FACULTY OF SCIENCES

Physics Syllabi for Academic Council
Department of Physics
(Under Continuous Evaluation System)

Session: 2021-22

1. **B.Sc. Non Medical and C.Sc. Sem I-VI**
2. **B.Sc.(Hons) Physics Sem I-IV**
3. **M.Sc. Physics Sem I-IV**
4. **B.Sc. Home Science Sem III and IV**
5. **B.Sc. Hons Maths Sem I and II**

The Heritage Institution

KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

FACULTY OF SCIENCES

SYLLABUS

of

Physics

For

B.Sc. Non-Medical &Computer Science

(Semester I to VI)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2021-22

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science

(Non-Medical &Computer Science)

Session-2021-22

Physics Semester I

Course Name	Program Name	Course Code		Course Type	Marks					Examination time (in Hours)
					Total	Paper	Ext.		CA	
							L	P		
Physics	B.Sc. (Non-Medical) B.Sc. (Computer Sci.)	BSNM-1395 BCSM-1395	I	E	100	Mechanics	30	-	20	3
			II			Electricity And Magnetism	30	-		3
			P			Physics Practical	-	20		3

Physics Semester II

Course Name	Program Name	Course Code		Course Type	Marks					Examination time (in Hours)
					Total	Paper	Ext.		CA	
							L	P		
Physics	B.Sc. (Non Medical) B.Sc. (Computer Sci.)	BSNM-2395 BCSM-2395	I	E	100	Relativity and Electromagnetism	30	-	20	3
			II			Vibration And Waves	30	-		3
			P			Physics Practical	-	20		3

Physics Semester III										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Physics	B.Sc. (Non-Medical) B.Sc. (Computer Sci.)	BSNM-3395	I	C	100	Statistical Physics and Thermodynamics	30	-	20	3
		BCSM-3395	II			Optics	30	-		3
			P			Physics Practical	-	20		3

Physics Semester IV										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Physics	B.Sc. (Non Medical) B.Sc. (Computer Sci.)	BSNM-4395	I	C	100	Quantum Mechanics	30	-	20	3
		BCSM-4395	II			Atomic Spectra & Lasers	30	-		3
			P			Physics Practical	-	20		3

B.Sc. Non-Medical &Computer Science Semester V										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Physics	B.Sc. (Non Medical) B.Sc. (Computer Sci.)	BSNM-5395 BCSM-5395	I	C	100	Physics (Condensed Matter Physics)	30	-	20	3
			II			Physics (Electronics	30	-		3
			P			Physics Practical	-	20		3

B.Sc. Non-Medical &Computer Science Semester VI										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Physics	B.Sc. (Non Medical) B.Sc. (Computer sci.)	BSNM-6395 BCSM-6395	I	C	100	Physics (Nuclear Physics)	30	-	20	3
			II			Physics (Radiation And Particle Physics)	30	-		3
			P			Physics Practical	-	20		3

SEMESTER–I
(2021-22)
PHYSICS
MECHANICS
(THEORY)

Course code: BSNM-1395 (I) for B.Sc. (Non Medical)
BCSM-1395 (I) for B.Sc. (Computer Science)

Course Outcomes: Mechanics -Paper (A)

After passing this course, students will be able to:

CO1: Understand the various coordinate systems and its applications. Students will be able to know the conservations laws and the symmetries of space & time.

CO2: Know the fundamental forces of nature, concept of centre mass, central forces and the motion of particle under central force and to determine the turning points of orbit. They will be able to understand the planetary motion by solving differential equation of orbits and studying Kepler's laws.

CO3: They will understand the origin of fictitious forces and their consequences on acceleration due to gravity, motion of a particle on earth, and Foucault's pendulum.

CO4: They will understand the elastic scattering in lab and centre of mass systems. They will learn the rotational motion of a body in general by studying the Euler's equations and Moment of inertia tensor.

B.Sc. (Semester System) (12+3 System of Education) (Semester–I) (Session 2021-22)
(Faculty of Sciences)

SEMESTER–I

PHYSICS

MECHANICS
(THEORY)

Course code: BSNM-1395 (I) for B.Sc. (Non Medical)
BCSM-1395 (I) for B.Sc. (Computer Science)

Time: 3 Hours **Marks: 30**

Pass Marks: 11

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I
Cartesian and spherical polar co–ordinate systems, area, volume, velocity and acceleration in these systems, Solid angle, Relationship of conservation laws and symmetries of space and time.

UNIT–II
Various forces in Nature (Brief introduction) centre of mass, equivalent one body problem, central forces, equation of motion under central force, equation of orbit and turning points. Kepler Laws. Concept of Ether and Michelson–Morley experiment.

UNIT–III
Inertial frame of reference. Galilean transformation and Invariance. Non Inertial frames, Coriolis force and its applications. Variation of acceleration due to gravity with latitude. Foucault pendulum.

UNIT–IV
Elastic collision in Lab and C.M. system, velocities, angles and energies, cross section of elastic scattering, Rutherford scattering. Rigid Body motion; Rotational motion, principal moments and Axes. Euler's equations, precession and elementary gyroscope.

Books Suggested:
1. Mechanics-Berkeley Physics Course, by C. Kittel, W. D. Knight, M. A. Ruderman, C. A. Helmholtz and R. J. Moyer-Tata Mc Graw Hill Publishing Company Ltd.,New Delhi. Vol-I (second edition)
2. Fundamentals of Physics by D. Halliday, R. Resnick and J. Walker (sixth edition)-Wiley India Pvt. Ltd., New Delhi, 2004.
3. Analytical Mechanics by S. K. Gupta, Modern Publishers.

SEMESTER–I
PHYSICS
ELECTRICITY AND MAGNETISM
(THEORY)
Course code: BSNM-1395 (II) for B.Sc. (Non Medical)
BCSM-1395 (II) for B.Sc. (Computer Science)

Course Outcomes: Electricity and magnetism

After passing this course the students will be able to:

CO1: understand the vector calculus and vector algebra and its applications in electricity and magnetism. The students will be able to solve the electrostatic problems with the help of Gauss law and Coulomb's law.

CO2: understand the applications of scalar potential for the calculation of electric field and electric potential due to an arbitrary charge distribution.

CO3: They will be able to find the electric potential and electric field of various charge distributions with the help of method of images. Students will understand the conduction of electric current in conductors by studying Ohm's law and equation of continuity.

CO4: They will be able to find the relationship between electric field from two different inertial frames of reference. They will be learn the origin of magnetism and properties of various kinds of magnetic materials.

SEMESTER–I
PHYSICS
ELECTRICITY AND MAGNETISM
(THEORY)

Course code: BSNM-1395 (II) for B.Sc. (Non Medical) Session 2021-22
BCSM-1395 (II) for B.Sc. (Computer Science)

Time: 3 Hours **Marks: 30**

Pass Marks: 11

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical and spherical coordinates. Coulomb's Law for point charges
And continuous distribution of charges. Electric field due to dipole, line charge and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.

UNIT–II

Work and potential difference. Potential difference as line integral of field. Electric potential due
to a point charge a group of point charges, dipole and quadruple moments, long uniformly charged wire, charged disc. Stoke's theorem and its applications in Electrostatic field, curl E=0.Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments.

UNIT–III

Poisson and Laplace's equation and their solutions in Cartesian and spherical coordinates. Concept of electrical images. Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet. Current and current density, equation of continuity. Microscopic form of Ohm's Law ($J=\sigma E$) and conductivity, Failure of Ohm's Law. Invariance of charge.

UNIT–IV

E in different frames of reference. Field of a point charge moving with constant velocity. Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of M and H and their relation to free and bound currents.
Permeability and susceptibility and their interrelationship. Orbital motion of electrons and Diamagnetism.

Books Suggested:

1. Fundamentals of Electricity and Magnetism by Arthur F. Kipp.
2. Electricity and Magnetism, Berkeley Physics Course, Vol. II by E.M. Purcell.
3. Introduction to Classical Electrodynamics by David Griffith.
4. EM Waves and Radiating System by Edward C. Jordan and K.G. Balmain.
5. Fields and Waves Electromagnetic by David K. Cheng.

SEMESTER–I
PHYSICS
PHYSICS PRACTICAL
Course code: BSNM-1395 (P) for B.Sc. (Non Medical)
BCSM-1395 (P) for B.Sc. (Computer Science)

Course Outcomes : Physics Lab Sem I
CO1: Students will be able to find the value of acceleration due to gravity using pendulums.
CO2 : It will give understanding of collisions In 1-Dimension.
CO3: It helps to study the moment of inertia of a body & on what factors its depends.

SEMESTER–I
PHYSICS PRACTICAL
Course code: BSNM-1395 (P) for B.Sc. (Non Medical)
BCSM-1395 (P) for B.Sc. (Computer Science)
Session 2021-22

Instructions to Practical Examiner
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

General Guidelines for Practical Examination
I. The distribution of marks is as follows: **Marks: 20**
i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

LIST OF EXPERIMENTS
1. To study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass).
2. To establish relationship between torque and angular acceleration using fly wheel.
3. To find the moment of inertia of a flywheel.
4. Study of bending of beams and determination of Young's modulus.
5. Determination of Poisson's ratio for rubber.
6. To determine energy transfer, coefficient of restitution and verify laws of conservation of linear momentum and kinetic energy in elastic collisions using one dimensional collisions of hanging spheres.
7. To verify the laws of vibrating string by Melde's experiment.
8. Measure time period as a function of distance of centre of suspension (oscillation) from centre of mass, plot relevant graphs, determine radius of gyration and acceleration due to gravity.
9. Find the value of 'g' by Kater's pendulum.
10. Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
11. To measure logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.

SEMESTER II

SEMESTER–II
PHYSICS
RELATIVITY AND ELECTROMAGNETISM
(THEORY)
Course code: BSNM-2395 (I) for B.Sc. (Non Medical)
BCSM-2395 (I) for B.Sc. (Computer Science)

Course Outcomes: Relativity & Electromagnetism -Paper (A)

After passing this course, students will be able to:

CO1: understand special theory of relativity and related basic concepts and applications.

CO2: derive Maxwell equations and their applications in propagation of e.m. waves in conductors and insulators.

CO3: apply the Biot Savart's Law and Ampere's circuital law in different situations and frames.

CO4: understand the Faraday's Law of electromagnetic induction and LCR circuits.

SEMESTER–II

Session -2021-22

PHYSICS

RELATIVITY AND ELECTROMAGNETISM

(THEORY)

Course code: BSNM-2395 (I) for B.Sc. (Non Medical)

BCSM-2395 (I) for B.Sc. (Computer Science)

Time: 3 Hours Marks: 30 **Pass Marks: 11**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Postulates of special theory of relatively. Lorentz transformations, observer and viewer in relativity. Relativity of simultaneity, Length, Time, velocities. Relativistic Dopper effect. Variation of mass with velocity, mass–energy equivalence, rest mass in an inelastic collision, relativistic momentum & energy, their transformation, concepts of Murkowski space, four vector formulation.

UNIT–II

Lorentz's force, Definition of B. Biot Savart's Law and its application to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its application. Divergence and curl of B. Hall effect, expression and co–efficient. Vector potential, Definition and derivation, current–density–definition, its use in calculation of charge in magnetic field at a current sheet. Transformation equation of E and B from one frame to another.

UNIT–III

Faraday's Law of EM induction, Displacement current, Mutual inductance and reciprocity theorem. Self inductance, L for solenoid, Coupling of Electrical circuits. Analysis of LCR series and parallel resonant, circuits Q–factor, Power consumed, power factor.

UNIT–IV

Maxwell's equations their derivation and characterizations, E.M. waves and wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma = 0$). Poynting vector, impedance of a dielectric to EM waves. EM waves in a conducting medium and Skin depth. EM wave velocity in a conductor and anomalous dispersion. Response of a conducting medium to EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence.

Recommended Books:

1. Introduction to Electrodynamics by D.J. Griffiths-Pearson Education Ltd., New Delhi, 1991
2. Physics of Vibrations and Waves by H.J. Pain.
3. EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain.
4. Fields and Waves Electromagnetic by David K. Cheng.

SEMESTER–II
PHYSICS
VIBRATION AND WAVES
(THEORY)
Course code: BSNM-2395 (II) for B.Sc. (Non Medical)
BCSM-2395 (II) for B.Sc. (Computer Science)

After passing this course the student will be able to:

CO1: demonstrate Lissajous figures by mechanical and analytical method with different cases.

CO2: understand Free, damped and resonance oscillations, both mechanical and electric using differential equations.

CO3: solve differential equation of forced oscillations & to obtain related quantities.

CO4: understand concept of coupled oscillators and wave motion. Student will also be able to apply the concept of waves and oscillations to any type of waves like e. m. waves, mechanical waves.

SEMESTER–II
Session 2021-22
PHYSICS
VIBRATION AND WAVES
(THEORY)
Course code: BSNM-2395 (II) for B.Sc. (Non Medical)
BCSM-2395 (II) for B.Sc. (Computer Science)

Time: 3 Hours **Marks: 30**

Pass Marks: 11

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I
Simply harmonic motion, energy of a SHO. Compound pendulum. Torsional pendulum Electrical Oscillations Transverse Vibrations of a mass on string, composition of two Perpendicular SHM of same period and of period in ratio 1:2.

UNIT–II
Decay of free Vibrations due to damping. Differential equation of motion, types of motion, types of damping. Determination of damping co–efficient– Logarithmic decrement, relaxation time and Q–Factor. Electromagnetic damping (Electrical oscillator).

UNIT–III
Differential equation for forced mechanical and electrical oscillators. Transient and steady state behaviour. Displacement and velocity variation with driving force frequency, variation of phase with frequency, resonance. Power supplied to an oscillator and its variation with frequency. Q–value and band width. Q–value as an amplification factor. Stiffness coupled oscillators, Normal co–ordinates and normal modes of vibration. Inductance coupling of electrical oscillators.

UNIT–IV
Types of waves, wave equation (transverse) and its solution characteristic impedance of a string. Impedance matching. Reflection and Transmission of waves at boundary. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a string of fixed length. Energy of vibration string. Wave and group velocity.

Recommended Books:
1. Fundamentals of Vibrations and Waves by S.P. Puri.
2. Physics of Vibrations and Waves by H.J. Pain.

PHYSICS PRACTICAL

Course code: BSNM-2395 (P) for B.Sc. (Non Medical)
BCSM-2395 (P) for B.Sc. (Computer Science)

COURSE OUTCOMES

CO1: Students will be able to study resonance in series & parallel LCR circuit.

CO2: At the end of this course, students will be able to find the value of capacitor, coefficient of self inductance, permeability & permittivity of air.

CO3: Students will be able to study the variation of magnetic field on the axis of coil & can find the value of horizontal component of magnetic field.

SEMESTER–II
PHYSICS PRACTICAL

Course code: BSNM-2395 (P) for B.Sc. (Non Medical)
BCSM-2395 (P) for B.Sc. (Computer Science)
Session2021-22

Instructions to Practical Examiner

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

General Guidelines for Practical Examination: (4.5h/week)

I. The distribution of marks is as follows: **Marks: 20**
i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

LIST OF EXPERIMENTS

1. To determine low resistance with Carey-Foster's Bridge.
2. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
3. To study the induced e.m.f. as a function of the velocity of the magnet.
4. Study of phase relationships using impedance triangle for LCR circuit and calculate impedance.
5. Resonance in a series and parallel LCR circuits for different R–value and calculate Q–value.
6. Capacitance by flashing and quenching of a neon lamp.
7. Measurement of capacitance, determination of permittivity of a medium air and relative permittivity by de–Sauty's bridge.
8. To determined L using Anderson Bridge.
9. To find the value of BH the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.
10. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.

Course Outcomes: PHY-Statistical Physics and Thermodynamics

Course code: BCSM-3395 (I)

After passing this programme the students will be able to:

CO1: Understand the basic ideas and scope of probability as well as distribution of n particles in different compartments.

CO2: Concept of different types of Statistics and the need for Quantum Statistics.

CO3: Understand the concept of entropy, Laws of Thermodynamics and applications to thermoelectric effect.

CO4: Understand the Maxwell Thermodynamics relations, Change of state and Claypron equation.

SEMESTER-III PHYSICS
Session2021-22
Course code: BCSM-3395 (I)
PAPER-A
STATISTICAL PHYSICS & THERMODYNAMICS
(THEORY)

Time: 3 Hours **Marks: 30**
Pass Marks: 11

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Basic ideas of Statistical Physics, Scope of Statistical Physics, Basic ideas about probability, Distribution of four distinguishable particles into compartments of equal size. Concept of macro states, microstates, Thermodynamic Probability, Effects of constraints on the system. Distribution of n particles in two compartments, Deviation from the state of maximum probability. Equilibrium state of dynamic system, Distribution of distinguishable n particles in k compartments of unequal sizes.

UNIT–II

Phase space and division into elementary cells. Three kinds of statistics. The basic approach in three statistics. Maxwell Boltzmann (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of law of distribution of molecular speeds. Need for Quantum Statistics – B.E. Statement of Planck's law of Radiation Wien's Displacement and Stefan's law. Fermi Dirac (FD) statistics. Comparison of M.B, B.E and F.D statistics.

UNIT–III

Statistical definition of entropy, Change of entropy of system, additive nature of entropy, Law of increase of entropy, Reversible and irreversible processes, and their examples, work done in reversible process, examples of increase in entropy in natural processes, entropy and disorder, Brief review of Terms, Laws of Thermodynamics, Carnot Cycle, Entropy changes in Carnot cycle, Absolute thermodynamics or Kelvin Scale of Temperature, Applications of thermodynamics to thermoelectric effect, Peltier Effect, Thomson Effect, change of entropy along reversible path in P-V diagram. Heat death of universe.

UNIT–IV

Derivation of Maxwell Thermodynamics relations, Cooling produced by adiabatic stretching, A diabetic Compression, change of internal energy with volume, Specific heat and constant pressure and constant volume. Expression for C_P-C_V, Change of state and Claypron equation, Joule-Thomson effect.

Text Reference Books:

1. Statistical Physics and Thermodynamics by V.S. Bhatia (Sohan Lal Nagin Chand), Jal.
2. A Treatise on Heat by M.N. Saha & B.N. Srivastava (The Indian Press Pvt. Ltd., Allahabad), 1965.
3. Statistical Mechanics: An Introductory Text by Bhattacharjee, J.K. (Allied Pub., Delhi), 2000.
4. Statistical Physics by Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
5. Statistical Mechanics by B.B. Laud, (Macmillan India Ltd.) 1981.

