



UNIVERSITY OF JAMMU

NOTIFICATION
(10/April/ ADP/08)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, has been pleased to authorize adoption of the revised Syllabi and Courses of Study in the subject of Physics M.Sc. Ist semester of Master's Degree Programme for the examination to be held in the years as under:-

<u>Class</u>	<u>Semester</u>	<u>For the examination to be held in the year(s)</u>	<u>Course No.</u>	<u>%age of change</u>
M.Sc.	I	Dec. 2011, 2012 & 2013	441	less than 10%
			442	less than 15%
			443	less than 5%
			445	less than 15%

The alternative question papers are required to be set as per the University regulation given as under:-

- i). If the change in the Syllabi and Courses of Study is less than 25%, no alternative Question paper will be set.
- ii). if the change is 25% and above but below 50% alternative Question Paper be set for one year.
- iii). If the change is 50% and above on whole scheme is changed, alternative Question Paper are set for two years.

F.Acd./XV/10/ 3771-96
Dated: 27-4-2010

Sd/-
(DR. P.S. PATHANIA)
REGISTRAR

Detailed Syllabus: M.Sc. Physics I Semester

C.No.: 441 (2011-2013)

Credits: 4

Duration of Examination: 3 Hrs.

Mathematical Physics

Max. Marks: 100

a) Semester Examination: 80

b) Sessional Assessment 20

Syllabus for Examination to be held in December 2011, December 2012 & December 2013

Unit I

Complex Variables:

Algebra of complex numbers, single and multidimensional functions, Branch points and branch lines, continuity and differentiability of complex functions, Cauchy-Riemann equations, Analyticity and singularity points, complex integration, Cauchy integral theorem, Stoke's theorem, Proof for multiple connected regions, Cauchy's theorem of residues, Simple problems on the above topics. (10)

Unit II

Matrices and Tensor Analysis:

Eigen values and eigen vectors, diagonalization of matrix, Physics laws, space of N-dimensions, coordinate transformation, summation convention, contra-variant and co-variant vectors, Contra-variant, covariant and mixed tensors, Kronecker delta, Tensor of higher rank, scalars or invariants, tensor fields, symmetric and skew-symmetric tensors, fundamental operations with tensors (Addition, Subtraction, outer multiplication, contraction, inner multiplication, quotient law, line element of metric tensor, conjugate or reciprocal tensor, associated tensor, Simple problems on the above topics. (10)

Unit III

Laplace Transform:

Integral Transforms, Laplace transform: Conditions for L.T., Simple properties of L.T., First and Second shifting theorems, L.T. of derivatives, Derivatives of L.T., L.T. of integrals, integration of L.T., initial and final value theorems, inverse L.T. by partial fractions, Simple problems on the above topics. (10)

Unit IV

Fourier Series and Transforms:

Fourier series, Dirichlet's conditions, determination of Fourier co-efficients, F.S. for arbitrary period, half-wave expansions, Fourier integral theorem, Fourier sine and cosine transforms, properties of Fourier transforms, Fourier Transforms of Dirac Delta function, simple problems. (10)

Unit V

Differential Equations:

Power series solution of differential equations validity of the power series method, Bessel's equation and solutions, Bessel's functions, recurrence formulae, orthogonality of Bessel functions, Leguerre's Differential equation, Generating function, orthogonal properties, Beta and gamma functions and their properties and inter relationships. (10)

Text and Reference Books:

1. Mathematical Methods for Physicists, by G. Arfken
2. Matrices and Tensors of Physicists, by A.W. Joshi
3. Advanced Engineering Mathematics; by E. Kreyszig
4. Special functions, by E.D. Rainville
5. Special functions, by W.W. Bell
6. Mathematical Method for Physicists and Engineers, by K.F. Reily, M.P. Hobson and S.J. Bence
7. Mathematics for Physicists, by Mary L. Boas
8. Mathematical Physics, by B.D. Gupta
9. Mathematical Physics, by H.K. Dass
10. Mathematical Physics, by Rajput

Note for Paper Setting:

The question paper shall have ten questions in all, two questions from each unit. The candidates shall have to attempt five questions, selecting one from each unit. Each question in the unit will have at least one part of short answer type, based on concepts, carrying three marks. The question in the paper may have more than two parts.

Detailed Syllabus: M.Sc. Physics 1st Semester

Course No: 442(2011-2013)

Title: classical Mechanics

Credits: 4

Maximum Marks: 100

Duration of time: 3 Hours

(a) Semester Examination:80

(b) Sessional assessment:20

Syllabus for the examinations to be held in Dec.2011, Dec.2012 and December 2013.

