentiation of tensor

Unit – II Elements of Complex Variable

Functions of a complex variable, the derivative and the Cauchy-Riemann differential equations, line integrals of complex functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residues; Cauchy's residue theorem, singular points of an analytic function, evaluation of residues, Jordon-Lemma, evaluation of definite integrals,.

Unit – III Theory of Fourier and Laplace Transforms

Fourier series analysis, evaluation of constants, Fourier sine, cosine and complex transforms, transforms of derivatives, Convolution theorem, Parseval's relation, Momentum representation: Examples from optics, Electromagnetism and quantum mechanics, Laplace transforms(LT) of simple function and derivatives, LT and solution of simple differential equations, convolution theorem.

Unit – IV Special Functions

Singularity structure of a general second order homogeneous differential equation : ordinary points, regular and irregular points, indicial equation, The point at infinity, Series expansion method for solving differential equations, series solutions, Generating functions and recurrence relations and orthogonality of Legendre and Hermite polynomials

BOOKS RECOMMENDED

1) Applied Mathematics for Engineers and Physicist: Pipes
2) Mathematical Physics: Harper
3) Advanced Engineering Mathematics: Kreyszig
4) Schaum Series for Transforms, Complex Variables and Tensors
5) Mathematical Methods: Arfken
6) Elements of Complex variables: Churchill

PT – 102 CLASSICAL MECHANICS

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Unit – I Lagrangian Mechanics

Mechanics of a particle, Mechanics of a system of particles, Constraints, Generalised coordinates, De Alembert's principle and Lagrangian equations, Lagrangian for a charged partcle in an electromagnetic field, application of Lagrangian formulation to (a) single particle in space, (b) Atwood's machine.

Unit – II Variational Principle

Hamilton's principle, some techniques of the calculus of variation, application to (a) geodesics in a plane (b) minimum surface of revolution, Derivation of Lagrange's equation from Hamilton's principle, Conservation laws and corresponding symmetry principles

Unit – III Two body central force problem and scattering

Reduction of two body central force problem to the equivalent one body problem, The equation of motion and the first integrals, Classification of orbits, the virial theorem, the Kepler problem, scattering in a central force field, Rutherford scattering, transformation of the scattering problem to laboratory coordinates.

Unit – IV Small oscillations

Formulation of the problem, the eigen value equation, frequencies of free vibration, free vibration of a linear tri atomic molecule, transition from a discrete to a continuous system, the Lagrangian formulation for continuous system.

Hamilton equations of motion, Hamilton's equation from variational principle, equation of canonical transformationx

BOOKS RECOMMENDED

1. Classical Mechanics: Goldstein.
2. Classical Mechanics: Takwale

PT – 103 ELECTROMAGNETISM AND LASER OPTICS

Max. Marks: 60 Pass Marks: 21

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Unit – I Application of Maxwell Equations

Maxwell's equation, Field energy, Poynting theorem, plane wave solution of Maxwell's equations, Reflection and Refraction at a plane boundary of dielectrics, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

Unit – II Electromagnetic Waves in Anisotropic Medium

The dielectric tensor of an anisotropic medium, structure of a monochromatic plane wave in an anisotropic medium: The phase velocity and the ray velocity, Fresnel's formulae for the propagation of E.M. wave in crystals, Geometrical constructions for determining the velocities of propagation and directions of vibrations, optical properties of uniaxial and biaxial crystals: The optical classification of crystals, E.M. wave propagation in uniaxial crystals.

Unit - III Electromagnetic Wave Interactions

E.M. wave propagation in biaxial crystals Refraction in crystals: double refraction, internal and external conical refraction, experimental demonstration of double refraction and conical refraction, Acoustic-optic interaction: Raman-Nath theory of ultrasonic diffraction of E.M. waves, magneto-optic interaction: Faraday effect, Electro-optic interaction: Kerr effect, interaction with matter: (a) normal and anomalous dispersion (b) Rayleigh scattering.

Unit -IV Nonlinear Optics

Nonlinear optical media, Second order nonlinear optics Second harmonic and rectification, The electro-optics effect, Three-wave mixing, Third order nonlinear optics, Third harmonic generation and self pulse modulation, four wave mixing, optical pulse conjugation.

Books Recommended

1. Introduction of electrodynamics: Griftith
2. Foundation of electromagnetic Theory: Reitz, Millford and Christy.
3. Electromagnetic waves and radiation systems: Jordan and ball man
4. Classical electrodynamics: Jackson

PT – 104 SEMICONDUCTOR ELECTRONICS

Max. Marks: 60 Pass Marks: 21

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Unit-I Biasing Techniques and Linear Amplifier

Continuity equation and its application to p-n junction under forward and reverse bias, Solution of Continuity equation for reversed and forward biased abrupt p-n junctions, Derivation of Einstein's equation, Load line for a transistor, Location of Q-point for the bipolar transistor, variation of bias current, Fixed and emitter feedback bias, Design idea of emitter feed-back bias, Stability index, Stabilization against variation in I_{CO}, V_{BE} and β (beeta), RC coupled CE amplifier, its frequency response and gain frequency plot, Gain band product,

Unit – II Power Amplifier and Oscillators

Operating conditions for power amplifier, power relations, The ideal transformer, voltage limitations of the transformer, non-linear distortion, Idea of inter-modulation distortion, The class A power amplifier, The push-pull amplifier, Feedback requirements of oscillations, Basic oscillator analysis, Hartley and Colpitt oscillators, Piezo-electric, frequency control , RC oscillators.

Unit – III Wave Shaping Circuits

Linear wave shaping, High pass RC circuit, High pass RC circuit as a differentiator, Low pass RC circuit, Low pass RC circuit as a integrator, Non-linear wave shaping, Shunt diode clipper and series diode clippers, Double ended p-n junction and Zener diode clipper circuits, Clamping circuits, Zero level and given level clamping, Fundamentals of voltage and current sweep generators, sweep wave forms, Miller integrating sweep circuits, Blocking and Triggered transistor blocking oscillator

Unit – IV Basics of Differential and Operational Amplifiers

Differential amplifier, Differential amplifier circuit configuration, Dual input balanced output differential amplifier, Voltage gain, differential input resistance, inverting and non-inverting inputs, common mode rejection ratio, Operational amplifier, input offset voltage, input offset currents, input bias currents, differential input resistance, input capacitance, offset voltage supply, rejection ratio, Ideal OP Amp, equivalent circuit of an OP Amp, ideal voltage transfer curve, inverting, dual and non-inverting amplifier, measurement of OP Amp parameters, frequency response

BOOKS RECOMMENDED

1. Electronics Fundamentals and Application: J.D. Ryder
2. Solid State Electronic Devices: B.G.Streetman
3. Electronic Principals: Malvino
4. Principals of Microwave: Atwarter
5. Electromagnetic Wave and Radiating System: Jorden and Ballmon
6. Electronic Devices and Circuits: Millman and Halkius