Course Outcomes: PHY-OPTICS

Course code: BCSM-3395 (II)

After passing this programme the students will be able to:

CO1: understand the concept of interference of waves by division of wave front and its different methods and concept of coherence.

CO2: understand the interference of waves by division of Amplitude and its methods and will have knowledge of interferometers

CO3: understand the Huygen's Fresnel theory and diffraction, Fraunhoffer diffraction due to single slit, double slit and n slits, the concept of resolving power.

CO4: understand the concept the polarization of light and types of polarisers.

SEMESTER–III

Session 2021-22
PHYSICS
Course Code: BCSM-3395 (II)
PAPER–B: OPTICS
(THEORY)

Time: 3 Hours **Marks: 30**
Pass Marks: 11

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Interference of Light:
Superposition of light waves and interference, Young's double slit experiment, Distribution of intensity in Young's double slit experiment, Conditions for sustained interference pattern,
Coherent sources of light, Temporal and spatial coherence, Mathematical analysis of temporal coherence, Interference pattern by division of wave front, Fresnel Biprism, Fresnel double mirror, Llyod's single mirror, Achromatic fringes. Displacement of fringes,

UNIT–II

Interference by Division of Amplitude:
Change of phase on reflection, Interference in thin films due to reflected and transmitted light, Interference in parallel and wedge shaped films, Colour of thin films. Need for extended source for interference by division of amplitude, non-reflecting films, Newton's Rings. Michelson Interferometer, Fabry Perot interferometer and etalon. Distribution of intensity in Fabry Perot fringes.

UNIT–III

Diffraction:
Huygens's fresnel theory, half-period zones, Zone plate, Distinction between Fresnel and Fraunhoffer diffraction. Fraunhoffer diffraction due to single slit, rectangular and circular aperture, double slits and plane transmission grating, Effect of diffraction in optical imaging, its use as a spectroscopic element and its resolving power, Resolving power of telescope, of diffraction grating, of microscope and of Fabry-Perot interferometer.

UNIT–IV

Polarization:
Plane Polarized light, Elliptically polarized light, wire grid polarizer, Sheet polarizer, Maul's Law, Brewster Law, Polarization by reflection and scattering, Double refraction, Nicol prism, Retardation plates, Production and Analysis of plane, circularly and elliptically polarized light, Quarter and half wave plates, Optical activity

Text Reference Books:

1. Fundamentals of Optics by F.A. Jenkins and Harvey E White, (Mcgraw Hill) 4th Edition, 2001.
2. Optics, Ajoy Ghatak by (McMillan Indian) 2nd Edition, 7th Reprint, 1997.
3. Optics by Born and Wolf, (Pergamon Press) 3rd Edition, 1965.
4. Physical Optics by B. K. Mathur and T. P. Pandya.
5. A textbook of Optic by N. Subrahmanyam, Brijlal and M. N. Avadhanulu.
6. Geometrical and Physical Optics by Longhurst.
7. Introduction to Modern Optics by G. R. Fowels.
8. Optics by P. K. Srivastav.

Course Outcomes: SEMESTER–III PHYSICS (PRACTICAL)

Course code: BCSM-3395 (P)

After passing this programme the students will be able to:

CO1: use spectrometer to determine the refractive index of different transparent materials wills dispersive power and resolving power of different transparent prisms and liquids using spectrometer.

CO2: use diffraction grating and apply it to determine dispersive power, resolving power, the wavelengths of Hg source and the Cauchy's constants.

CO3: to measure an accessible (Horizontal and vertical) and inaccessible heights using sextant.

CO4: set up of Newton's rings to determine wavelength of sodium light.

CO5: demonstrate the verification of laws of probability distribution.

SEMESTER–III
Session2021-22
PHYSICS
Course Code: BCSM-3395 (P)
(PRACTICAL)

Instructions to Practical Examiner

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

General Guidelines for Practical Examination

I. The distribution of marks is as follows: **Marks: 20**
i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

List of Experiments

1. To determine refractive index of glass and liquid using spectrometer.
2. To determine the Cauchy's constants.
3. To study the refractive index of a doubly refracting prism.
4. To set up Newton's rings to determine wavelength of sodium light.
5. To determine the wavelength by using plane diffraction grating (Use Hg source)
6. To determine dispersive power of plane diffraction grating.
7. To determine resolving power of a telescope.
8. To measure an accessible (Horizontal and vertical) height using sextant.
9. To measure inaccessible height by using sextant.
10. Verify laws of probability distribution by throwing of similar coins.
11. To determine the wavelength of given laser source using Young's double slit experiment

Course Outcomes: Quantum Mechanics (Paper A)

Course code: BCSM-4395 (I)

After completing this course

CO1: Students will be familiar with the main aspects of the historical development of quantum mechanics

CO2: Students will understand the central concepts and principles in quantum mechanics

CO3: Students will be able to find the solution of Schrödinger wave equation for simple systems in one dimension and for Hydrogen atom.

CO4: Students will understand concept of X rays spectra and molecular spectra.

SEMESTER–IV
Session 2021-22
PHYSICS
Course code: BCSM-4395 (I)
PAPER–A
QUANTUM MECHANICS
(THEORY)

Time: 3 Hours **Marks: 30**
Pass Marks: 11

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Formalism of Wave Mechanics:
Brief introduction to need and development of quantum mechanics, photoelectric effect, Compton effect, Wave particle duality, De Broglie hypothesis, Wave packet, Group velocity, Uncertainty principle and its applications. Fundamental postulates of wave mechanics, Time dependent and time independent Schrodinger wave equation for a free particle and equation of a particle subject to forces. Stationary states, Superposition principle.

UNIT–II

Normalization and probability interpretation of wave function, Gaussian wave packet. Admissibility conditions of wave function, Eigen function and Eigen value, Expectation value, Operator and commutator formalism, Hermitian operator, orthogonal system, Probability current and conservation of probability, Ehrenfest theorem,.

UNIT–III

Problem in One and Three Dimensions:
Application of Schrodinger Equation for solving one dimensional Particle in a box, one dimensional potential step, Potential Barrier and Linear harmonic oscillator. Schrodinger equation for spherically symmetric potential for hydrogen atom. Spherical harmonics and their solution. Physical significance of quantum number, Degeneracy.

UNIT–IV

Production of X Rays and its properties, X-ray spectra, Moseley law, Absorption of X Rays, Auger effect, Molecular bonding of hydrogen molecule ion and hydrogen molecule, Molecular spectra, selection rules, Raman Effect.

Text Reference Books:

1. A Text book of Quantum Mechanics by P.M. Mathews and K. Venkatesan, (Tata McGraw Hill Pub., Co., Delhi) 2002.
2. Quantum Mechanics by J.L. Powell and B. Craseman (Narosa Pub. House, New Delhi) 1997.
3. Concepts of Modern Physics by Arthur Beiser (McGraw Hill Pub. Co., New Delhi, 9th Ed.)
4. 1995.
5. Elements of Modern Physics by S.H. Patil (McGraw Hill), 1998.
6. Quantum Mechanics by E. Merzbacher (John Wiley, 2nd Edition)
7. Fundamentals of Molecular Spectroscopy by C.N. Banwell (Tata McGraw Hill Pub. Co.,
8. Delhi), 2001.
9. Atomic Spectra by H.G. Kuhn (Longmans), 2nd Ed., 1969.
10. Introduction to Quantum Mechanic by L. Pauling and E.B. Wilson (Tata McGraw Hill Pub. Co., Delhi), 2002.
11. Quantum Mechanics by W. Greiner (Springer Verlag), 1994.
12. Fundamentals of Molecular Spectroscopy by C.B. Banwell-Tata McGraw Hill, 1986.
13. Molecular Spectroscopy: Jeanne L McHale.

Course Outcomes: PHY- ATOMIC SPECTRA & LASERS
Course Code: BCSM-4395 (II)

After passing this programme the students will be able to:

CO1: understand fine and hyperfine spectrum of hydrogen atom and the concept of spin of an electron

CO2: demonstrate understanding of exchange symmetry of wave function, different coupling schemes and spectra of atoms with more than one electron.

CO3: understand the fundamentals of lasers and its processes

CO4: have the knowledge of different components and types of lasers and its applications

SEMESTER–IV
Session 2021-22
PHYSICS
Course code: BCSM-4395 (II)
PAPER–B
ATOMIC SPECTRA & LASERS
(THEORY)

Time: 3 Hours **Marks: 30**
Pass Marks: 11

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

One Electron Atomic Spectra:
Brief review of Bohr and Rutherford model of atom. Idea of vector model of atom and quantum numbers, Spectrum of Hydrogen atom, Line structure, electron spin, Stern Gerlach
experiment, spin orbit coupling, electron magnetic moment, total angular momentum, fine and Hyperfine structure of hydrogen atom, Lande g factor, Normal Zeeman effect, anomalous Zeeman effect.

UNIT–II

Many Electron System Spectra:
Exchange symmetry of wave function, Pauli's Exclusion principle, Electronic configuration and atomic states, shells, sub shells in atoms, Two valence electron atoms: LS and JJ coupling schemes and resulting spectral terms, optical spectra for one and many electron system(Helium), spectra of alkaline earth atoms.

UNIT–III

Laser Fundamentals:
Derivation of Einstein relations, Concept of stimulated emission and population inversion,
Fauchber Ledenberg formula, Threshold and Schawlow Tonnes condition, Components of laser devices and its types, three level and four level laser schemes, elementary theory of optical cavity.

UNIT–IV

Laser Systems:
Construction, mode of creating population inversion and output characteristics of Ruby laser, He-Ne laser, CO_2laser and Nd: YAG laser, applications of lasers–a general outline, Q-switching, Basics of holography.

Text Reference Books:

1. Introduction to Atomic Spectr by: H.E. White-Auckland McGraw Hill, 1934.
2. Spectroscopy Vol. I, II & III by Walker & Straughen
3. Introduction to Molecular Spectroscopy by G.M. Barrow-Tokyo McGraw Hill, 1962.
4. Spectra of Diatomic Molecules by Herzberg-New York, 1944
5. Introduction to Atomic Spectra by H.E. White (Mcgraw Hill, Book Co., Inc., New York)
6. Laser Fundamentals by W.T. Silfvast (Foundation Books), New Delhi, 1996
7. Laser and Non-Liner Optics by B.B. Laud (New Age Pub.) 2002
8. Laser, Svelto by (Plenum Pres) 3rd edition, New York

SEMESTER–IV
Session 2021-22
PHYSICS
Course Outcomes: PHY Lab Sem IV

Course code: BCSM-4395 (P)

CO1: The exercises included in this laboratory course are aimed at training the students to handle different type of equipment for verification of some of the laws and concepts studied in theory like concepts of thermodynamics, photoelectric effect and for carrying out precise measurements so that they develop confidence to use later the sophisticated instruments in their respective fields.

CO2: After the completion of this course students will be able to use spectrometer and hence will be able to study absorption spectra of iodine.

CO3: At the end of this course students will be able to prepare cane sugar solution and hence will be able to find its specific rotation by using polarimeter.

SEMESTER–IV
Sessio2021-22
PHYSICS
(PRACTICAL)
Course code: BCSM-4395 (P)

Instructions to Practical Examiner
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

General Guidelines for Practical Examination
I. The distribution of marks is as follows: **Marks: 20**
i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

List of Experiments
1. To study adiabatic expansion of gas and hence to calculate value of V.
2. To find the coefficient of Thermal Conductivity of a bad conductor by Lee's method.
3. To plot a calibration curve of a given thermocouple (copper constantan).
4. To study the photoelectric effect and determine the value of Planck's constant.
5. To determine the ionization potential of mercury.
6. Study of variation of light intensity with distance using photovoltaic cell
(Inverse Square Law)
7. To determine the heating efficiency of an electric kettle with varying voltage.
8. To study the absorption spectra of iodine vapours.
9. To study the rotation of plane of polarization by using polarimeter.
10. To determine the specific rotation of sugar using Laurent's half shade polarimeter
11. To study the characterizations of Photovoltaic cell.

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–V) (Session 2021-22)
PHYSICS (CONDENSED MATTER PHYSICS)
(THEORY)
Course code: BSNM-5395 (I) for B.Sc. (Non Medical)
BCSM-5395 (I) for B.Sc. (Computer Science)

Course Outcomes

After passing this course, students will be able to:

CO 1. Understand basics about crystal structures in solids, various types of crystal structure, unit cells and symmetry operations.

CO 2. Understand the experimental methods to determine crystal structures, reciprocal lattice, Brillioun zones and form factor.

CO 3. Understand the concept of lattice vibrations and role of phonons in determining specific heat of solids at low temperatures and models of specific heat.

CO 4. Build concept from free electron model to Kronig Penny model and its application to band theory to differentiate insulators, semiconductors and conductors.

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–V) (Session 2021-22)
PHYSICS (CONDENSED MATTER PHYSICS)
(THEORY)
Course code: BSNM-5395 (I) for B.Sc. (Non Medical)
BCSM-5395 (I) for B.Sc. (Computer Science)

Time: 3 Hours **Max. Marks: 30** **Pass Marks: 11**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Crystal structure, Symmetry operations for a two and three dimensional crystal, Two dimensional Bravais lattices, Three dimensional Bravais lattices, Basic primitive cells, Crystal planes and Miller indices, Diamond and NaCl structure.

UNIT–II

Crystal Diffraction: Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Brag's law in reciprocal lattice, Brillioun zones and its construction in two and three dimensions, Structure factor and atomic form factor.

UNIT–III

Lattice vibrations, Concepts of phonons, Scattering of photons by phonons, Vibration and monoatomic, linear chains, Density of modes, Einstein and Debye models of specific heat. Free electron model of metals, Free electron, Fermi gas and Fermi energy.

UNIT–IV

Band Theory: Kronig Penney model, Metals and insulators, Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, band gap in semiconductors.

Books Suggested:

1. Introduction to Solid State Physics by C. Kittel (Wiley Eastern)
2. Elements of Modern Physics by S.H. Patil (TMGH, 1985).
3. Solid State Physics by Puri and Babbar.
4. Condensed Matter Physics by T.S. Bhatia (Vishal Publishing Co.)

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–V) (Session 2021-22)
PHYSICS (ELECTRONICS)
Course code: BSNM-5395 (II) for B.Sc. (Non Medical)
BCSM-5395 (II) for B.Sc. (Computer Science)

Course Outcomes- After completing this course a student will be able to

CO1: understand, concept of voltage and current sources, working of a p-n junction diode, zener diode, and their use in basic gates, photonic devices, rectification and voltage regulation.

CO2: understand the characteristics, biasing and working of BJT and FETs.

CO3: able to understand h-parameters, amplifiers using BJT & FETs and types of feedbacks and practical example of negative feedback (emitter follower).

CO4: understand LC and RC oscillators and their comparison.

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–V) (Session 2021-22)
PHYSICS (ELECTRONICS)
Course code: BSNM-5395 (II) for B.Sc. (Non Medical)
BCSM-5395 (II) for B.Sc. (Computer Science)
(THEORY)

Time: 3 Hours **Marks: 30** **Pass Marks: 11**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 6 marks.**

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Concepts of current and voltage sources, p-n junction, Biasing of diode, V-I characteristics, Rectification: half wave, full wave rectifiers and bridge rectifiers, Efficiency, Ripple factor, Qualitative ideas of filter circuits (Shunt capacitor, L section and π filters), Zener diode and voltage regulation, Introduction to Photonic devices (construction and working of solar cell, photodiode and LED). Basic concepts of Boolean algebra, AND, OR ,NOT and NAND gates using diodes.

UNIT–II

Junction transistor : Structure and working relation between different currents in transistors, Sign conventions, Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics, Structure and characteristics of JEFT, Transistor biasing and stabilization of operating point, Voltage divider biasing circuit.

UNIT–III

Working of CE amplifier, Amplifier analysis using h-parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier and its voltage gain, Feed back in amplifiers, Different types, Voltage gain, Advantage of negative feed back, Emitter follower as negative feedback circuit.

UNIT–IV

Barkausen criterion of sustained oscillations, LC oscillator (tuned collector, tuned base Hartley), RC oscillators, Phase shift Oscillator and Wein bridge Oscillator

Books Suggested:

1. Basic Electronics and Linear Circuits by N.N. Bhargave, D.C. Kulshreshtha and S.C. Gupta.

2. Foundations of Electronics by D. Chatophadhyay, P.C. Rakshit, B. Saha and N.N. Purkit.

3. Basic Electronics by D.C. Tayal (Himalaya Pub.)

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–V) (Session 2021-22)
PHYSICS PRACTICAL
Course code: BSNM-5395 (P) for B.Sc. (Non Medical)
BCSM-5395 (P) for B.Sc. (Computer Science)

Course Outcomes : Physics Lab Sem V

CO 1. Students will be able to characterize p-n junction, zener diode, and their use as rectifier, filters, clipping element and to find energy gap.
CO 2. Student will be able to use CRO for AC voltage and frequency.
CO 3. Students will be able to characterize Common base and common emitter transistors and their use as amplifier.
CO 4. Students will be able to use diodes as basic gates.

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–V) (Session 2021-22)
PHYSICS PRACTICAL
Course code: BSNM-5395 (P) for B.Sc. (Non Medical)
BCSM-5395 (P) for B.Sc. (Computer Science)

Instructions to Practical Examiner
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya MahaVidyalaya, Jalandhar
General Guidelines for Practical Examination
I. The distribution of marks is as follows: **Marks: 20**
i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

LIST OF EXPERIMENTS-
1. Measurement of reverse saturation current in p-n-junction diode at various temperatures and to find the approximate value of energy gap.
2. To draw forward and reverse bias characteristics of a p-n junction diode.
3. To study working of CRO and its use to find AC signal voltage and its frequency.
4. Study of a diode as a clipping element.
5. To measure the efficiency and ripple factors for (a) halfwave (b) full wave and (c) bridge rectifier circuits.
6. To draw the characteristics of a Zener diode.
7. To study characteristics of Common Base transistor. and to find input resistance, output resistance, voltage gain and current gain.
8. To study characteristics of Common Emitter transistor. and to find h-parameters.
9. To study the gain of an amplifier at different frequencies and to find Band width
10. To study the reduction in the ripple in the rectified output with RC, LC and л filters.
11. To study logic gates (OR, AND, NOT and NAND).

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–VI) (Session 2021-22)
PHYSICS (NUCLEAR PHYSICS)
(THEORY)

Course code: BSNM-6395 (I) for B.Sc. (Non Medical)
BCSM-6395 (I) for B.Sc. (Computer Science)

Course Outcomes

After passing this course, students will be able to:

CO 1. Understand basic properties of nucleus and nuclear forces.