Unit-I

constraints and their classifications, Generalized coordinates D Alembert's principle, Lagrange's equations, properties of kinetic energy function, theorem on total energy, Lagrange's equation for conservative, non-conservative, and dissipative systems, Lagrangian for a charged particle moving in an electromagnetic field, Rayleigh's dissipative functions. Gauge transformations, Applications of Lagrange's equation: motion of charged particle on surface of earth, body sliding on an slide plane, Harmonic oscillator, simple and compound pendulum.

(10)

Unit — II

Generalized momentum, cyclic symmetry of space and time and conservation laws of linear momentum, angular momentum and energy. Translation and rotational cyclic coordinates-symmetric properties: coordinate systems with relative translational motions, rotational coordinate systems, inertial forces, coriolis force, effects of coriolis forces on: motion of freely falling body, motion on or near earth surface, motion of a projectile, air flow on surface of earth: centre of mass and relative coordinates, the centre of mass frame, reduction of two body central force problem to an equivalent one body problem.

(10)

Unit—III

Equation of motion and first integrals. Equivalent one dimensional problem and classification of orbits. The virial theorem. The differential equation for the orbit and integrable power law potential: Conditions of closed orbits, Kepler problem: inverse square law of

force: The motion in time in the Kepler problem: Orbits of artificial satellites: Scattering in a central force field, Rutherford Scattering.

Unit-IV

Hamilton's principle, Calculus of variation and its application to geodiscs and minimum number of revolutions, Derivation of Lagrange's equation from Hamilton's principle, Lagrange's equation for non-holonomic systems (method of undetermined multipliers) and application to cylinder rolling on inclined plane δ and Δ variations, Derivation of Hamilton's equations from variational principle, Principle of least action, Application of Hamiltonian formulation to harmonic oscillator and simple pendulum.

(10)

Unit - V

Canonical transformation: Generating functions, properties, examples, Integral invariance of Poincare, Jacobian determinants, Lagrange and Poisson brackets, their relationship and invariance under canonical transformation, Poisson theorem, angular momentum. Poisson brackets, Hamilton-Jacobi equation for Hamilton's principle-function, Application to Harmonic oscillator problem, Hamilton equation for Hamilton's characteristic function, separation of variables and applications to particle motion under central force.

(10)

Text and Reference Books

1. N.C.Rana & P.S.Joag, (Tata McGrae-Hill, 1991):n Classical Mechanics.
2. H.Goldstien (Addition Wesley, 1980): Classical Mechanics.
3. A.Sommerfeld: Mechanics.
4. I.Perceival & D.Richards (Cambridge University press, 1982): introduction to dynamics.

Note for paper setting:

The question paper shall have ten questions in all, two questions from each unit. The candidates shall have to attempt five questions, selecting one from each unit. Each question in the unit will have at least one part of short answer type, based on concepts, carrying three marks. A question in the paper may have more than two parts.

Detailed Syllabus: M.Sc. Physics 1st Semester

Course No: 443 (2011-2013)

Title: Quantum Mechanics-I

Credits:4

Maximum Mark: 100

Duration of time: 3 Hours

(a) Semester Examination:80

(b) Sessional assessment :20

Syllabus for the examinations to be held in Dec.2011,Dec.2012 and December 2013.

Unit-I

The principle of superposition, one and three dimensional wave packets, Motion of wave packet, Differential equation satisfied by wave packet, Interpretation of wave function, probability current density, equation of continuity, wave packet in momentum space, Ehrenfest's theorem, wave packets and uncertainty relations and spread of wave packet.

(10)

Unit-II

Applications of Schrödinger Equation:

One dimensional finite square well potential, particle in a two & three dimensional box, exchange degeneracy, symmetric and anti-symmetric states, solution of free particle Schrödinger equation in spherical polar coordinates, solution of three dimensional harmonic oscillator in spherical polar coordinates, degeneracy of harmonic oscillator states.

(10)

Unit-III

General Formalism:

Fundamental postulates of wave mechanics, operator representation of dynamical variables, commutation of operators, Adjoint and hermitian operators unitary operator, Eigen value problem for operators, properties of Eigen functions and eigen values of hermitian operators, simultaneous eigen functions, Dirac Delta function and box normalization of free particle wave function. Uncertainty principle in operator approach. ket & Bra notation, matrix representation

of wave function & operators. Energy spectrum of one dimensional harmonic Oscillator using matrix mechanics (10)

Unit-IV

Theory of Angular Momentum-I

Definition of generalized angular momentum, operators for J_+ , J_- , J_z commutation relation of angular momentum operator with \vec{r} & \vec{p} . Spectrum of Eigen values of J^2 and J_z , operators for orbital angular momentum L in spherical polar coordinates, Eigen values & Eigen functions of L^2 & L_z . spin angular momentum, Eigen values and Eigen functions of S^2 & S_z .

