

COURSEWISE SCHEME

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|-----------------------|-----------------|-------------------------------|-------|
| 1. Course Code | : 624 | 7. Maximum marks | : 500 |
| 2. Course Name | : M.Sc. Physics | 8. Minimum Passing percentage | : 36 |
| 3. Total Subject | : 4 | | |
| 4. Compulsory Subject | : 4 | | |
| 5. Optional Subject | : 0 | | |
| 6. Project | : Y | | |

Sub. code	Subject Name	Theory										Practical		Total	
		Paper						CCE		Total Marks					
		1st	2nd	3rd	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
Compulsory															
501	Mathematical Physics	85	0	0	85	131	15	5	160	36	0	0	160	36	
502	Classical Mechanics	85	0	0	85	131	15	5	160	36	0	0	160	36	
503	Quantum Mechanics-I	85	0	0	85	131	15	5	160	36	0	0	160	36	
504	Electronic Devices	85	0	0	35	131	15	5	100	36	0	0	100	36	
505	Practical-I Gen. Physics Based Practical	0	0	0	0	0	0	0	0	0	50	18	50	18	
506	Practical-II Electronics Based Pratical	0	0	0	0	0	0	0	0	0	50	18	50	18	

Department of Higher Education Govt. of M.P.

Semester Wise Syllabus for Post Graduate Classes

As recommended by Central Board of Studies and

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CLASS - M.Sc.

SUBJECT - PHYSICS

SEMESTER - I

PAPER - I

MM-85

MATHEMATICAL PHYSICS

Unit -I

Differential equations: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials. Curvilinear co-ordinate system with specific cases of Cartesian, Cylindrical, and Spherical coordinate systems.

Unit -II

Integral transforms. Fourier integral. Fourier transform and inverse Fourier transforms. Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms. Laplace transform of derivatives. Application to a damped harmonic oscillator.

Unit -III

Green's functions: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transform. method of constructing Green's function, Green's function for electrostatic boundary value problems and quantum-mechanical scattering problem.

Unit -IV

Complex variables: Analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula. Taylors, Maclaurin, Laurent series & mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued unctons(Branch points).

Unit -V

This unit will have a short *note* question covering all the four units. The students will have to answer any two questions out of the four.

Books Recommended :

1. L. A. Pipes
2. Arfken
3. P.K. Chattopadhyay
4. H.K. Dass
5. Ghatak, Goyal & Guha
6. M.R Spiegel (Schaum Series)

Mathematics of Engineers and Physicists
Mathematical Methods for Physicists
Mathematical Physics
Mathematical Physics
Mathematical Physics
Complex variable & Laplace Transform

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CLASS - M.Sc.
SEMESTER - I

SUBJECT - PHYSICS
PAPER - II

MM - 85

CLASSICAL MECHANICS

Unit - I

Newtonian mechanics of one and many particles systems: Conservation laws, Constraints their classification, Principle of virtual work; D'Alembert's principle in generalized coordinates, The Lagrange's equation from D'Alembert's principle. Configuration space, Hamilton's principle deduction from D'Alembert's principle, Generalized momenta and Lagrangian formulation of the conservation theorems, Reduction to the equivalent one body problem; the equation of motion and first integrals, the differential equation for the orbit.

Unit - II

The equations of canonical transformation and generating functions; The Hamilton-Jacobi Action and Angle variables. Poisson's brackets; simple algebraic properties of Poisson's brackets. The equation of motion in Poisson's Brackets notation. Poisson theorem; principle of least action. The Kepler problem, Inverse central force field, Rutherford scattering.

Unit - III

Theory of small oscillations, Equations of motion, Eigen frequencies and general motion, normal modes and coordinates, Applications to coupled pendulum and linear bistable molecule. Rotating coordinate systems. Acceleration in rotating frames. Coriolis force and its terrestrial astronomical applications, Elementary treatment of Eulerian coordinates and transformation matrices. Angular momentum inertia tensor. Euler equations of motion for a rigid body. Torque free motion for a rigid body.