CO 2. Understand about radioactivity, theories of alpha, beta and gamma decay, neutrino hypothesis.

CO 3. Understand concepts and types about nuclear reactions, reactions cross section and compound nucleus.

CO 4. Understand nuclear models (Liquid drop and Shell model) and their failures and successes.

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–VI) (Session 2021-22)
PHYSICS (NUCLEAR PHYSICS)
(THEORY)
Course code: BSNM-6395 (I) for B.Sc. (Non Medical)
BCSM-6395 (I) for B.Sc. (Computer Science)

Time: 3 Hours **Marks: 30** **Pass Marks: 11**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 marks.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Nuclear Properties: Constituents of nucleus, non-existence of electrons in nucleus, Nuclear mass and binding energy, features of binding energy versus mass number curve, nucleus radius, angular momentum and parity, nuclear moments: magnetic dipole moment and electric quadruple moment, properties of nuclear forces, Yukawa theory.

UNIT–II

Radioactive Decays: Modes of decay of radioactive nuclides and decay Laws, radioactive series and displacement law, radioactive dating, Alpha decay: Gamow's theory of alpha decay, barrier penetration as applied to alpha decay, Geiger Nuttal law, Beta decays: β-, β+ and electron capture decays, Neutrino hypothesis and its detection, parity violation in β decay, Gamma transitions, internal conversion.

UNIT–III

Nuclear Reactions: Types of nuclear reactions, reactions cross section, conservation laws, Kinematics of nuclear reaction, examples of nuclear reactions: proton, deuteron, alpha particle, neutron and photon induced reactions. Q-value and its physical significance, Compound nucleus

UNIT–IV

Nuclear Models: Liquid drop model, semi-empirical mass formula, condition of stability, evidence for nuclear magic numbers, Shell Model, energy level scheme, angular momenta of nuclear ground states, parity and magnetic moment of nuclear ground states.

Reference Books:

1. Basic Ideas and Concepts in Nuclear Physics by K. Hyde
2. Introduction to Nuclear Physics by H.A. Enge
3. Nuclear Physics by I. Kaplan (Addison Wesley)
4. Nuclei and Particles by E. Segre

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–VI) (Session 2021-22)
PHYSICS (RADIATION AND PARTICLE PHYSICS)
Course code: BSNM-6395 (II) for B.Sc. (Non Medical)
BCSM-6395 (II) for B.Sc. (Computer Science)

Course Outcome:

After successfully completing this course a student will be able to:

CO1: understand interaction of radiation and charged particles with matter.

CO2: understand theory and working of various types of nuclear detectors like gas filled, semiconductor, solid state track detectors and nucleus emulsions.

CO3: understand theory and working of various particle accelerators, linear and cyclic and phase stability conditions.

CO4: understand about elementary particles, different types of interactions and quark mode.

Bachelor of Science (Semester System) (12+3 System of Education)

(Semester–VI) (Session 2021-22)

PHYSICS (RADIATION AND PARTICLE PHYSICS)

Course code: BSNM-6395 (II) for B.Sc. (Non Medical)

BCSM-6395 (II) for B.Sc. (Computer Science)

(THEORY)

Time: 3 Hours **Marks: 30** **Pass Marks: 11**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 6 marks.**

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Interaction of Radiation and Charged Particles with Matter: Derivation of Bethe-Bloch formula, Stopping power and range of heavy charged particles, Energy loss of electrons and positrons, Positrons annihilation, interaction of gamma rays with matter.

UNIT–II

Nuclear Radiation Detection: Gas-filled detectors, Proportional and Geiger-Mueller counters, Scintillation detectors, Semiconductor detectors, Cherenkov effect, Solid state nuclear track detectors. Bubble chamber.

UNIT–III

Accelerators: Linear accelerators, Cyclic accelerators: Cyclotron, Synchrocyclotron, Betatron, Electron and proton synchrotron, Colliding beam machines: introduction to Large Hadron Collider

UNIT–IV

Elementary Particles: Historical introduction, high energy physics units, fermions and bosons, particles and antiparticles, Classification of particles, types of interactions, electromagnetic, weak, strong interactions, gravitational interactions, Quantum numbers and conservation laws: Charge, Baryon number, lepton number, parity, isospin, charge conjugation, strangeness. Introduction to quarks and qualitative discussion of the quark model,

Reference Books:

1. Basic Ideas and Concepts in Nuclear Physics by K. Hyde
2. Introduction to Nuclear Physics by H.A. Enge
3. Nuclear Physics by I. Kaplan (Addison Wesley)
4. Nuclei and Particles by E. Segre
5. Introduction to High Energy Physics by D.H. Perkins
6. Elementary Particles by I.S. Hughes

(Semester–VI) (Session 2021-22)

PHYSICS PRACTICAL

Course code: BSNM-6395 (P) for B.Sc. (Non Medical)
BCSM-6395 (P) for B.Sc. (Computer Science)

Course Outcome: After successfully completing this course a student will be able to:

CO1: understand magnetic parameters and phenomenon of hysteresis and tracing of B-H curve.
CO2: understand application of zener diode as voltage regulators.
CO3: understand the characteristics and working of FET & LDR and response of RC circuits.
CO4: use of GM counter to understand the concepts of dead time and absorption coefficient and statistical fluctuations.

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–VI) (Session 2021-22)
PHYSICS PRACTICAL
Course code: BSNM-6395 (P) for B.Sc. (Non Medical)
BCSM-6395 (P) for B.Sc. (Computer Science)

Instructions to Practical Examiner
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar
General Guidelines for Practical Examination
I. The distribution of marks is as follows: **Marks: 20**
i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session.
Paper will consist of 8 experiments out of which an examinee will mark 6 experiments andone of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

LIST OF EXPERIMENTS-

1. To trace the B-H curves for different materials using CRO and find the magnetic parameters from these.
2. To study the stabilization of output voltage of a power supply with Zener diode.
3. To draw output and mutual characteristics of an FET (Experiments) and determine its parameters.
4. To set up an oscillator and to study its output on CRO for different C values.
5. To draw the plateau of a GM counter and find its dead time.
6. To study the statistical fluctuations using GM counter.
7. To study the absorption of beta particles in aluminium using GM counter and determine the absorption coefficient of beta particles from it.
8. To study the characteristics of a thermistor and find its parameters.
9. To study the response of RC circuit to various input voltage (square, sine and triangular).
10. To study characteristics of LDR.

ANNEXURE E
Faculty of Sciences
Syllabus for
Bachelor of Science (Honours) Physics
(Under Continuous Evaluation System)

(SEMESTER: I-IV)

Session – (2021-22)

Kanya Maha Vidyalaya, Jalandhar
(Autonomous)
The Heritage Institution

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Honours) Physics

Session-2021-22

Semester-I

Sr. No.	Course Code	Course Type	Course Title	Max Marks				Examination time in Hours)
				Total	Ext		CA	
					L	P		
1.	BOPL-1421 BOPL-1031 BOPL-1431	C	Punjabi(Compulsory [1]Basic Punjabi [2]Punjab History and Culture	50	40	-	10	3
2.	BOPL-1102	C	Communication skills in English	50	40	-	10	3
3.	BOPL-1393	C	Mechanics-I	75	60	-	15	3
4.	BOPL-1394	C	Electricity &Magnetism-I	75	60	-	15	3
5.	BOPL-1335	C	Mathematics-I	50	40	-	10	3
6.	BOPL-1086	C	Chemistry-I	50	40	-	10	3
7.	BOPP-1397	C	Physics Lab-I	50	-	40	10	3
8.	BOPP-1088	C	Chemistry Lab-I	50	-	40	10	3
9.	AECD-1161	AC	*Drug Abuse: Problem Management & Prevention (Compulsory)	50	40	-	10	3
10.	SECF-1492	AC	*Foundation Program	25	20		5	1

***Marks of these papers will not be added in total marks**

1 In Lieu of Punjabi (Compulsory) for students from Punjab

2. In Lieu of Punjabi (Compulsory) for students outside Punjab (Other States)

SEMESTER -II

Sr. No.	Course Code	Course Type	Course Title	Max Marks				Examination time in Hours)
				Total	Ext		CA	
					L	P		
1	BOPL-2421 BOPL-2031 BOPL-2431	C	Punjabi(Compulsory [1]Basic Punjabi [2]Punjab History and Culture	50	40	-	10	3
2	BOPM-2102	C	Communication Skills in English	50	25	15	10	3
3	BOPL-2393	C	Electricity & Magnetism-II	75	60	-	15	3
4	BOPL-2394	C	Vibrations and Waves	75	60	-	15	3
5	BOPL- 2335	C	Mathematics-II	50	40	-	10	3
6	BOPL-2086	C	Chemistry-II	50	40	-	10	3
7	BOPP-2397	C	Physics Lab-II	50	-	40	10	3
8	BOPP-2088	C	Chemistry Lab-II	50	-	40	10	3
9	AECD-2161	AC	*Drug Abuse: Problem, Management and Prevention (Compulsory)	50	40	-	10	3
10	SECM-2502	AC	* Moral Education Programme	25	20		5	1

****Marks of these papers will not be added in total marks**

1 In Lieu of Punjabi (Compulsory) for students from Punjab

2. In Lieu of Punjabi (Compulsory) for students outside Punjab (Other States)

Semester-III

Sr. No.	Course Code	Course Type	Course Title	Max Marks				Examination time in
				Total	Ext		CA	
					L	P		
1	BOPL-3391	C	Optics	75	60	-	15	3
2	BOPL-3392	C	Statistical &Thermal Physics	75	60	-	15	3
3	BOPL-3333	C	Mathematics –III	50	40	-	10	3
4	BOPL-3084	C	Chemistry-III	50	40	-	10	3
5.	BOPM-3135	C	Python Programming Interdisciplinary Course (ID)-I	50	25	15	10	3
5	BOPP-3396	C	Physics Lab –III	50	-	40	10	3
6	BOPP-3087	C	Chemistry Lab –III	50	-	40	10	3
8	AECE-3221	AC	*EVS (Compulsory)	100	60	20	20	3
9	SECP-3512	AC	* Gender Sensitisation Course	Grade only				

***Marks of these papers will not be added in total marks**

Semester-IV

Sr. No.	Course Code	Course Type	Course Title	Max Marks				Examination time in Hours)
				Total	Ext		Int	
					L	P		
1	BOPL-4391	C	Mechanics - II	75	60	-	15	3
2	BOPL-4392	C	Atomic Spectroscopy	75	60	-	15	3
3	BOPL-4333	C	Mathematics –IV	50	40	-	10	3
4	BOPL-4084	C	Chemistry-IV	50	40	-	10	3
5	BOPL -4175	C	Statistical Methods Interdisciplinary Course (ID)-II	50	40	-	10	3
6	BOPP-4396	C	Physics Lab –IV	50	-	40	10	3
7	BOPP-4087	C	Chemistry Lab –IV	50	-	40	10	3
8	SECS-4522	AC	*Social Outreach		Grade only			2

***Marks of this papers will not be added in total marks**

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.

2. Students will demonstrate knowledge of classical mechanics, electromagnetism, quantum mechanics, Electronics, Nuclear and thermal physics, and be able to apply this knowledge to analyse a variety of physical phenomena.

3. Students will demonstrate knowledge of organic, Physical and inorganic chemistry and are able to recognize and apply the principles of atomic and molecular structure to predict chemical properties and chemical reactivity.

4. Students will show that they have learned laboratory skills, enabling them to take measurements in a physics and chemistry laboratory and analyse the measurements to draw valid conclusions.

5. Upon completion of this degree, students will be able to understand theoretical concepts of instruments that are commonly used in most physics and chemistry fields as well as interpret and use data generated in instrumental analysers.

6. Students will be capable of oral and written scientific communication, and will prove that they can think critically and work independently.

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER–I
SESSION 2021-22

MECHANICS-I

Course Code: BOPL-1393

Course Outcomes: Mechanics -I

After passing this course, students will be able to:

CO1: Understand the various coordinate systems and its applications. Students will be able to know the conservations laws and the symmetries of space & time.

CO2: Know the fundamental forces of nature, concept of center mass, central forces and the motion of particle under central force and to determine the turning points of orbit.

CO3: Understand the frames of reference, coriolis forces and its applications and effect of rotation of earth on g.

CO4: understand the elastic collision in different systems, cross section of elastic scattering as well as Rutherford scattering and know the motion of rigid body.

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**
)
SEMESTER-I

COURSE CODE: BOPL-1393

MECHANICS-I

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 21 **Total Teaching hours: 60**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

Unit- I

Co-ordinate system and Motion of a Particle: Cartesian and Spherical polar co-ordinate systems; area, volume, displacement, velocity and acceleration in these systems. Solid angle, Newton's laws of motion. Relationship of conservation laws and symmetries of space and time.

Unit- II

Conservation of Momentum and Collisions: Internal forces and momentum conservation, Centre of mass, Elastic collisions in laboratory and centre of mass systems; velocities, angles, energies in these systems and their relationships. Conservation of angular momentum and examples-shape of the galaxy, angular momentum of solar system. Torques due to internal forces, angular momentum about center of mass. Cross-section elastic scattering and impact parameter, Rutherford scattering.

Unit- III

Inverse-Square-Law Force: Forces in nature (qualitative). Central forces, Potential energy and force between a point mass and spherical shell, a point mass and solid sphere, gravitational and electrostatic self-energy. Two body problem and concept of reduced mass. Motion of a body under central force, equation of orbit in inverse-square force field. Kepler's laws and their derivation.

Unit- IV

Dynamics of Rigid Bodies: Equation of motion of a rigid body, rotational motion of a rigid body in general and that of plane lamina. Rotation of angular momentum vector about a fixed axis. Angular momentum and kinetic energy of a rigid body about principal axis, Euler's equations. Precession and elementary gyroscope, Spinning top.

Reference Books:

1. Mechanics-Berkeley Physics Course, Vol-I by C. Kittel, W. D. Knight, M. A. Ruderman, C. A. Helmholtz and R. J. Moyer-Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Fundamentals of Physics by D. Halliday, R. Resnick and J. Walker -Wiley India Pvt. Ltd., New Delhi.
3. Introduction to Classical Mechanics by R. G. Takwale & P.S. Puranik. Tata McGraw Hill Publishing Company Ltd., New Delhi
4. An introduction to Mechanics by D. Kleppne r& R. Kolenkow. Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Mechanics by H.S. Hans & S.P Puri, Tata McGraw Hill Publishing Company Ltd. New Delhi.
6. Analytical Mechanics by S. K. Gupta, Modern Publishers.

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER–I

SESSION 2021-22
ELECTRICITY & MAGNETISM-I

Course No. BOPL-1394

Course Outcomes: Electricity and Magnetism-I

After passing this course the students will be able to:

CO1: understand the vector calculus and vector algebra and its applications in electricity and magnetism. The students will be able to solve the electrostatic problems with the help of Gauss law and Coulomb's law.

CO2: understand the applications of scalar potential for the calculation of electric field and electric potential due to an arbitrary charge distribution.

CO3: solve the problems with the help of method of images and understand the conduction of electric current and fundamental laws of electricity and relate the electric and magnetic fields in two inertial frames of reference.

CO4: able to understand electric field, potential and polarization of different media and related quantities.

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)
SEMESTER-I

COURSE CODE: BOPL-1394

ELECTRICITY AND MAGNETISM-I

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 21 **Total Teaching hours: 60**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

Unit- I

Calculus of Vectors : Introduction to gradient, divergence & curl; their physical significance. Rules for vector derivatives, useful relations involving gradient, divergence &curl. Fundamental theorem for gradients, Gauss's and Stoke's theorems.

Unit- II

Electrostatics and Electric Current: Electric charge and its properties, Coulomb's law. The electric field due to a point charge and continuous charge distributions, Field due to electric dipole, Field lines, flux, Gauss's law and its applications. Curl of electric field. Relation between potential and electric field. Poisson's and Laplace's equations. Electric potential due to different charge distribution: Wire, Ring, Disc, Spherical Shell, Sphere, dipole etc. The potential energy for a point and continuous charge distribution.

Unit- III

Field of Moving Charges:- Conductors in the electrostatic field, Capacitors, Current and current density, drift velocity, expression for current density vector, equation of continuity. Ohm's Law and expression for electrical conductivity, limitations of Ohm's law. Equipotential surface method of electrical images, Measurement of charge in motion, Transformation of electric and magnetic fields in different frames of references, Electric field due to moving charges, electric force in two inertial frames, Interaction between moving charges.

Unit- IV

Electric Fields in Matter: Moments of charge distribution, Potential and field of a dipole, torque and force on a dipole in an external electric field, polarizability tensor, Electric field caused by polarized matter, Electric field of Polarized Sphere, Dielectric sphere in a uniform electric field, Field of a charge in a dielectric medium, Electric susceptibility and atomic polarizability tensor, Polarization in alternating fields.

Text and Reference Books:

1. Introduction to Electrodynamics by D.J. Griffiths, Perason Prentice Hall of India, New Delhi
2. Electricity & Magnetism by E.M. Purcell, Berkeley Physics Course Vol. 2, McGraw Hill, New York
3. Fundamental of Physics by D. Halliday, R. Resnick and J. Walker (6th edition)-John Wiley India Pvt. Ltd.,.
4. Electricity and Magnetism by A. S. Mahajan & A. A. Rang Wala, Tata –McGraw Hill Publication Pvt. Ltd.

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER–I

Course Title: Mathematics-I

Course Code: BOPL-1335

Course outcomes

After the completion of this course, students should be able to :

CO 1: Give argument related to limits, continuity and derivative of a function.

CO 2: Understand the concept of maxima and minima of a function of a single variable.

CO 3: Explain the significance of Roll's theorem, Mean Value theorem, and Taylor's and Maclaurin's theorem to find the expansions of functions.

CO 4: Demonstrate the geometrical meaning of integral calculus as an area and their uses in the determination of C.G & moments of inertia.

CO 5: Understand how to solve linear differential equations with constant coefficients and linear homogeneous and inhomogeneous differential equations of second order.

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)

SEMESTER-I

COURSE CODE: BOPL-1335

MATHEMATICS-I

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**

Pass Marks: 18 **Total Teaching hours: 60**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT –I

Functions and Derivatives: Limits, continuity and derivative of function. Differentiation of standard functions, Successive differentiation. Geometrical significance of derivative. Maxima and Minima of a function of single variable. Partial differentiation. Chain rule of differentiation. 15 Lectures

UNIT –II

Differential Calculus: Statement of Rolle's theorem and Mean value theorem, Taylor's and Maclaurins theorems and their applications to formal expansion of functions. Tangents and normals. Basic idea about asymptotes.