(10)

Unit - V

Theory of Angular Momentum-II

Matrix representation of $J^2, J_z, J_+, J_-, J_x, J_y$ for $J=1/2, 1$. Pauli's spin matrices & their properties. Addition of two angular Momentum, coupled & uncoupled representation, Clebsch Gordon Coefficients, Spectrum of eigen values of total angular momentum. Calculation of C.G. coefficients when (1) $j_1=1/2, j_2=1/2$ (2) $j_1=1/2, j_2=1$

(10)

Text and Reference Books

1. L.I.Schiff, Quantum Mechanics (McGraw-Hill)
2. S. Gasiorowicz, Quantum Physics (Wiley)
3. B. Craseman and J D Powell, Quantum Mechanics (Addison Wesley)
4. A.P. Messiah, Quantum Mechanics
5. J.S. Sakurai, Modern Quantum Mechanics
6. Mathews and Vankatesan, Quantum Mechanics

Note for paper setting:

The question paper shall have ten questions in all, two questions from each unit. The candidates shall have to attempt five questions, selecting one from each unit. Each question in the unit will have atleast one part of short answer type, based on concepts, carrying three marks. A question in the paper may have more than two parts.

DETAILED SYLLABUS

M. Sc. Physics 1st Semester

Course No. 445 (2011-2013)

Duration of Examination: 3hrs

Title: **Integrated Electronics-I**

Max. Marks: 100

Credits: 4

Semester Exam: 80

For the years 2010, 2011 & 2013.

Sessional Assessment: 20

UNIT I Carrier Concentration & Transport

Introduction to Electronic Materials, Crystal planes (Miller Indices), Crystal Structures of Si and GaAs, band theory of solids, Fermi levels in intrinsic and doped semiconductors, degenerate semiconductors derivation of intrinsic carrier concentration, carrier mobility and drift velocity, Resistivity and Conductivity, Hall effect, diffusion phenomenon, Haynes-Shockley experiment, Einstein's relationship, carrier injection & Direct bandgap, recombination processes (direct), Auger recombination, continuity equation, high field effects.

UNIT II P-N Junction Theory

P-N junction: thermal equilibrium condition, depletion region (abrupt and linearly graded junctions), depletion capacitance: C-V characteristics, impurity distribution, and varactor; I-V characteristics; generation-recombination and high-injection effects, temperature effect, charge storage and transient behaviour; minority carrier storage, diffusion capacitance, junction breakdown: tunneling effect and avalanche multiplication; semiconductor heterojunctions.

UNIT III Photonic Devices and BJT's

Energy momentum relationship, direct and indirect bandgap semiconductors, transferred electron effect (Gunn Diode), quantum mechanical phenomenon, tunnel diode, IMPATT Diode, Semiconductor LED's and LASER's, Photodiodes (Heterojunctions) emission in semiconductors, optical absorption, spontaneous and stimulated emission.

The Transistor action, active mode operation, current gain, Static characteristics, modes of operation (Ebers-Moll Model), I-V characteristics of CB and CE configurations, frequency response of BJT's, basic concepts of HBT and thyristors.

UNIT IV Digital Electronics-I

Combinational Logic Circuits:

Review of Boolean Laws & Theorems; Logic Families; TTL AND, OR, NAND, NOR and NOT Gate circuits; Standard forms of Boolean expressions (SOP & POS form) and their implantation; Karnaugh simplification of SOP & POS expressions (upto 5-variables); Don't care conditions; Simplification by Quine McClusky method; Data selector/multiplexer (4-1, 8-1 & 16-1); Encoder (decimal to BCD) and Demultiplexer (1 to16); Decoder (BCD to Decimal); Seven segment decoder.

UNIT V Digital Electronics-II

Sequential Logic Circuits:

Clock waveform and its characteristics; One bit memories: RS, JK, JK-master slave, D and T Flip Flops (Unlocked, Locked and Edge triggered); Counters: Modulus of Counter; Asynchronous 2-bit, Up/Down and decade counter; Design of synchronous counter (Mod-8); Resistors: Shift Resistors (SISO, SIPO, PISO and PIPO); Applications of Shift Registers.

Note for Examiners :

The question paper shall have ten questions in all, two questions from each unit. The candidates shall have to attempt 5 questions, selecting one from each unit. Each question in the unit will have atleast one part of short answer type, based on concepts, carrying three marks. A question in the paper may have more than two parts.

References:

1. Semiconductor Devices: Physics & Technology; S.M.Sze, John Wiley & Sons.
2. Solid State Electronics Devices: Ben. G. Streetman; Prentice-Hall of India Ltd.
3. Physics of Semiconductor Devices; M Shur; Prentice-Hall of India Ltd.
4. Physics of Semiconductor Devices: S.M.Sze: Wiley Eastern Limited.
5. Semiconductor Devices & Integrated Electronics; A.B.Milnes;B.S.Publishers & Distributors, New Delhi