Unit - IV

Symmetries of space and time. Invariance under Galilean transformation, Covariant four-dimensional formulation, 4 - Vectors and 4 - scalars. Relativistic generalization of Newton's laws, 4 - momentum and 4 - force, variance under Lorentz transformation relativistic mechanics. Covariant Lagrangian, covariant Hamiltonian, Examples.

Unit - V

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Books Recommended

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|--|-------------------------------------|
| 1. H. Goldstein (Addison Wesley) | Classical Mechanics |
| 2. N.C. Rana & P.S. Jog | Classical Mechanics |
| 3. Landau & Lifshitz (Pergamann Press) | Classical Mechanics |
| 4. A. Sommerfeld (Academic Press) | Classical Mechanics |
| 5. R.G. Takwale & P.S. Puranik | Introduction to Classical Mechanics |

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CLASS - M.Sc.

SUBJECT - PHYSICS

SEMESTER - I

PAPER - III

MM - 35

QUANTUM MECHANICS- I

Unit - I

Basic Postulates of quantum Mechanics, equation of continuity, Normality, orthogonality and closure properties of eigen functions, expectation values and Ehrenfest theorems, solution of Schrodinger equation for one dimensional (a) potential well (b) potential step and (c) Potential barrier.

Unit - II

Linear vector space, concept of Hilbert space, bra and ket notation for state vector, representation of state vectors and dynamical variables by matrices and unitary transformation (Translation and rotation), creation and annihilation operators, matrices for x and p . Heisenberg uncertainty relation through operators (Schwartz inequality).

Unit -III

Solution of Schrodinger equation for (a) linear harmonic oscillator (b) hydrogen - like atom (c) square well potential and their respective application to atomic spectra, molecular spectra and low energy nuclear states (neutron).

Unit - IV

Angular momentum in quantum mechanics, Eigen values and Eigen function of L^2 and L_z in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.

Unit -V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text Books and reference-book:

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|------------------------------|--------------------------|
| 1. L I Schiff, | Quantum Mechanics |
| 2. S Gasiorovicz, | Quantum Physics |
| 3. B Craseman and J D Powell | Quantum Mechanics |
| 4. A P Messiah | Quantum Mechanics |
| 5. J. J. Sakurai | Modern Quantum Mechanics |
| 6. Mathews and Venkatesan | Quantum Mechanics |

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CLASS - M.Sc.
SEMESTER - I

SUBJECT - PHYSICS
PAPER - IV

MM - 25

ELECTRONIC DEVICES

Unit - I

Transistors: JFET, BJT, MOSFET and MESFET, structure derivations of the equations for I-V characteristics under different condition, microwave devices, tunnel diode, transfer electron devices (Gunn diode), avalanche transits time devices, Impatt diodes and parametric devices.

Unit - II

Photonic devices: radiative and non-radiative transitions, optical absorption, bulk and thin film photo conductive devices (LDR), diode Photo detectors, Solar cell (open circuit voltage and short circuit current, fill factor), LED (high frequency limit, effect of surface and indirect recombination current, operation of LED), semi-conductors; diode lasers (conditions for population inversion in active region, light confinement factor, optical gain and threshold current for lasing).

Unit - III

Memory Devices: Read Only Memory (ROM) and Random Access Memory (RAM). Types of ROM: PROM, EPROM, EEPROM and EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM. Hybrid Memories: CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices: Geometry and organization of magnetic (FDD & HDD) and Optical (CD-ROM, CD-R, CD-R/W, DVD) Storage devices.

Unit - IV

Electro-optics, Magneto-optic and Acousto-optic effects, materials properties related to get these effect, important ferro electric, liquid crystal and polymeric materials for these devices, piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, piezoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices,

Unit - V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text books and reference books:

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| 1. | SM Sze Willey (1985) | Semiconductors devices - physics technology |
| 2. | M S tyagi | Introduction to semiconductors devices |
| 3. | M Sayer and A Manisingh | Measurement instrumentation and experimental design in physics and engineering |
| 4. | Ajoy Ghatak and Thyagrajam | Optical Electronics |