15 Lectures

UNIT –III

Integral Calculus: Integration as inverse of differentiation. Indefinite integrals of standard forms. Method of substitution. Integration using partial fractions. Integration by parts. Reduction formulae. Definite integrals. Definite integral as limit of a sum and geometrical interpretation as an area.

15 Lectures

UNIT –IV

Differential Equations: Definition & formation of differential equations. Linear differential equation of first order and first degree. Linear homogenous and inhomogeneous differential equation of second order. Linear differential equations with constant coefficients.

15 Lectures

Text Book:

Higher Engineering Mathematics: B.S. Grewal, Delhi, Khanna

Reference Books:

1. Differential Calculus by Shanti Narayan, New Delhi, Shyam Lal
2. Integral Calculus by Shanti Narayan, Delhi, S. Chand
3. Mathematical Hand Book by M. Vygodsky, Mir, Moscow

Bachelor of Science (Honours) Physics Semester–I

SESSION 2021-22

Course Title: Chemistry I

Course Code: BOPL-1086

Course outcomes:

Students will be able to

CO1: differentiate between chiral and achiral compounds, configuration and conformation.

CO2: understand the concept of isomerism

CO3: understand the resolution of enantiomers and differentiate between dextrorotatory and laevorotatory compounds.

CO4: do conformational analysis of ethane, butane, cyclohexane, monosubstituted and disubstituted cyclohexane.

CO5: explain the various methods of formation and chemical reactions of alkanes, alkenes and alkynes.

CO6: understand functional group transformation by nucleophilic substitution.

CO7: describe the mechanism and stereochemistry of nucleophilic substitution reactions.

CO8: understand the principles of nucleophilic addition to carbonyl groups.

Bachelor of Science (Honours) Physics Semester–I
SESSION 2021-22
Course Title: Chemistry I
Course Code: BOPL-1086

Examination Time: 3 Hours **Max. Marks: 50**
Theory: 40, CA: 10

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT I

Stereochemistry: General introduction to stereochemistry and molecular chirality, properties of chiral molecules-optical activity, enantiomers, introduction to absolute and relative configuration, the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Stereochemistry of alkenes, naming stereo isometric alkenes by the E-Z system.
Conformational analysis. Conformational analysis of ethane, butane, cyclohexane, mono substituted and disubstituted cyclohexane

UNIT II

Chemistry of alkanes and alkenes: General chemistry of alkanes and alkenes, preparation of alkanes by decarboxylation. Wurtz reaction and Corey House reaction with mechanisms. Dehydration of alcohols and regioselectivity of these reactions. Acid catalysed dehydration of alcohols with complete mechanistic discussion, Mechanism of dehydrohalogenation of alkyl halides (Elimination mechanism), stereoselective and anti-elimination in elimination reactions.
Mechanism of hydrogenation of alkenes, stereochemistry of hydrogenation of cyclo alkenes, electrophilic addition of hydrogen halides to alkenes its regioselectivity explained on the basis of mechanism, free radical addition of hydrogen bromide to alkenes, acid catalysed hydration of alkene with mechanism, stereochemistry of halogen addition to alkenes and its mechanistic explanation. Hypohalous acid addition to alkenes, epoxidation of alkenes.
Alkynes: General chemistry of alkynes, preparation of alkynes, acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkynes, with detailed discussion of mechanism of these reactions.

UNIT-III

Nucleophilic substitution reactions: Functional group transformation by nucleophilic substitution, the biomolecular (S_N2), mechanism of nucleophilic substitution, stereochemistry of S_N2 reactions, steric effect in S_N2 reactions, nucleophiles and nucleophilicity. The unimolecular (S_N1) mechanism of nucleophilic substitution, carbocation stability and the rate of substitution, stereochemistry of S_N1 reactions, carbocation arrangements in S_N1 reactions, solvent effects, substitution and elimination as competing reactions.

UNIT-IV

Chemistry of carbonyl compounds. Principles of nucleophillic addition to carbonyl groups: Hydration, acetal formation, cyanohydrin formation; reactions with primary and secondary amines, Wittig reaction, mechanism of halogenation, acid and base catalysed enolization, haloform reaction, aldol condensation, conjugate nucleophillic addition to unsaturated carbonyl compounds

Text and Reference Books:

1. Advanced Organic Chemistry, Reactions Mechanisms and Structure by J. March.
2. Organic Chemistry by F. A Carey
3. Schaum's Outlines Series Theory and Problems of Organic Chemistry by Herbert Meislick and Jacob Sharefkin
4. Problems and their solution in Organic chemistry by I.L. Finar,
5. Organic Chemistry by D.J. Cram and G.S. Hammond.
6. J.E. Banks, Naming Organic Compounds – Programmed Introduction to Organic Chemistry.
7. E.L. Eliel, Stereochemistry of carbon compounds.

Bachelor of Science (Honours) Physics Semester–I
Course Outcomes: Physics Lab-I Sem I

Course No. BOPP-1397

CO1: Students will be able to find the value of acceleration due to gravity using pendulums.

CO2: It will give understanding of collisions in 1-Dimension.

CO3: It helps to study the moment of inertia of a body & on what factors it depends.

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)

SEMESTER-I

COURSE CODE: BOPL-1397

PHYSICS LAB-I

Maximum Marks: 50 (External 40 + Internal 10) Examination Time: 3 Hours

Total Teaching hours: 90

Instructions to Practical Examiner:

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, KanyaMahaVidyalaya, Jalandhar

General Guidelines for Practical Examination

I. The distribution of marks is as follows:

i) One experiment 20 Marks

ii) Brief Theory 6 Marks

iii) Viva–Voce 7 Marks

iv) Record (Practical file) 7Marks

II. There will be one sessions of 3 hours duration. The paper will have one session and will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 20.

IV. In a single group no experiment be allotted to more than three examinee in any group.

List of experiments-

1. To measure the time periods of oscillation for the objects of various geometrical shapes but of same mass.
2. To study rotational motion using a flywheel and hence show that torque is proportional to angular acceleration.
3. To find the moment of inertia of an irregular body about an axis through its centre of gravity with a torsion pendulum.
4. To determine the moment of inertia of a flywheel.
5. To determine the Young's modulus by bending.
6. Determination of Poisson's ratio for rubber.
7. To verify laws of conservation of (a) linear momentum, (b) kinetic energy in elastic collisions using one dimensional collisions of hanging spheres. (c) Also determine energy transfer and coefficient of restitution.
8. To determine modulus of rigidity of copper wire by Maxwell needle experiment.
9. To determine the coefficient of viscosity of glycerine by Stoke's method.
10. To find the unknown capacitance of a capacitor by flashing and quenching
11. of a neon lamp.
12. Measurement of capacitance, determination of permittivity of a medium air and relative permittivity by de–Sauty's bridge.
13. To study the variation in resistance of filament of a bulb with temperature.

Reference Books:

1. Practical Physics, C.L. Arora, S. Chand & Co.

Bachelor of Science (Honours) Physics Semester–I

SESSION 2021-22

Course Title: Chemistry Lab-I

Course Code: BOPL-1088

Course outcomes

Students will be able to

CO1: develop skills required for the qualitative analysis of organic compounds,

CO2: detect elements (N, S and halogens)

CO3: detect functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro) in simple organic compounds

CO4: determine the physical constants of organic compounds.

CO5: prepare the derivatives of organic compounds.

Bachelor of Science (Honours) Physics Semester–I
SESSION 2021-22
Course Title: Chemistry Lab-I
Course Code: BOPL-1088

Examination Time: 3 Hours Max. Marks: 50
Practical: 40, CA: 10

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

General Guidelines for Practical Examination
The preliminary examination of physical and chemical characteristics (physical state, colour, odor and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, iodine), solubility tests including acid-base reactions, classification tests involving functional reactivity other than acid-base test, preparation of derivatives for given pure organic compounds.
The following categories of compounds should be analysed:

-Phenols
- Carboxylic acids
-Carbonyl compounds (ketones, aldehydes)
-Carbohydrates
-Aromatic amines
-Amides and Nitro compounds

Suggested Book:

1. Practical Organic Chemistry by F.G. Mann and B.C. Saunders
2. Practical Organic Chemistry by Vogel

Semester II

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)
Semester II

Course Outcome of ELECTRICITY & MAGNETISM-II

Course No. BOPL-2393

After passing this course, students will be able to:

CO1: understand source of magnetic field and application of BiotSavart's Law and Ampere's circuital law in different situations.

CO2: understand different type of magnetic materials and their characteristics.

CO3: understand the Faraday's Law of electromagnetic induction and LCR circuits.

CO4: derive Maxwell equations and their applications in propagation of e.m. waves in conductors and insulators.

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)
SEMESTER-II

COURSE CODE: BOPL-2393

ELECTRICITY AND MAGNETISM-II

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 21 **Total Teaching hours: 60**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

Unit-I

Magnetostatics : Magnetic fields, magnetic forces, magnetic force on a current carrying wire. Torque on a current loop, Biot-Savart law. Magnetic Field due to infinite wire carrying steady current, field of rings and coils. Magnetic field due to a solenoid, Force on parallel current carrying wires. Ampere's circuital law and its applications to infinite hollow cylinder, solenoid and toroid. The divergence and curl of magnetic induction, Comparison of magnetostatics and electrostatics. Magnetic vector potential and its expression. Surface current density and Change in magnetic field at a current sheet. Hall Effect.

Unit-II

Magnetic Fields in Matter: some important terms associated with magnetic materials, Field of a current loop, force on magnetic dipole in a an external field, torque on current loop, potential energy of magnetic dipole, Electric currents in atoms, electron spin and magnetic moment, free and bound currents, magnetization and magnetic susceptibility, Magnetic field caused by magnetized matter,. Basics about diamagnetism paramagnetism and ferromagnetism, hysteresis curve.

Unit-III

Faraday's law and Maxwell's equations: Electromagnetic Induction, Faraday's Induction Experiments, Faraday's Laws of Electromagnetic Induction (Integral And Differential Forms) ,Lenz's law, Self-Induction, Expression for Self Induction : Neumann's Formula, . Self-Inductance of a Solenoid and a Toroidal, Energy Stored in an Inductor, Mutual Induction, Expression for Coefficient of Mutual Induction and Reciprocity theorem, Mutual Inductance of two Solenoids, Inductive Coupling of Electrical Circuits, Modification of Ampere's Law and the Displacement Current, Maxwell's Equation of Electromagnetism, Series and Parallel LCR Circuits, Average Power Associated with LCR Circuit

Unit-IV

Plane Electromagnetic Waves: Production of em waves, EM wave spectrum, EM wave equation for a medium having finite μ and ε but $\sigma = 0$, Nature of em waves, Wave equation for polarized em waves and their solutions, Relation between electric and magnetic field vectors an em wave, Impedance of a dielectric to em waves, The Poynting vector and flow of energy in an em wave, Equation of continuity, EM waves for a medium having finite values of μ and ε but $\sigma \neq 0$, Solution of wave equation for a

conducting medium, Skin depth, EM wave velocity and wave dispersion in a conductor, Behaviour of a medium as a conductor or dielectric, Characteristic impedance of a conducting medium to em waves, magnetic and electric energy densities, Poynting vector and Equation of Continuity for a Conducting medium, Reflection and transmission of em waves at the boundary (Normal and Oblique incidence).

Text and Reference Books:

1. Introduction to Electrodynamics by David J. Griffiths, Pearson Prentice Hall of India

2. Electricity & Magnetism, Berkeley Physics Course Vol. 2 by E.M. Purcell, McGraw Hill, New York

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)
Semester II

Course Outcomes: Vibrations and Waves

Course No. BOPL-2394

After passing this course the student will be able to:

CO1: demonstrate Lissajous figures by mechanical and analytical method with different cases.

CO2: understand Free, damped and resonance oscillations, both mechanical and electric using differential equations.

CO3: solve differential equation of forced oscillations & to obtain related quantities.

CO4: understand concept of coupled oscillators and wave motion. Student will also be able to apply the concept of waves and oscillations to any type of waves like e. m. waves, mechanical waves.

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)
SEMESTER-II

COURSE CODE: BOPL-2394

VIBRATIONS AND WAVES

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 21 **Total Teaching hours: 60**
Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

Unit-I

Simple and Damped Oscillations: Simple Harmonic Motion, energy of SHO, Compound pendulum, Torsional pendulum, Equation of SHM, Superposition of two perpendicular SHM, Lissajous figures– superposition of SHM's. Damped motion of mechanical and electrical oscillator, heavy damping, critical damping. Energy dissipation and energy of damped oscillator, amplitude decay, logarithmic decrement, relaxation time, Q value, comparison between Free and Damped oscillations

Unit-II

Forced Oscillations: Differential equation of forced mechanical oscillator**,** Transient and steady state behaviour of a forced oscillator, Variation of displacement and velocity with frequency of driving force, frequency dependence of phase angle between force and (a)displacement, (b) velocity, Power supplied to oscillator by driving force and its variation with driving force frequency, Resonance absorption and Q-value as a measure of power absorption bandwidth, Q-value as amplification factor, Forced electrical oscillator, Variation of current with frequency, Variation of power supplied with frequency of applied voltage, Q factor as amplification factor.

Unit-III

Coupled Oscillations: Stiffness coupled oscillators, In phase and Out phase modes, normal co-ordinates and normal modes of vibration, solutions for differential equations for normal modes and exchange of energy, inductance coupling of electrical oscillators, loose, intermediate and strong coupling, energy exchange between two electrically coupled oscillators.

Unit-IV

Wave Motion: Types of wave motion**,** The wave equation, transverse waves on a string, the string as a forced oscillator, characteristic impedance of a string, reflection and transmission of transverse waves on a string at a boundary, Energy of a progressive wave, impedance matching, standing waves on a string of fixed length, Energy of a vibrating string, normal modes and eigen frequencies. Energy in a normal mode of oscillation, wave groups, group velocity, dispersive and non-dispersive media, longitudinal waves.

Reference Books:1. The Physics of Vibrations and Waves by H.J. Pain, John Wiley, Chichester

2. Vibrations and Waves in Physics by I.G. Main-Cambridge University, Cambridge

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)

Semester–II

Course Title: Mathematics-II

Course Code: BOPL-2335

Course outcomes

After the completion of this course, students should be able to

CO 1: Manage to solve problems related to series solution of Bessel, Legendre and Hermite functions.
CO 2: Understand the concept of Partial differential equations& its applications to find the solution of Laplace, Wave & Diffusions equations.
CO 3: Apply Laplace transforms on periodic functions and differential equations with constant coefficients.
CO 4: Differentiate between Fourier Sine & Cosine series and Fourier Sine & Cosine transforms.
CO 5: Classify the difference between Laplace transforms and Fourier transforms.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-II
COURSE CODE: BOPL-2335
MATHEMATICS-II

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 18 **Total Teaching hours: 60**

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.
Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT –I

Second order Differential Equations: Linear differential equations with variable coefficients. Series Solution of Bessel, Legendre, Hermite, Laguerre and Hypergeometric differential equations by Frobenius method. Recurrence relations and orthogonality properties.

15 Lectures

UNIT –II

Partial Differential Equations: Definition and formation of first and second order partial differential equations, Laplace, Wave and diffusion equation in one and two dimensions, Solutions of these equations by separation of variables.

15 Lectures

UNIT –III

Laplace Transforms: Definition, elementary Laplace transforms, transforms of derivatives, integration of transforms, Laplace transform of periodic functions, solution of differential equations with constant coefficients using Laplace transforms.

15 Lectures

UNIT –IV

Fourier series and Transforms: Periodic functions, Drichlet's conditions, Fourier coefficients, Sine and Cosine series, half range expansions, exponential series, differentiation and integration of Fourier transform, Fourier Sine and Cosine transforms, Inversion formulae, Fourier transforms of derivatives.

15 Lectures

Text Book:

1. Mathematical Methods for Physicists by George Arfken, New York, Academic Press

Reference Books:

1. Mathematics Hand book by M. Vygodsky, Mir, Moscow
2. Higher Engineering Mathematics by B.S. Grewal, Delhi, Khanna
3. Applied Mathematics for Engineers and Physicists by Pipes &Harvill, London, McGraw Hill
4. Mathematics of Physics and Modern Engineering by Sokolnikoff & Recheffer

COURSE CODE: BOPL-2086
Chemistry-II

(Theory)

Course outcomes:

Course outcomes:

Students will be able to

CO1: understand the key features of coordination compounds viz. variety of structures, oxidation numbers and electronic configurations, coordination numbers and explain the bonding and stability of complexes. CO2: describe the shapes and structures of coordination complexes with coordination numbers ranging from 4 to 12.

CO3: describe the stability of metal complexes by the use of formation constants.

CO4: understand the splitting of d-orbitals in octahedral, tetrahedral, cubic and square planar fields of ligands.

CO5: calculate C.F.S.E. of high spin and low spin octahedral and high spin tetrahedral complexes.

CO6: explain thermodynamic effects of crystal field splitting and determine microstate and ground state terms.

CO7: draw MOEL diagram for octahedral and tetrahedral complexes. CO8: explain bonding in polynuclear metal carbonyls and counting of electrons in carbonyl clusters. CO9: describe the effect of macrocyclic ligands on anion and cation complex structure.

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)
SEMESTER-II

Bachelor of Science (Honours) Physics (Semester II)

(Session: 2021-2022)

Course Code: BOPL-2086

COURSE TITLE: Chemistry-II (Theory)

Examination Time: 3 Hours **Max. Marks: 50**
(Theory: 40, CA: 10)

Instructions for the Paper Setters:
Eight questions of equal marks (eight marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT- I Co-ordination Chemistry: Introduction, Werner's coordination theory, naming of co-ordinate complexes. Co-ordination numbers 1-12 and their stereo-chemistries. Factors affecting co-ordination numbers and stereo-chemistry
(a) Configurational Isomers
(b) Conformational isomerism, VSPER theory, molecular orbital theory applied to homoneuclear diatomic molecules and heteronuclear Diatomic molecules.

Bonding in metal complexes: Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, Electro-neutrality and back bonding, limitations of V.B. theory.
Stability of coordination compounds: Introduction, Stability constant, stepwise stability constant, overall stability constant. Factors affecting the stability of metal ion complexes with general ligands, HSAB principle.

UNIT-II Crystal field theory: Splitting of d-orbitals in octahedral, tetrahedral fields of ligands. Calculation of C.F.S.E. in high spin and low spin octahedral and High spin tetrahedral complexes, factors affecting the 10 Dq Value. Structural effects of crystal field splitting (Jahn-Teller distortion, variation of Ionic radii with increase in atomic number). Thermodynamics effects of C.F. splitting, variation in lattice energies, Hydration energies, Dissociation energies, Formation constants of 71 hexammines. Site selection in spinels, Paramagnetism, diamagnetism, ferro and anti ferromagnetism. Microstates and spectroscopic terms, a calculation of spectroscopic terms for d1 electronic configurations, L S coupling, Hund"s rule for finding the ground state terms, Electronic spectral properties of Ist transition series, limitations of C.F.T.

UNIT-III Molecular Orbital Theory: Evidence for covalent character in Bonding, MOEL diagram for octahedral and tetrahedral complexes involving bonding, charge transfer transitions.
πAcid Ligands: Definition Carbon monoxide complexes, bonding in linear MCO groups. polynuclear metal carbonyls, carbonyl hydrides and halides. Metal-metal bonding metal-metal multiple bonding, isolable analogies, Structure of high nuclearity carbonyl clusters, counting of electrons in carbonyl clusters.
UNIT-IV Alkali metal and alkaline earth metal chelators: Macrocyclic ligands, macrocyclic effect, crown ethers and podands, coronands, cryptands, structure of 18 crown-6 complex

with KNCS, ion cavity complex, effect of anion and cation type on complex structure, simultaneous complexation of metal ion and water or of two metal ions,sandwich formation, cryptands and their cation complexes, podands with aromatic donors and groups.

Text and Reference Books:

1. Inorganic Chemistry, 3rd Ed. By J.E. Huheey
2 Advanced Inorganic Chemistry by . F.A. Cotton and G. Wilkinson
3. Concepts and Models of Inorganic Chemistry by B.E. Douglas and D.H. McDaniel
4. Topics in current chemistry Vol-II by R. Hilgenfeld and W. Saengar

BACHELOR OF SCIENCE (HONURS) PHYSICS (**SESSION 2021-22**)

PHYSICS LAB-II

Course No. BOPP-2397

COURSE OUTCOMES

CO1: Students will be able to study resonance in series & parallel LCR circuit.

CO2: At the end of this course, students will be able to find the value of capacitor, coefficient of self-inductance, permeability & permittivity of air.

CO3: Students will be able to study the variation of magnetic field on the axis of coil & can find the value of horizontal component of magnetic field.

CO4: Students will be able to verify various concepts related to oscillations of various pendulums and laws of vibrations of strings.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-II

COURSE CODE: BOPL-2397

PHYSICS LAB-II

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 18 **Total Teaching hours: 90**

General Guidelines for Practical Examination

I. The distribution of marks is as follows:

i) One experiment 20 Marks **ii) Brief Theory 6 Marks**

iii) Viva–Voce 7 Marks **iv) Record (Practical file) 7 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
2. To study the induced e.m.f. as a function of the velocity of the magnet.
3. To study the phase relationships using impedance triangle for LCR circuit and calculate impedance.
4. Resonance in a series and parallel LCR circuits for different R–value and calculate Q–value.
5. To determine low resistance with Carey-Foster's Bridge.
6. To measure the self-inductance L of a given coil by Anderson Bridge method.
7. To find the value of BH, the horizontal component of ear using a deflection & vibration magnetometer.
8. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.
9. To plot a graph between the distance of the knife edge from the centre of gravity and the time period of a compound pendulum from graph find (a) acceleration due to gravity, (b) the radius of gyration and moment of inertia about an axis passing through centre of gravity.
10. To determine the acceleration due to gravity by Kater's Pendulum.
11. To verify the laws of vibrating string by using Meldes apparatus and to show that /2 λ is constant.
12. To measure logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.

Reference Books:

1. Practical Physics by C.L. Arora, S. Chand & Co.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)

(Semester-II)

COURSE CODE: BOPP-2088

Chemistry Lab-II

(Practical)

Course outcomes:

Students will be able to

CO1: separate and identify the various ions present in the mixture.

CO2: detect and remove interfering radicals present in the mixture.

CO3: understand the principle of inorganic qualitative analysis.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-II

COURSE CODE: BOPL-2088

CHEMISTRY LAB-II

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 18 **Total Teaching hours: 60**

Qualitative Analysis

Identification of cations and anions in a mixture which may contain combinations of acid ions. These must contain interfering acid anions and one, the insoluble.

a) Special Tests for Mixture of anions

I. Carbonate in the presence of sulphate.
II. Nitrate in the presence of nitrite
III. Nitrate in the presence of bromide and iodide.
IV. Chloride in the presence of bromide and iodide.
V. Chloride in the presence of bromide.
VI. Chloride in the presence of iodide.
VII. Bromide and iodide in the presence of each other and of chloride.
VIII. Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.
IX. Borate in the presence of copper and barium salts.

b) Separation and identification of cations in mixtures

i) Separation of cations in groups.
ii) Separation and identification of Group I, Group II ,Group III, Group IV, Group V and Group VI cations.

Reference Books:

1. Vogel's Qualitative Inorganic Analysis (revised) by G. Svehla, and B. Sivasankar, Pearson
2. Vogel's Textbook of Quantitative Inorganic Analysis (revised) by R. C. Bassett, G. H. Denney,and J. Jeffery, Mendham
3. Vogel's book on Inorganic Qualitative Analysis

SEMESTER III

SEMESTER–III

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-III
OPTICS

Course Code: BOPL-3391

Course Outcome of Optics

After passing this programme the students will be able to:

CO1: understand the concept of interference of waves by division of wave front and its different methods and concept of coherence.

CO2: understand the interference of waves by division of Amplitude and its methods and will have knowledge of interferometers

CO3: understand the Huygen's Fresnel theory and diffraction, Fraunhoffer diffraction due to single slit, double slit and n slits, the concept of resolving power.

CO4: understand the concept the polarization of light and types of polarisers.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-III

OPTICS

Course Code: BOPL-3391

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Total Teaching hours: 60

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Interference of Light: Superposition of light waves and interference, young's double slit experiment, Distribution of intensity in young's double slit experiment, Conditions for sustained interference pattern, Coherent sources of light, Temporal and spatial coherence, Mathematical analysis of temporal coherence, Interference pattern by division of wave front, Theory of interference fringes Fresnel Biprism, thickness of thin transparent sheet Fresnel double mirror, Llyod's single mirror, Displacement of fringes,.

UNIT–II

Interference by Division of Amplitude: Change of phase on reflection, Interference in thin films due to reflected and transmitted light, colour of thin film, Need for extended source for interference by division of amplitude, Fringes of equal inclination and equal. Thickness non reflecting films, Newton's Rings and their application, Michelson Interferometer and their application, Fabry Perot interferometer and etalon. Distribution of intensity in Fabry Perot fringes. Anti reflection coatings

UNIT–III

Diffraction: Diffraction of Light, Huygen's Principle, Huygen's -fresnel Diffraction theory, half-period zones, Zone plate, Diffraction at a straight edge, Diffraction by a circular aperture, diffraction by circular disc Distinction between fresnel and fraunhoffer diffraction. Fraunhoffer diffraction at a single slit, at double slit, at rectangular and circular apertures, Effect of diffraction in optical

imaging, Diffraction of N slits, dispersive power, Rayleigh Criterion for resolving power, Resolving power of telescope in diffraction grating, its use as a spectroscopic element and its resolving power, Resolving power of microscope. Resolving power of Fabry-perot interferometer.

UNIT–IV

Polarization: Transverse nature of light, Polarization by reflection and refraction, Brewster's Law, Malus Law, Double refraction, Nicol Prism, Elliptically and circularly polarized light, Quarter wave and half-wave plates, production and detection of polarized light, Optical activity, specific rotation. Half shade polarimeter

Reference Books:

1. Text book of Optics by N. Subramanayam, B. Lal and M. N. Avadhamulu
2. Fundamentals of Optics: by Jenkins and White
3. Optics by Ajoy Ghatak

STATISTICAL AND THERMAL PHYSICS

(SESSION 2021-22)

Course No. BOPL-3392

Course Outcomes: STATISTICAL AND THERMAL PHYSICS

After passing this programme the students will be able to:

CO1: Understand the basic ideas and scope of probability as well as distribution of n particles in different compartments.

CO2: Concept of different types of Statistics and the need for Quantum Statistics.

CO3: Understand the concept of entropy, Laws of Thermodynamics and applications to thermoelectric effect.

CO4: Understand the Maxwell Thermodynamics relations, Change of state and Claypron equation. Thermodynamic Potentials and Equilibrium of Thermodynamic Systems

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-III

COURSE CODE: BOPL-3392

STATISTICAL AND THERMAL PHYSICS

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 21 **Total Teaching hours: 60**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Basic ideas of Statistical Physics, Scope of Statistical Physics, Basic ideas about probability, Distribution of four distinguishable particles into compartments of equal size. Concept of macro states, microstates, Thermodynamic Probability, Effects of constraints on the system. Distribution of n particles in two compartments. Deviation from the state of maximum probability. Equilibrium state of dynamic system. Distribution of distinguishable n particles in k compartments of unequal sizes.

UNIT–II

Phase space and division into elementary cells. Three kinds of statistics. The basic approach in three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of law of distribution of molecular speeds. Need for Quantum Statistics – B.E. Statement of Planck's law of Radiation, Wien's Displacement and Stefan's law. Pressure exerted by radiations, equation of state of Photon gas, Radiation pressure and stability of massive stars, Fermi Dirac (FD) statistics. Application of FD statistics to free electron gas inside conductor, equation of state of a degenerate Fermi gas, Stability of white dwarfs, Comparison of M.B, B.E and F.D statistics, relative occupation of energy levels.

UNIT- III

Statistical Basis of Entropy: Definition of entropy, change of entropy of a system, third law of thermodynamics. Additive nature of entropy, law of increase of entropy, reversible and irreversible processes and their examples, work done in a reversible process, Examples of increase of entropy in some natural processes, entropy and disorder. Brief review of terms used

in thermodynamics, Laws of Thermodynamics, Carnot's Heat Engine, Entropy changes in Carnot's cycle, Carnot's theorem, Thermodynamic temperature scale, Thermoelectric effect and its applications, change of entropy along a reversible path in P-V diagram, entropy of a perfect gas, equation of state of an ideal gas, Heat death of Universe.

UNIT- IV

Maxwell's Thermodynamic Relations : Perfect differentials in Thermodynamics, Derivation Maxwell Thermodynamic Relationships, Cooling produced by adiabatic expansion, adiabatic compression, adiabatic stretching of wires and thin films, change of internal energy with volume. Expression for Cp-Cv, variation of Cv with volume, Clapeyron's equation. Joule-Thomson effect and its thermodynamic treatment, Joule-Thomson effect for a Vander Waal's gas, Production of very low temperatures by adiabatic demagnetization, Concept of Negative Temperatures, Thermodynamic Potentials and Equilibrium of Thermodynamic Systems, Equation of state of an ideal gas, degrees of freedom, Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic, Mean free path (Zeroth Order).

Reference Books:

1. Thermal Physics by S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. A Treatise on Heat by Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics by Enrico Fermi, 1956, Courier Dover Publications.
4. Heat and Thermodynamics by M.W.Zemasky and R. Dittman, 1981, McGraw Hill
5. Statistical Physics and Thermodynamics by V.S. Bhatia and T.S. Bhatia (Vishal Publishing Co.)

B.Sc. (Honours) Physics Semester–III
Session 2021-22
Course Title: Mathematics-III
Course Code: BOPL-3333
Course outcomes

After the completion of this course, students should be able to

CO 1: Understand the concept of complex numbers and De-moivre's theorem.

CO 2: Understand De-moivre's theorem.

CO3: Understand the basic concept of lines, parabola, hyperbola and ellipse

CO 4: Understand and Demonstrate the concept of cone, cylinder and sphere

CO 5: Understand the tangent plane and normal plane to the surfaces

B.Sc. (Honours) Physics Semester–III
Session 2021-22
Course Title: Mathematics-III
Course Code: BOPL-3333

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 18 **Total Teaching hours: 60**

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.
Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT –I

Complex numbers and their geometrical interpretation, De-Moivre's theorem and its applications. 15 Lectures

UNIT –II

Polar and Cartesian co-ordinates, Distance Formulae, Section Formulae of a line in different forms, Angle between two lines, Intersection of two lines, Standard Equation of ellipse, parabola, hyperbola and their properties . 15 Lectures

UNIT –III

Sphere, Cone, Cylinder and simple properties of these surfaces. Equation of tangent planes and normal planes to above surfaces. 15 Lectures

UNIT –IV

Double and Triple integrals, Evaluation of area and volumes using double triple integrals. Change of order in integration in double integrals. Area in polar co-ordinates, Triple integrals in spherical and polar coordinates. 15 Lectures

Text Book:
B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

B.Sc (Hons.) Physics (Semester-III)
COURSE CODE: BOPL-3084
(SESSION 2021-22)

Chemistry-III

(Theory)

Course outcomes:

Students will be able to

CO1: acquire the knowledge of structure and intermolecular forces present between solids, liquids and gases.

CO2: Understand the concept of surface tension and interfacial tension

CO3: Understand the concept of reaction rates and determine the rate law from initial rate data

CO4: demonstrate an understanding of basic principles of colligative properties

CO5: understand the basic concepts of colloidal state of matter and applications of colloids.

Bachelor of Science (Honours) Physics Semester–III
Session: 2021-22
Course Title: Chemistry III
(Physical Chemistry)
Course Code: BOPL-3084

Examination Time: 3 Hours **Max. Marks: 50**
Theory: 40, CA: 10

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section. **Each question carries 8 marks.**

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT I

1. Solutions

Ideal and non–ideal solutions, methods of expressing concentrations of solutions, Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination.Osmosis,law of osmotic pressure and its measurement,determination of molecular weight from osmotic pressure, elevation of boiling point and depression of freezing point.

UNIT-II

2. Surface Chemistry

Bulk phases and interfacial region, types of interfaces; Surface tension and interfacial tension. Thermodynamics of surfaces, plane interface, curved interface, Laplace and Kelvin equations, the contact angle, capillary rise and surface tension. Surface tension of solutions, Gibbs adsorption equation and its derivation from thermodynamic considerations.Surfactants,Surface films on liquids. Criteria for spreading in liquid-liquid systems. (Wetting as contact angle and capitulary action Phenomenon solid liquid systems).

UNIT-III

3. Chemical Kinetics

Rate of reaction, rate constant and rate laws, the order of reaction, first ,second & third and zero order reactions, half-lives; determination of reaction order. Temperature dependence of reaction rates, reaction mechanism, rate-determining step approximation, steady-state approximation. Catalysis, homogeneous catalysis, autocatalysis, oscillation reactions. Enzyme catalysis, heterogeneous catalysis.

UNIT-IV

4. Liquid State

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid

and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

5. Colloidal State

Definition of colloids, classification of colloids, Solids in liquids (Sol): kinetic, optical and electrical, properties, stability of colloids, protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers, General applications of colloids.

Book Recommended:

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education,2006.
3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (IndianPrint)

INTERDICIPLINARY COURSE ID-I

Bachelor of Science (Honours) Physics

Semester–III

Session- 2021-22

Course Title: Python Programming **Course Code: BOPM-3135**

Course Outcome

After passing the course the students will be able to:

CO1: Comprehend the use of various programming constructs like data types, operators, string processing and control structures.

CO2: Identify the flow of control in various control statement.

CO3: Implement various built-in and user defined function, packages and modules to solve basic problems in Physics.

CO4: Comprehend file manipulation using various built-in functions.

CO5: Comprehend visualization of data and result through graphics.

Bachelor of Science (Honours) Physics

Semester–III

Session- 2021-22

Course Title: Python Programming **Course Code: BOPM-3135**

Examination Time:(3+3) Hours **Max. Marks:50**

Theory: 25, Practical:15

CA:10

Instructions for the Paper Setters:

Eight questions of equal marks (10 marks each), (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from Section.

UNIT I

Introduction to python and Setting up the Python development Environment, Basic syntax, interactive shell, editing, saving, and running a script, Concept of data types, Declaring and using Numeric data types: int, float, complex Lists and Tuples and their basic operations, Python console Input / Output. Arithmetic operators and expressions, Conditions, Comparison operators, Logical Operators, Is and In operators.

UNIT II

String Handling, Unicode strings, Strings Manipulation: - compare strings, concatenation of strings, slicing strings in python, converting strings to numbers and vice versa. Dictionaries Control statements: if-else, Nested If-Else, Loops (for, while) Loop manipulation using pass, continue, break and else.

Matrix operations using NumPy array (Multiplication. Addition, matrix multiplication, inverse, determinant, adjoint, Eigenvalues, etc).

UNIT III

Built in function and modules in python, user defined functions, passing parameters, arguments and return values; formal vs actual arguments, Lamda function in python, Recursion, organizing python codes using functions, modules and external packages.

Case study of Projectile Motion.

UNIT IV

SciPy: Integration, differentiation and interpolation.

Files: manipulating files and directories, OS and Sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab separated) understanding read functions, read(), readline() and readlines() Understanding write functions, write() and writelines() Manipulating file pointer using seek. Introduction to graphics. **Plotting graphs and objects.**

References / Textbooks:

1. Mark Lutz, Learning Python, O'Reilly Media, 2013.
2. David Beazley, Python cookbook, O'Reilly Media, 2013.
3. David Beazley, Python Essential Reference, Addison-Wesley Professional, 2009.
4. John Zelle, Python programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc, 2004.
5. Alex Mortelli, Python in a Nutshell, O'Reilly Media, 2006.

Note: The latest editions of the books should be followed.

Course Outcomes: Physics Lab-III

Semester III

(SESSION 2021-22)

Course No. BOPP-3396

CO1: After the completion of this course students will be able to use spectrometer along with prism, doubly refractive prism, diffraction grating to find various optical parameters.

CO2: Students will be able to find resolving power of grating and telescope

CO3: At the end of this course students will be able to use polarimeter and hence will be able to measure specific rotation by using polarimeter.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-III

COURSE CODE: BOPL-3396

PHYSICS LAB-III

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 18 **Total Teaching hours: 90**
Instructions to Practical Examiner

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

General Guidelines for Practical Examination

I. The distribution of marks is as follows:

i) One experiment 20 Marks

ii) Brief Theory 6 Marks

iii) Viva–Voce 7 Marks

iv) Record (Practical file) 7Marks

II. There will be one sessions of 3 hours duration. The paper will have one session and will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 20.

IV. In a single group no experiment be allotted to more than three examinee in any group.

List of experiments-

1. To determine refractive index of glass and liquid using spectrometer.
2. To determine the Cauchy's constants.
3. To study the refractive index of a doubly refracting prism.
4. To set up Newton's rings to determine wavelength of sodium light.
5. To determine the wavelength by using plane diffraction grating (Use Hg source)
6. To determine dispersive power of plane diffraction grating.
7. To determine resolving power of a telescope.
8. To determine resolving power of a grating.
9. To study the absorption spectra of iodine vapours.
10. To study the rotation of plane of polarization by using polarimeter.
11. To determine the specific rotation of sugar using Laurent's half shade polarimeter

Reference Books:

1 Practical Physics Volume-II, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications

BACHELOR OF SCIENCE (HONURS) PHYSICS
SEMESTER-III
(SESSION 2021-22)
COURSE CODE: BOPL-3087
CHEMISTRY LAB-III

Course outcomes

Students will be able to

CO1: understand the technique of crystallisation

CO2: compare the viscosity and surface tension of different liquids and solutions

CO3: determine the rate of the reactions

CO4: efficiently use of calorimeter in various experiments

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)

SEMESTER-III

COURSE CODE: BOPL-3087

CHEMISTRY LAB-III

Maximum Marks: 50 (External 40 + Internal 10) Examination Time: 3 Hours

Total Teaching hours: 60

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Crystallisation:

Concept of indication of crystallisation. Phthalic acid from hot water (using fluted filter paper &stem less funnel) Acetanilide from boiling water, Naphthalene from Ethanol, Benzoic acid from water

Physical Chemistry

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalyzed by Hydrogen ions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)

3. To study the viscosity and surface tension of glycerine solution in water.
4. To determine the solubility of benzoic acid at different temperatures and to determine H of the dissolution process.
5. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Book Recommended:

1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
5. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
6. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand & Co.
8. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
9. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

Semester IV

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-IV

Course Outcome of Optics

Course No. BOPL-4391

After passing this programme the students will be able to:

CO1: understand the concept of interference of waves by division of wave front and its different methods and concept of coherence.

CO2: understand the interference of waves by division of Amplitude and its methods and will have knowledge of interferometers

CO3: understand the Huygen's Fresnel theory and diffraction, Fraunhoffer diffraction due to single slit, double slit and n slits, the concept of resolving power.

CO4: understand the concept the polarization of light and types of polarisers.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-IV

COURSE CODE: BOPL-4391

OPTICS

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Total Teaching hours: 60

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT–I

Interference of Light: Superposition of light waves and interference, young's double slit experiment, Distribution of intensity in young's double slit experiment, Conditions for sustained interference pattern, Coherent sources of light, Temporal and spatial coherence, Mathematical analysis of temporal coherence, Interference pattern by division of wave front, Theory of interference fringes Fresnel Biprism, thickness of thin transparent sheet Fresnel double mirror, Llyod's single mirror, Displacement of fringes,.

UNIT–II

Interference by Division of Amplitude: Change of phase on reflection, Interference in thin films due to reflected and transmitted light, colour of thin film, Need for extended source for interference by division of amplitude, Fringes of equal inclination and equal. Thickness non reflecting films, Newton's Rings and their application, Michelson Interferometer and their application, Fabry Perot interferometer and etalon. Distribution of intensity in Fabry Perot fringes. Anti reflection coatings

UNIT–III

Diffraction: Diffraction of Light, Huygen's Principle, Huygen's -fresnel Diffraction theory, half-period zones, Zone plate, Diffraction at a straight edge, Diffraction by a circular aperture, diffraction by circular disc Distinction between fresnel and fraunhoffer diffraction. Fraunhoffer diffraction at a single slit, at double slit, at rectangular and circular apertures, Effect of diffraction in optical imaging, Diffraction of N slits, dispersive power, Rayleigh Criterion for resolving power, Resolving

power of telescope in diffraction grating, its use as a spectroscopic element and its resolving power, Resolving power of microscope. Resolving power of Fabry-perot interferometer.

UNIT–IV

Polarization: Transverse nature of light, Polarization by reflection and refraction, Brewster's Law, Malus Law, Double refraction, Nicol Prism, Elliptically and circularly polarized light, Quarter wave and half-wave plates, production and detection of polarized light, Optical activity, specific rotation. Half shade polarimeter

Reference Books:

4. Text book of Optics by N. Subramanayam, B. Lal and M. N. Avadhamulu
5. Fundamentals of Optics: by Jenkins and White
6. Optics by Ajoy Ghatak

Course Outcomes: Atomic Spectroscopy
Course No. BOPL-4392

After passing this programme the students will be able to:

CO1: understand fine and hyperfine spectrum of hydrogen atom and the concept of spin of an electron

CO2: demonstrate understanding of exchange symmetry of wave function, different coupling schemes and spectra of atoms with more than one electron.

CO2: Understand the concept of spin and magnetic moment of an electron

CO3: Students will understand concept of X rays spectra and molecular spectra.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-IV

ATOMIC SPECTROSCOPY

COURSE CODE: BOPL-4392

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 21 **Total Teaching hours: 60**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

Unit-I

Introduction to Atomic Spectra: Observation of spectra, Types of spectra, Light sources, Spectral analysis, Units in spectroscopy, Bohr's Theory and Hydrogen spectrum, Explanation of Spectral series, Representation of spectral lines by terms, Energy level Diagram, Ritz combination Rule, Continuum at series limit, Evidences in favour of Bohr's Theory, Experimental confirmation of Bohr's theory, Franck-Hertz Experiment.

Unit-II

Spectra of Alkali Atoms: Different series in Alkali Spectra, Term values. The effective quantum number and the quantum defect, The Spinning electron and the vector model, The normal order of fine structure doublets, Electron Spin orbit interaction, Spin orbit interaction for Non-penetrating orbits, Doublet structure in alkali Spectra (Fine Structure), Energy level diagram of Sodium Atom, Selection rules for doublets, Intensity rules for fine structure doublets.

Unit-III

Zeeman Effect and the Paschen-Back effect: Early discoveries and developments, The vector model of one electron system in weak magnetic field. The magnetic moment of a bound electron, Magnetic interaction energy, Selection rules, Intensity rules, The Paschen-Back

effect, The Paschen-Back effect of a Principal-series doublet, Selection rules for the Paschen-Back effect, the Zeeman and Paschen-Back effect of hydrogen.

Unit-IV

X-rays Spectra: Production of X-rays, Origin of X-rays from electromagnetic theory, X-ray diffraction, Bragg's law, Laue Spots, Bragg's spectrometer, Reflection and refraction of X-rays, X- ray scattering, Continuous X-ray spectrum, Characteristics absorption and emission Spectra, comparison of optical and X-ray Spectra, Moseley's law, Applications of Moseley's law.

Text and Reference Books:

1. Introduction to Atomic Spectra by H. E. White
2. Atomic Spectra and Atomic structure by Gerhard Herzberg
3. Concepts of Modern Physics by Arthur Beiser
4. Elements of Spectroscopy by Gupta, Kumar and Sharma

B.Sc. (Hons.) Physics Semester–IV

Course Title: Mathematics-IV

Course Code: BOPL-4333

Course outcomes

After the completion of this course, students should be able to

CO 1: Understand the concept of matrices, determinants

CO 2: Solve system of linear equations and obtain Eigen values, eigen vectors and characteristic polynomial

CO 3: Understand the concept of Vector Spaces, Linear Independence and Dependence

CO 4: Understand the concept of Basis and Dimension

CO5: Understand the concept of linear Transformation and its its matrix representation

B.Sc. (Honours) Physics Semester–IV

Session 2021-22

Course Title: Mathematics-IV

Course Code: BOPL-4333

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**

Pass Marks: 18 **Total Teaching hours: 60**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT –I

Matrices, Determinants and their properties, algebra of matrices, Eigen values and Eigen vectors, Unitary, Hermitian and Orthogonal matrices and their properties, Cayley-Hamilton theorem and its applications

15 Lectures

UNIT –II

Elementary operations on matrices, Rank of a matrix, Row Rank, Column rank and their equivalence, System of linear equations and conditions for consistency, Quadratic forms .

15 Lectures

UNIT-III

Vector spaces, subspaces, linear spans, linear dependence and independence, basis and dimension, Linear transformation, Representation of linear transformation by matrices

15 Lectures

UNIT –IV

Infinite Series, Series Of positive terms, alternate series, Behaviour of infinite series, Cauchy's convergence criterion, D' Alembert Ratio Test, Cauchy's root test, Rabbes test Gauss test, Cauchy's Integral test, Absolute and conditional convergence (Tests without Proof)

15 Lectures

Text Book:

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

B.Sc. (Hons.) Physics (Semester-IV)

COURSE CODE: BOPL-4084
CHEMISTRY-IV

(Molecular Spectroscopy)

Students will be able to

CO1: learn about the Principle and applications of ultraviolet and Woodward Fisher Rule

CO2: understand the infra-red spectroscopy in organic structure determination

CO3: explain common terms in NMR spectroscopy such as chemical shift, coupling constant, and anisotropic effect, spin spin splitting, shielding constant and their affect on the spectra of the compound.

CO4: study thevarious measurement techniques in NMR spectroscopy.

CO5: understand the various cleavages and rearrangements in Mass spectroscopy.

CO6: factors affecting cleavage patterns in Mass spectroscopy.

CO7: interpret the spectrum of unknown compounds on the basis of NMR and Mass spectroscopy.

CO8: understand the various applications of NMR and Mass spectroscopy.

CO9: use NMR and Mass spectroscopy data in elucidating the chemical structure of a compound.

CO10: solve the numerical problems based on use NMR and Mass spectroscopy.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)

SEMESTER-IV

COURSE CODE: BOPL-4084

CHEMISTRY-IV

(Molecular Spectroscopy)

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**

Total Teaching hours: 60

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT – I

1. Energy and Electromagnetic Spectrum

Introduction, electromagnetic spectrum and Units, Regions of the spectrum, Basic features of different spectrometers, Statement of Born-Oppenheimer approximation, Degree of freedom, Frank Condon Principle, Fluorescence and Phosphorescence.

II. Ultraviolet and Visible Spectroscopy The energy of electronic excitation, Measurement techniques, Beer-Lambert Law, Molar extinction coefficient. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, Auxochromes, Absorption and intensity shifts, Transition probability. Factors affecting λ_{max}, Effect of steric hindrance to coplanarity, Solvent effects.

UNIT – II

III. Infrared Spectroscopy

Vibrational energy levels, Selection rules, Force constant, Fundamental vibration frequencies, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect) of different functional groups. Sampling

techniques.

IV. Applications of UV and IR Spectroscopy

Applications of UV spectroscopy, Woodward Fieser rules for calculating λ_{max} of conjugated polyenes and α,ß -unsaturated carbonyl compounds. Applications of IR spectroscopy, Absorption of Common functional Groups, Interpretation of simple IR spectra, Finger print regions. Simple numerical problems based on UV and IR spectroscopy.

UNIT-III

V. Proton Magnetic Resonance spectroscopy (^{1}H NMR) The Nuclear spin, Larmor frequency, the NMR isotopes, Population of nuclear spin level, Spin and Spin lattice relaxation. Measurement techniques (CW & FT method), Solvent used. Chemical shift, Reference compounds, Shielding constant, Range of typical chemical Shifts, Simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

VI. Applications of NMR spectroscopy NMR spectra with various examples such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene, o-, m-, p- anisidine, o-, m-, p- nitrophenols, acetophenone. Simple numerical of structure elucidation of NMR spectroscopic data.

UNIT- IV

VII. Mass Spectrometery

Basic Principles. Elementary theory. Molecular ions, isotope ions, Fragment ions of odd and even electron types, Nitrogen rule, Factors affecting cleavage patterns, Simple cleavage, Cleavages at a hetero atom, Multicentre fragmentations, Rearrangements, Diels – Alder fragmentation, Mc Lafferty rearrangement.

VIII. Applications of Mass Spectroscopy

IX. Cleavage associated with common functional groups , Aldehydes, Ketones, Cyclic and Acyclic Esters, Alcohols, Olefins, Aromatic compounds, Amines, Interpretation of the spectrum of unknown simple molecules.

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, New York
2. D.H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry.
3. Spectrometric Identification of Organic Compounds - R.M. Silverstein & F. X. Webster; Publisher: John Willey and Sons,Inc.
4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing Company Inc.
5. Introduction to Spectroscopy – D. L. Pavia, G. M .Lampman, and G. S. Kriz Publisher: Brooks / Cole, a part of cengage learning

INTERDICIPLINARY COURSE ID-II

Bachelor of Science (Honours) Physics

Semester–IV

Session- 2021-22

Course Title: Statistical Methods **Course Code: BOPL-4175**

Course Outcomes

Upon completion of this course, students should be able to:

CO 1: Understand the concept of error propagation and uncertainties experimental measurements and results.

CO 2: see the impact of number of observations on the experimental results.

CO 3: Fit regression curves depicting relation among the physical quantities.

CO 4: Understand the probabilities, expectations and corelations.

Bachelor of Science (Honours) Physics
Semester–IV
Session- 2021-22

Course Title: Statistical Methods **Course Code: BOPL-4175**
Examination Time: 3 Hours **Max. Marks: 50**
Theory: 40
CA : 10
Instructions for the Paper Setters:

Eight questions of equal marks (10 marks each) are to be set, two in each of the four Sections (AD). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

The question paper must contain 30% of the article/ theory from the syllabus.

Unit-I

Errors and Uncertainties in Measurements: Experimental observations and data, Accuracy, Precision, Systematic Errors, Random Errors, Significant Figures and Roundoff, error as uncertainties, Minimizing Uncertainties, using uncertainties in experimental results.

Unit-II

Describing data: Introduction to Origin, Mean, Median, Mode, variance, standard Deviation, probable error, simple applications.

Unit-III

Correlation Analysis: Meaning, types, scatter diagram, Karl Pearsons method, significance of correlation coefficient; regression Analysis: regression coefficients, their properties (without derivations), regression equations, least square method (linear and polynomial).

Unit-IV

Probability distribution: Meaning of probability, Mathematical Expectations, introduction to binomial, Poisson and normal (Gaussian) distribution (properties without derivation), simple applications.

NOTE: Internal assessment may be based on applications in **Origin** on mean, standard deviation, probability distributions (normal, Poisson, Gaussian), curve fitting, coefficient of linear correlation.

Text Books:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics

2. Hogg R.V. , Mckean, J.W. and Craig A.T.: Introduction to Mathematical Statistics

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-IV
PHYSICS LAB-IV

Course No. BOPP-4396

COURSE OUTCOMES

CO1: to measure an accessible (Horizontal and vertical) and inaccessible height using sextant.

CO2: demonstrate the verification of laws of probability distribution.

CO3: demonstrate adiabatic expansion, thermo emf, thermal conductivity and thermal expansion measurements.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-IV

COURSE CODE: BOPL-4396

PHYSICS LAB-IV

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 18 **Total Teaching hours: 90**

General Guidelines for Practical Examination

I. The distribution of marks is as follows:

i) One experiment 20 Marks **ii) Brief Theory 6 Marks**

iii) Viva–Voce 7 Marks **iv) Record (Practical file) 7 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session and will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. To measure an accessible (Horizontal and vertical) height using sextant.
2. To measure inaccessible height by using sextant.
3. Verify laws of probability distribution by throwing of similar coins.
4. To study adiabatic expansion of gas and hence to calculate value of γ.
5. To determine the heating efficiency of an electric kettle with varying voltage.
6. To determine Stefan's constant using Boltzmann's Law.
7. To find the coefficient of Thermal Conductivity of a bad conductor by Lee's method.
8. To plot a calibration curve of a given thermocouple (copper constantan) using a potentiometer.
9. To measure thermal expansion of crystal using interference fringes.
10. To measure the thermo e.m.f. as a function of temperature of the hot junction.

Reference Books :

1. Practical Physics Vol.II, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications
2. Practical Physics, C.L. Arora, S. Chand & Co.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)

(Semester-IV)
COURSE CODE: BOPP-4087
Chemistry Lab-IV
(Practical)

Course Outcomes

Students will be able to

CO1: know the principle and mechanism of Conductometric titrations and polarimetric experiments

CO2: determine the heat of of neutralization and Heat of solution Calorimetrically

CO3: know the principle and working of Abbe's Refractometer

CO4:determine the composition of unknown mixture of two liquids by refractive index measurements.

BACHELOR OF SCIENCE (HONURS) PHYSICS (SESSION 2021-22)
SEMESTER-IV
COURSE CODE: BOPL-4087
CHEMISTRY LAB-IV

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Total Teaching hours: 60

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).

2. Polarimetry: Determine the %age composition of an optically active solution.

3. Calorimetry:
   a) Determination of Heat of neutralization
      (i) Strong acid-strong base
      (ii) Weak acid-strong base.
   b) Determination of Heat of solution of KCl, NH_4Cl, KNO_3

4. Conductometry:
   a) Determination of cell constant.
   b) Determination of specific and equivalent conductance of electrolyte (NaCl andHCl).
   c) Precipitation titration of Na_2SO_4 vs. $BaCl_2$.
   d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH_3COOH.

5. Determination of adsorption isotherm of oxalic acid on charcoal

Books Recommended:

1. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
2. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
3. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
4. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand & Co.
5. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
6. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

FACULTY OF SCIENCES

SYLLABUS
of
Master of Science (Physics)
(Semester: I -IV)

(Under Continuous Evaluation System)

Session: 2021-22

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO YEAR DEGREE PROGRAMME

Master of Science (Physics)

Session 2021-22

Master of Science (Physics)
SEMESTER-I

Course Code	Course Name	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MPHL-1391	Analog and Digital Electronics	C	100	80	-	20	3
MPHL-1392	Mathematical Physics	C	100	80	-	20	3
MPHL-1393	Classical Mechanics	C	100	80	-	20	3
MPHL-1394	Computational Techniques	C	100	80	-	20	3
MPHP-1395	Electronics Lab	C	100	-	80	20	3
MPHP-1396	Computer Lab	C	100	-	80	20	3
Total			**600**				

Master of Science (Physics)
SEMESTER-II

Course Code	Course Name	Course Type	Total	Ext.		CA	Examination time (in Hours)
				L	P		
MPHL-2391	Quantum Mechanics-I	C	100	80	-	20	3
MPHL-2392	Electrodynamics-I	C	100	80	-	20	3
MPHL-2393	Condensed Matter Physics-I	C	100	80	-	20	3
MPHL-2394	Atomic & Molecular Spectroscopy	C	100	80	-	20	3
MPHP-2395	Condensed Matter Physics Lab -I	C	100	-	80	20	3
MPHP-2396	Spectroscopy Lab	C	100	-	80	20	3
Total			**600**				

Master of Science (Physics) **Semester-III**							
Course Code	Course Name	Course Type	Marks				Examination Time (in Hours)
			Total	External		CA	
				L	P		
MPHL-3391	Quantum Mechanics-II	C	100	80	--	20	3
MPHL-3392	Electrodynamics-II	C	100	80	--	20	3
MPHL-3393	Condensed Matter Physics-II	C	100	80	--	20	3
MPHL-3394	Nuclear Physics	C	100	80	--	20	3
MPHP-3395	Condensed Matter Physics Lab-II	C	100	--	80	20	3
MPHP-3396	Nuclear Physics Lab	C	100	--	80	20	3
Master of Science (Physics) **Semester-IV**							
MPHL-4391	Particle Physics	C	100	80	--	20	3
MPHL-4392	Statistical Mechanics	C	100	80	--	20	3
MPHL-4393 (OPT-_)	Student may choose any two subjects from the following list of options	C	100	80	--	20	3
MPHL-4394(OPT-_)		C	100	80	--	20	3
MPHD-4395	Assignment/ Project		50	-	40	10	

OPT-I Photonics
OPT-II Radiation Physics
OPT-III Reactor Physics
OPT-IV Nano Technology
OPT-V Material Science
OPT-VI Space Science

Program Specific Outcomes: M.Sc. (Physics)

After the successful completion of the program, the student will be able to do the following

PSO 1. The Master of Science in Physics program provides the detailed functional knowledge of the fundamental theoretical concepts and experimental methods of physics. It will help the candidate to enhance her general competence, and analytical skills on an advanced level, and will prepare her according to the jobs needed in education, research or public administration.

PSO 2. The student will have the knowledge of the topics of the research conducted by researchers at the Department of Physics, and knowledge of a well-defined area of research within physics.

PSO 3. The student will have the understanding of the basic concepts of classical mechanics, quantum mechanics, statistical mechanics and electricity and magnetism to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical and mathematical reasoning.

PSO 4. The student will learn to carry out experiments in basic as well as certain advanced areas of physics such as nuclear physics, condensed matter physics, spectroscopy, lasers and electronics.

PSO 5. The work course of project and assignment will give the students special expertise within one of the research areas represented at the Department of Physics which will result in some research experience within a specific field of physics, through a supervised project.

PSO 6. The student will be able to critically apply the knowledge gained during the course to scientific models and solve problems in the areas of electrodynamics, quantum mechanics, classical mechanics, statistical mechanics, and advanced mathematical methods.

PSO 7. **General competence**

The candidate will be able to

- Understand the role of physics in society and know the historical development of physics, its possibilities and limitations, and understands the value of lifelong learning.
- Gather, assess, and make use of new information.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHL-1391
ANALOG AND DIGITAL ELECTRONICS

COURSE OUTCOMES

After passing this course the student will be able to:

CO 1. Understand the concept of Electronic devices (MOSFET, UJT, SCR) and their applications.
CO 2. Demonstrate the concept of Electronic circuits: Operational Amplifier and its applications
CO 3. Use concept of Digital Principles for electronic conversions.
CO 4. Demonstrate application of sequential circuits.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHL-1391

ANALOG AND DIGITAL ELECTRONICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I: Electronic Devices and semiconductor Memories

MOSFETs, construction and working of U.J.T. and SCR and their application in wave generation and power control. Types of Memories, Read/Write Memory, ROM, EPROM, EEPROM, static dynamic memory, memory cell: static RAM Memory cells, NMOS static cells.

Lectures 15

UNIT-II: Electronic Circuits:

Operational amplifier (OP-AMP), OP-AMP as inverting and non-inverting, scalar, summer, integrator, differentiator. Schmitt trigger and logarithmic amplifier, Electronic analog computation circuits

Lectures 15

UNIT-III: Digital Principles:

Binary and Hexadecimal number system, Binary arithmetic, Logic gates, Boolean equation of logic circuits, Karnaugh map simplifications for digital circuit analysis, and design, Encoders & Decoders, Multiplexers and Demultiplexers, Parity generators and checkers, Adder-Subractor circuits.

Lectures 15

UNIT-IV: Sequential Circuits:

Flip Flops, Registers, Up/Down counters, D/A conversion using binary weighted resistor network, Ladder, D/A converter, A/D converter using counter, Successive approximation A/D converter.

Lectures 15

Text and Reference Books

1. Electronic Devices and Circuits by Millman and Halkias-Tata McGraw Hill, 1983.
2. Digital Principles and Applications by A.P.Malvino and D.P.Leach-Tata McGraw Hill, New Delhi, 1986.
3. Digital Computer Electronics by A P Malvino-Tata McGraw Hill, New Delhi, 1986
4. Electronic Devices and Circuit Theory 10e by Robert L. Boylestad; Louis Nashelsky 2009.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHL-1392

MATHEMATICAL PHYSICS

COURSE OUTCOMES OF MATHEMATICAL PHYSICS

On completion of this course a student will be able to:

CO 1. Understand and use, advanced mathematical methods and theories on various mathematical and physical problems.

CO 2. Identify different special mathematical functions.

CO 3. Understand Cartesian (X, Y, Z), Spherical polar (r, θ, φ) and Cylindrical (ρ, φ, z) co-ordinate systems and their transformation equations.

CO 4. Solve partial differential equations with appropriate initial or boundary conditions with Green function techniques

CO 5. Have confidence in solving mathematical problems arising in physics by a variety of mathematical techniques

Master of Science (Physics)

SEMESTER-I
(SESSION 2021-22)

COURSE CODE: MPHL-1392

MATHEMATICAL PHYSICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I: Coordinates systems, Fourier and Laplace transform.

Curvillinear coordinates, Differential vector operators in curvilinear coordinates, spherical and cylindrical systems, General coordinate transformation, Tensors: covariant, contra variant and Mixed, Algebraic operations on tensors, Illustrative applications.

Fourier decomposition, Fourier series and convolution theorem, Fourier transforms and its applications to wave theory. Laplace Transform, Laplace transform of derivatives and integrals, Inverse Laplace transform, Application of Laplace Transform.

20Lectures

UNIT-II: Complex analysis.

Function of a complex variables, Analytical functions and Cauchy–Riemann conditions, Cauchy integral theorem, Cauchy integral formula, Taylor and Laurent series, singularities and residues, Cauchy residue theorem, calculations of real integrals.

10Lectures

Unit –III: Differential equations and Special Functions.

Second order differential equations, Frobenions method, wronskian and a second solution, the Strum Liouville theorem, one dimensional Green's function. Gamma functions. The exponential integral and related functions, Bessel functions of the first and second kind, Legendre polynomials, associated Legendre polynomials and spherical harmonics, Generating functions for Bessel, Legendre and associated Legendre functions, Hermite Functions.

20Lectures

UNIT-IV: Group theory:

Definition of a group, multiplication table, conjugate elements and classes of groups, direct product Isomorphism, homomorphism, permutation group, definition of the three dimensional rotation groups and SU(2)

10Lectures

Text and Reference Books

1. Mathematical Methods for Physicist by GeorgeArfken-NewYorkAcademy,1970.
2. Mathematical Physics by P.K.Chattopadhyay, NewAgeInternational,1990.

Master of Science (Physics)

Semester-1

(SESSION 2021-22)

COURSE CODE: MPHL-1393

CLASSICAL MECHANICS

COURSE OUTCOMES

CO 1. After the students complete this course they will be familiar with aspects of Classical Mechanics such as Lagrangian and Hamiltonian formulation, particle in central potentials, rigid body motion. These will form the essential background for other courses such as Quantum Mechanics, Electrodynamics and High Energy Physics that students would learn in the subsequent semesters.

CO 2. Students will learn the importance of Lagrangian and Hamiltonian mechanics over the Newtonian mechanics and be able to solve the complex problems on the equations of motion by applying these two techniques.

CO 3. Having successfully completed this course, students will be able to demonstrate knowledge and understanding of orbit problems using the conservation of angular momentum and total energy.

CO 4. Students will also be able to demonstrate understanding of rigid body motion using Euler theorem and Euler angles, which will help them to solve advanced problems pertaining to celestial mechanics.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHL-1393

CLASSICAL MECHANICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the PaperSetters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I: Lagrangian Mechanics

Newton's laws of motion, mechanics of a system of particles, constraints, generalized coordinates D'Alembert's principle and Lagrange equations of motion for conservative systems, simple applications of Lagrangian formulation.**Variational Principles:**Hamiltons principle, some techniques of the Calculus of variations, derivation of Lagrange equations from Hamilton's principle, conservation theorems and symmetry properties.

Lectures 15

UNIT-II: Central Force Problem

Two body central force problem, reduction to equivalent one body problem, the equation of motion and first integrals, the equivalent one dimensional problem, and
classification of orbits, the Virial theorem, the differential equation for the orbit, conditions for closed orbits, the Kepler problem, scattering in a central force field (Rutherford scattering cross section formula).

Lectures 15

UNIT-III: Hamiltonian Mechanics

Legendre transformation and Hamilton equations of motion, cyclic coordinates and conservation theorems, derivation of Hamiltons equations from a variational principle, the principle of least action, simple applications of Hamiltonian formulation.

Canonical Transformations: The equations of canonical transformation, examples of canonical transformations, Poisson brackets, equations of motion, infinitesimal canonical transformations and conservation theorems in the Poisson bracket formulation, Hamilton-Jacoby theory.

Lectures 15

UNIT-IV: Rigid Body Dynamics

The independent coordinates of a rigid body, orthogonal transformation,
the Euler angles, Euler's theorem on the motion of rigid body, finite and infinitesimal rotations, rate of change of a vector, angular momentum and kinetic energy about a point for a rigid body, the inertia tensor and moment of inertia, the eigen values of the inertia tensor and the principal axis transformation. Euler's equations of motion, torque free motion of a rigid body.

Small Oscillations: Eigen value equation, Free vibrations, Normal Coordinates, vibrations of a triatomic molecule.

Lectures 15

Reference Books:

1. Classical Mechanics by Herbert Goldstein-Narosa Pub. House, New Delhi, 1970.
2. Mechanics by L.D. Landau-Pergamon Press, Oxford, 1982.
3. Classical Mechanics by Rana and Joag-Tata McGraw Hill, New Delhi, 1995.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHL-1394

COMPUTATIONAL TECHNIQUES

COURSE OUTCOMES

On completion of this course a student will be able to:

CO 1. The very first outcome of the course is having knowledge about various programming languages, their need in research and development.

CO 2. The introduction to MATLAB gives a basic knowledge about syntaxes and procedures used in MATLAB to solve various mathematical problems.

CO 3. Understanding of interpolation of data from an experimental data with equal and unequal intervals.

CO 4. The students will be able to solve integration and differentiation numerically by using various methods.

CO 5. Understanding of various numerical methods to solve polynomial and transcendental equations gives an insight of working of these methods.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHL-1394

COMPUTATIONAL TECHNIQUES

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I: Introduction of MATLAB

Introduction: Basics of MATLAB, working with arrays, creating and printing plots, Interacting Computations: Matrices and Vectors, Matrices and Array Operations, built in functions, saving and loading data, plotting simple graphs Programming in MATLAB: Scriptfiles, function files, Compiled files, p-code, variables, loops, branches, and control flow, Input/Output, Advanced data objects, structures, cells

Lectures18

UNIT-II: Interpolation

Interpolation, Newton's formula for forward and backward interpolation, Divided differences, Symmetry of divided differences, Newton's general interpolation formula, Lagranges interpolation formula

Lectures12

UNIT-III: Numerical Differentiation and integration

Numerical integration, A general quadrature formula for equidistant ordinates, Simpson, Weddle and Trapezoidal rules, Monte- Carlo Method, Euler's method, Modified Euler's method, Runge Kutta Method.

Lectures15

UNIT-IV: Roots of Equation

Approximate values of roots, Bisection Method, Regula-Falsi Method, Newton-Raphson method, Bairstow method. Simultaneous Linear Algebraic Equations: Solution of Simultaneous Linear equations, Gauss elimination method, Gauss-Jordon method, Matrix inversion, finding eigen values and eigen vectors, matrix factorization, Curve fitting and Interpolation; polynomial curve fitting, least square curve fitting

Lectures15

Text and Reference Books

1. Getting started with MATLAB by RudraPratap-OxfordUniversityPress-2005.
2. A concise introduction to MATLAB by William JPalm III-McGrawHill-2008.
3. Numerical Mathematical Analysis by James Scarborough (Oxford and IBH),1966.
4. Elementary Numerical Analysis by S.D. Conte (McGrawHill),1965.
5. Numerical Methods for Mathematics by John. H. Methews Science and Engineering(Prentice Hall of India).

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHP-1395
ELECTRONICS LAB

COURSE OUTCOMES

After successfully completion of this lab student will be able to

CO1: Characterise and understand the applications of DIAC, TRIAC, UJT and SCR.

CO2: Investigate characteristics of MOSFET and Multivibrators.

CO3: understand experimentally working of Operational Amplifier and its applications

CO4: basics about Digital Logic circuits from logic gates to ALU.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHP-1395
ELECTRONICS LAB

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Practical Examiners:
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, KanyaMahaVidyalaya, Jalandhar

LIST OF EXPERIMENTS

1. To Study the DC characteristics and applications of DIAC.
2. T o study the DC characteristics and applications of SCR.
3. To study the DC characteristics and applications of TRIAC.
4. Investigation of the DC characteristics and applications of UJT.
5. Investigation of the DC characteristics of MOSFET.
6. Study of bi-stable, mono-stable and astable, multivibrators.
7. Study of Op-Amps and their applications such as an amplifier (inverting, non-inverting), scalar, summer, differentiator and integrator.
8. Study of logic gates using discrete elements and universal gates.
9. Study of encoder, decoder circuit.
10. Study of arithmetic logic unit (ALU)circuit.
11. Study of shift registers.
12. Study of half and full adder circuits.
13. Study of A/D and D/A circuits.

Master of Science (Physics)

SEMESTER-I

(SESSION 2021-22)

COURSE CODE: MPHP-1396

COMPUTER LAB

After completion of this lab Student will be

CO1: familiar with various MATLAB syntaxes and techniques to carryout simple calculations.

CO2: able to develop MATLAB programs to find roots of equations.

CO3: able to apply MATLAB commands to plot simple graphs in 2D.

CO4: able to write MATLAB programs to solve numerical integration, numerical differentiation and interpolation.

Master of Science (Physics)

SEMESTER-I
(SESSION 2021-22)

COURSE CODE: MPHP-1396
COMPUTER LAB

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Practical Examiners:
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, KanyaMahaVidyalaya, Jalandhar

LIST OF EXPERIMENTS
1.Determination of Roots

a) Bisection Method
b) Newton Raphson Method
c) Secant Method
2.Integration

a) Trapezoidal rule
b) Simpson1/3andSimpson3/8rules
c) Gaussian Quadrature
3.Differential Equations

a) Euler's Method
b) Runge Kutta Method

4.Interpolation

a) Forward interpolation, Backward interpolation.
b) Lagrange's interpolation.
5.Applications

a) Chaotic Dynamics, logistic map
b) One dimensional Schrondinger Equation
c) Time period calculation for a potential
d) Luminous intensity of a perfectly blackbody vs. temperature

Master of Science (Physics)

SEMESTER-II

(SESSION 2021-22)

COURSE CODE: MPHL-2391
QUANTUM MECHANICS-I

COURSE OUTCOMES OF QUANTUM MECHANICS

This course develops concepts in quantum mechanics such that the behavior of the physical universe could be understood from a fundamental point of view. It provides a basis for further study of quantum mechanics

CO 1. The very first outcome of the course is that the student will learn the mathematical tools needed to solve quantum mechanics problems. This will include complex functions and Hilbert spaces, and the theory of operator algebra and the concept that quantum states could be described in a vector space. Solutions of ordinary and partial differential equations that arise in quantum mechanics will also be studied.

CO 2. The student will be able to build connections between mathematical development and conceptual understanding.

CO 3. The student will be able to apply the concepts of quantum mechanics to solve the one and three dimensional problems of quantum mechanics to understand the basics of atomic structures and the wave mechanics of these atoms.

CO 4. The student will learn the basic concepts of spin and angular momentum and the role of spherical harmonics in determining the shape of electronic clouds around the nucleus. They will also learn about the utilization of simple harmonic oscillator and the role of Hilbert space in developing simple harmonic oscillator.

Master of Science (Physics)

SEMESTER-II

(SESSION 2021-22)

COURSE CODE: MPHL-2391

QUANTUM MECHANICS-I

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I: ***Basic Formulation and quantum Kinematics:*** Stern Gerlach experiment as a tool to introduce quantum ideas, analogy of two level quantum systems with polarisation states of light. Complex linear vector spaces, ket space, bra space and inner product, operators and properties of operators .Eigen kets of an observable, eigen kets as base kets, matrix representations. Measurement of observable, compatible vs incompatible observable, commutators and uncertainty relations. Change of basis and unitary transformations. Diagonalisation of operators. Position, momentum and translation, momentum as a generator of translations, canonical commutation relations. Wave functions as position representation of ket vectors. Momentum operator in position representation, momentum Space wave function.

Lectures18

UNIT-II: ***Quantum Dynamics:*** Time evolution operator and Schrödinger equation, special role of the Hamiltonian operator, energy eigen kets, time dependence of expectation values, spin precession. Schrodinger vs. Heisenberg picture, unitary operators, state kets and observable in Schrodinger and Heisenberg pictures, Heisenberg equations of motion, Ehrenfest's theorem. Simple harmonic oscillator Energy eigen values and eigen vectors of SHO, Matrix representation of creation and annihilation operators, Zero-point energy; Coherent states.

Lectures12

UNIT-III: Symmetry Principles: Symmetry and conservation laws, Space time translation and rotations. Conservation of linear momentum, energy and angular momentum. Unitary transformation, Symmetry and Degeneracy, space inversion and parity. Time reversal invariance.

Lectures12

UNIT-IV: Spherical Symmetric Systems and Angular momentum : Schrodinger equation for a spherically symmetric potential. Orbital angular momentum commutation relations. Eigen value problem for L^2, spherical harmonics. Three dimensional harmonic oscillator, three dimensional potential well and the hydrogen atom. Angular momentum algebra, commutation relations. Introduction to the concept of representation of the commutation relations in different dimensions. Eigen vectors and eigen functions of J^2 and Jz. Addition of angular momentum and C.G. coefficients.

Lectures18

Text and Reference Books

1. Modern Quantum Mechanics by J.J.Sakurai-Pearson EducatonPvt.Ltd.,New Delhi,2002.
2. A textbook of Quantum Mechanics by P M Mathews, K Venkatesan, MccGraw Hill Education
3. Quantum Mechanics: Concepts and Applications by N. Zettili, John Wiley & Sons.
4. Quantum Mechanics by Merzbacher JohnWiley&Sons,NewYork,1970.
5. Quantum Mechanics (2^{nd} Ed.) by V.K. Thankappan, New Age International Publications, New Delhi, 1996

Master of Science (Physics)

SEMESTER-II

(SESSION 2021-22)

COURSE CODE: MPHL-2392
ELECTRODYNAMICS-I

COURSE OUTCOMES

After passing this course the students will be able to:

CO1: understand the basic concepts of electrostatics and magnetism and related quantities and their calculations for different charge distribution as well as the behaviour of electric and magnetic field inside matter. The students will have the ability to solve the electrostatic problems by method of images helps.

CO2: demonstrate knowledge about the time-varying magnetic and electric fields and their effects by

CO3: understand the propagation of electromagnetic waves in conducting and insulating media.

Master of Science (Physics)

SEMESTER-II

(SESSION 2021-22)

COURSE CODE: MPHL-2392

ELECTRODYNAMICS-I

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I: Electrostatics: Coulomb's law, Gauss's law and its applications, Scalar potential, Poisson's equation, Laplace equation. method of images, multipole expansion, Solution of boundary value problems: Green's function and its calculation for the image charge problem in the case of a sphere, uniqueness theorem. Electrostatics of dielectric media, Boundary value problems in dielectrics; molecular polarizability, electrostatic energy in dielectric media.

Lectures 18

UNIT-II: Magnetostatics: Biot and Savart's law. The differential equation of Magnetostatics and Ampere's law, magnetic vector potential and magnetic fields of a localized current distribution. Magnetic moment, force and torque on a magnetic dipole in an external field. Dynamics of charged particles in static and uniform electromagnetic fields. Magnetic materials, Magnetization and microscopic equations.

Lectures 12

UNIT-III: Time-varying fields: Electromagnetic induction. Faraday's law of induction, Energy in a magnetic field. Maxwell's displacement current, Maxwell's equations in free space and linear isotropic media; vector and scalar potential, General Expression for the electromagnetic fields energy, Gauge transformations; Lorentz gauge and Coulomb gauge. Poynting theorem, conservation laws for a system of charged particles and electromagnetic field, Equation of continuity

Lectures 15

UNIT-IV: Electromagnetic Waves: Plane wave like solutions of the Maxwell equations. Polarization, linear and circular polarization. Superposition of waves in one dimension. Group velocity. Illustration of propagation of a pulse in dispersive medium. Reflection and refraction of electromagnetic waves at a plane surface between dielectrics. Polarization by reflection and total internal reflection. Interference, coherence, and diffraction. Waves in conductive medium, Simple model for conductivity.

Lectures 15

Text and Reference Books

1. Introduction to Electrodynamics - D.J. Griffiths-Pearson Education Ltd., New Delhi,1991.
2. Classical Electrodynamics - J.D. Jackson-John & Wiley Sons Pvt. Ltd. New York, 2004.
3. Classical Electromagnetic Radiation - J.B. Marion-Academic Press, New Delhi, 1995.
4. Classical Electrodynamics: S.P. Puri, (Tata McGraw Hill, New Delhi)

SEMESTER-II
(SESSION 2021-22)

COURSE CODE: MPHL-2393
Condensed Matter Physics-I

Course Outcome of Condensed Matter Physics-I

After studying this course, the students will be able to understand:

CO1: various theories related to heat capacities and significance of lattice heat capacity and phonons

CO2: about various types of lattice defects, dislocations and grain boundaries and their role in cryatal growth.

CO3: concepts related with electrical and thermal conductivities and relation between them as well as concepts of activation and hydration energies.

CO4: properties and concepts related to Dielectrics and Ferro Electrics and thermodynamics of ferroelectric transitions

Master of Science (Physics)

SEMESTER II

(SESSION 2021-22)

COURSE CODE: MPHL-2393

Condensed Matter Physics-I

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

Unit-I

Lattice Specific Heat and Elastic Constants:

Different theories of lattice specific heat of solids, Einstein model of the Lattice Specific heat, Density of modes of vibration, Debye model of Lattice specific heat, Born cut-off procedure, Specific heat of metals. Elastic strain and stress components, Elastic compliance and stiffness constants, Elastic constants of cubic crystals, Elastic waves in cubic crystals.

Unit-II

Defects and Diffusion in Solids:

Point defects: Impurities, Vacancies-Schottky and Frankel vacancies, Diffusion, Fick's law, Self diffusion in metals, Color centers and coloration of crystals, F-centres, V-centres, Line defects, Edge and screw dislocations, Burgers vectors, Stress field of dislocations, Grain boundaries, Low angle grain boundaries, dislocation densities, Dislocation multiplication and slips, dislocation and crystal growth.

Unit-III

Conductivity of metals and ionic crystals

Electrical conductivity of metals, Drift velocity and relaxation time, The Boltzmann transport, equation, The Sommerfield theory of conductivity, Mean free path in metals, Qualitative, discussion of the features of the resistivity, Mathiesson's rule.Thermal conductivity of metals, Wiedemann-Franz law. Hydration energy of ions, Activation energy for formation of defects in ionic crystals, Ionic conductivity in pure alkali halides.

Unit-IV

Dielectrics and Ferro Electrics:

Macroscopic field, The local field, Lorentz field, The Claussius-Mossotti relations, Different contribution to polarization: dipolar, electronic and ionic polarizabilities, Ferroelectric crystals: Classifications and their general properties, Structure and properties of $BaTiO_3$, The dipole theory of ferroelectricity, objection against dipole theory, Thermodynamics of ferroelectric transitions.

Books:

1. Solid State Physics by A.J. Dekker-Prentice Hall, 1965.

2. An Introduction to Solid State Physics by C. Kittle-Wiley, 1958

3. Elementary Solid State Physics by Omar, Addison Welly, 1975.

4. Principles of Solid State Physics by R.A. Levey-Academic Press, 1968

5. Introduction of Solid State Physics by Ashroft-Cengage Learning, 1999

Master of Science (Physics)

SEMESTER II

(SESSION 2021-22)

COURSE CODE: MPHL-2394

ATOMIC AND MOLECULAR SPECTROSCOPY

COURSE OUTCOMES

Students will have achieved the ability to

CO 1. Describe the atomic spectra of one and two valance electron atoms. the student will understand the relativistic corrections for the energy levels of the hydrogen atom and their effect on optical spectra and the key properties of many electron atoms

CO 2. Explain the change in behaviour of atoms in external applied electric and magnetic field.

CO 3. Explain rotational, vibrational, electronic and Raman spectra of molecules.

CO 4. Explain the role of Frank Condon principle in determining electronic spectra of the molecule. The student will also learn about the dissociation and pre-dissociation energies.

CO 5. state and justify the selection rules for various optical spectroscopies in terms of the symmetries of molecular vibrations

Master of Science (Physics)

SESSION 21-22

SEMESTER-II

COURSE CODE: MPHL-2394

ATOMIC AND MOLECULAR SPECTROSCOPY

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I: Spectra of one and two valance electron systems

Magnetic dipole moments, Larmor's theorem, Space quantization of orbital, spin and total angular momenta, Vector model for one and two valance electron atoms, Spin-orbit interaction and fine structure of hydrogen, Lamb shift, Spectroscopic terminology, Spectroscopic notations for L-S and J-J couplings, Spectra of alkali and alkaline earth metals, Interaction energy in L-S and J-J coupling for two electron systems, Selection and Intensity rules for doublets and triplets.

15Lectures

UNIT-II: Breadth of spectral line and effects of external fields

The Doppler effect, Natural breadth from classical theory, natural breadth and quantum mechanics, External effects like collision damping, asymmetry and pressure shift and stark broadening, The Zeeman Effect for two electron systems, Intensity rules for the Zeeman effect, The calculations of Zeeman patterns, Paschen-Back effect, LS coupling and Paschen–Back effect, Lande's factor in LS coupling, Stark effect.

15Lectures

UNIT-III: Microwave and Infra-Red Spectroscopy - rigid rotator, Intensity of rotational lines, Effect of isotopic substitution, Microwave spectrum of polyatomic molecules, Microwave oven, the vibrating diatomic molecule as a simple harmonic and anharmonic oscillator, Diatomic vibrating rotator, The vibration-rotation spectrum of carbon monoxide, The interaction of rotation and vibrations, Outline of technique and instrumentation, Fourier transform Spectroscopy.

15Lectures

UNIT-IV: Raman and Electronic Spectroscopy

Quantum and classical theories of Raman Effect, Pure rotational Raman spectra for linear and polyatomic molecules, Vibrational Raman spectra, Structure determination from Raman and infra-red spectroscopy, Electronic structure of diatomic molecule, Electronic spectra of diatomic molecules, Born Oppenheimer approximation, The Franck Condon principle, Dissociation and pre-dissociation energy, The Fortrat diagram, Example of spectrum of molecular hydrogen.

Text and Reference Books

1. Atomic and molecular Spectra: Laser by Raj Kumar, Kedarnath Ram Nath
2. Fundamentals of molecular spectroscopy by C.B.Banwell-TataMcGrawHill,1986.
3. Spectroscopy Vol. I,II&III by Walker&Straughen,Chapman&Hall1976
4. Introduction to Molecular spectroscopy by G.M.Barrow-TokyoMcGrawHill,1962.
5. Spectra of diatomic molecules by Herzberg-NewYork,1944.

Master of Science (Physics)

SESSION 21-22

SEMESTER-II

COURSE CODE: MPHP-2395

CONDENSED MATTER PHYSICS LAB-I

COURSE OUTCOMES

Student upon completion of this course will be able to

CO 1. successfully apply the theoretical techniques presented in the course to practical problems

CO 2. Understand Hall Effect and demonstrate concept of Pn junction g-factor using ESR, formation and analysis of Hysteresis loop.

CO 3. Demonstrate experimental determination of Energy gap using Four Probe Method and characteristics of photovoltaic cell.

Master of Science (Physics)

SESSION 21-22

SEMESTER-II

COURSE CODE: MPHP-2395

CONDENSED MATTER PHYSICS LAB-I

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Practical Examiners:

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

LIST OF EXPERIMENTS

1. To determine Hall coefficient by Hall Effect.
2. To determine the band gap of a semiconductor using p-n junction diode.
3. To determine the magnetic susceptibility of a material using Quink's method.
4. To determine the g-factor using ESR spectrometer.
5. To determine the energy gap and resistivity of the semiconductor using four probe method.
6. To trace hysteresis loop and calculate retentivity, coercivity and saturation magnetization.
7. To determine dielectric constant of a dielectric material.
8. To study the series and parallel characteristics of a photovoltaic cell.
9. To study the spectral characteristics of a photovoltaic cell.

SEMESTER-II

COURSE CODE: MPHP-2396

SPECTROSCOPY LAB

Course Outcomes

On successful completion of the course students will be able to:

CO 1. develop analytical, laboratory skills through laboratory which involve the application of physics to various spectroscopy systems.

CO 2. successfully apply the theoretical techniques presented in the course to practical problems

CO 3. set up the Fabry Parot interferometer, Michelson Morley interferometer, Zeeman experimental instrument and constant deviation spectrometer.

SEMESTER-II

COURSE CODE: MPHP-2396

SPECTROSCOPY LAB

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Practical Examiners:

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

LIST OF EXPERIMENTS

1. To find the wavelength of monochromatic light using Febry Perot interferometer.
2. To find the wavelength of monochromatic light using Michelson interferometer.
3. To calibrate the constant deviation spectrometer with white light and to find the wavelength of unknown monochromatic light.
4. To find the wavelength of He-Ne Laser using Vernier Calliper and the grating element of the given grating.
6. To verify the existence of Bohr's energy levels with Frank-Hertz experiment.
7. To determine the charge to mass ratio (e/m) of an electron with normal Zeeman Effect
8. To determine the velocity of ultrasonic waves in a liquid using ultrasonic interferometer
9. Particle size determination by diode laser

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3391

QUANTUM MECHANICS-II

Course outcomes

CO 1. Quantum mechanics-II aim at the applications of quantum mechanics. The course should give deeper knowledge about the foundations of quantum mechanics and skills in problem solving in quantum mechanics.

CO 2. Make students familiar with various approximation methods applied to atomic, nuclear and solid-state physics, and to scattering.

CO 3. The students will learn the applications of Time-independent and time-dependent perturbation theory in quantum mechanics and will develop a knowledge and understanding of perturbation theory, level splitting, and radiative transitions;

CO 4. Develop a knowledge and understanding of the scattering matrix and partial wave analysis; and to solve quantum mechanics problems;

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3391

QUANTUM MECHANICS-II

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

Unit-I: Perturbation Theory

First and second order perturbation theory for non degenerate and degenerate systems. Perturbation of an oscillator and anharmonic oscillator, the variation method. First order time dependent perturbation theory, constant perturbation, Calculation of transition probability per unit time for harmonic perturbation. The Helium atom problem, Stark effect.

Unit-II: Scattering Theory

Born approximation, extend to higher orders. Validity of Born approximation for a square well potential, Optical theorem. Partial wave analysis, unitarity and phase shifts. Determination of phase shift, applications to hard sphere scattering. Low energy scattering in case of bound states. Resonance scattering.

Unit-III: Relativistic Quantum Mechanics

Klein Gordon equation. Dirac Equation, Lorentz covariance of Dirac equation. Positive and negative energy solutions of Dirac equation, positrons. Properties of gamma matrices. Parity operator and its action on states. Magnetic moments and spin orbit energy.

Unit-IV: Identical Particles

Brief introduction to identical particles in quantum mechanics, Fermions and Bosons, wave function of n-identical particles and Slater's determinant, symmetrisation postulates, Exchange operators and exchange degeneracy, Application to 2 and 3 electron systems. Pauli Exclusion Principle,

References :

1. Quantum Mechanics by L I Schiff-Tokyo McGraw Hill, 1968.
2. A textbook of quantum mechanics by P.M. Methews and K. Venktasen Mcgraw Hill Education, 2017
3. Introduction to Quantum Mechanics by David J. Griffiths, pearson, 2015

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3392

Electrodynamics-II

Course outcomes

After passing this course the students will be able to:

CO1: Understand different types of waveguides. The transmission of electromagnetic signals through waveguide. The attenuation and loss of signal in waveguides

CO2: Correlate Einstein's special theory of relativity with classical mechanics and electrodynamics in terms of tensor notation.

CO3: Study the fields around electric dipole, magnetic dipole and electric quadruple. The transition of signal from full wave and half wave antennas.

CO4: Understand fields due to moving charges in terms of vectors and in terms of relativistic mechanics.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3392

Electrodynamics-II

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks.

UNIT-I

Wave Guides: Field at the surface of and within a conductor. Cylindrical cavities and waveguides, modes in a rectangular wave guide, energy flow and attenuation in wave guides.
Perturbation of boundary conditions, resonant cavities, power loss in cavity and quality factor.

UNIT-II

Relativistic Formulation of Electrodynamics: Special theory of relativity, simultaneity, length contraction, time dilation and Lorentz's transformations, Structure of space-time, four scalars, four vectors and tensors, relativistic mechanics: proper time and proper velocity, relativistic energy and momentum. Relativistic electrodynamics: Magnetism as a relativistic phenomenon and field transformations. Field tensor. Recasting Maxwell equations in the language of special relativity, covariance and manifest covariance.

UNIT-III

Radiating Systems: In **h**omogenous Wave Equation for potentials: Retarded Potentials ,Fields of radiation of localized oscillating sources, electric dipole fields and radiation, magnetic dipole and electric quadrupole fields, central fed antenna, brief introduction to radiation damping and radiation reaction.

UNIT-IV

Fields of Moving Charges: Lienard Wiechert potential, field of a moving charge. Radiated power from an accelerated charge at low velocities, Larmour's power formula and its relativistic generalization; Angular distribution of radiation emitted by an accelerated charge.

Text and Reference Books:

1. Classical Electrodynamics by J.D. Jackson-John Wiley & Sons Pvt. Ltd., New York.
2. Introduction to Electrodynamics by D.J. Griffiths-Pearson Education Ltd.
3. Classical Electromagnetic Radiation by J.B. Marion-Academic Press, New Delhi.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3393

Condensed Matter Physics-II

Course Outcome of Condensed Matter Physics-II

CO 1. Condensed Matter Physics-II aim at the applications of Solid state Physics. The course should give deeper knowledge about magnetic materials.

CO 2. Make students familiar with various concepts like curie's temperature, super exchange interaction and properties of hysteresis loop.

CO 3. The students will have knowledge of superconductors and its types and how its properties can be applicable in the research field.

CO 4. Develop a knowledge and understanding of the optical properties and students will get the knowledge how these properties are beneficial in the field of research.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3393

CONDENSED MATTER PHYSICS-II

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

Unit- I

Classification of magnetic materials, Origin of permanent magnetic dipoles, Diamagnetic susceptibility, Langevin diamagnetic equation, Classical theory of paramagnetism, Quantum theory of paramagnetism, Quenching of orbital angular momentum, Cooling by adiabatic demagnetization, Paramagnetic susceptibility of conduction electrons, Determination of susceptibilities of para and diamagnetic materials: Theory, Gouy method and Quincke's method

Unit - II

Ferromagnetism, Curie point and the exchange integral, Weiss molecular field, the interpretation of the Weiss field, Temperature dependence of spontaneous magnetization, Saturation magnetization at absolute zero, Ferromagnetic domains, Anisotropy energy, Transition region between domains: Bloch wall, Origin of domains, Coercivity and hysteresis, Spin waves, Quantization of spin waves, Thermal excitations of magnons, Neutron Magnetic Scattering, Ferrimagnetic Order, Curie temperature and susceptibility of ferrimagnets, Antiferromagnetism, Two sublattice model.

Unit – III

Superconductivity, zero resistivity, critical temperature, Meissner effect, Type I and Type II superconductors, specific heat and thermal conductivity,Thermodynamics of superconducting transition, London's equation, Coherence length, BCS theory of conventional superconductors, BCS ground states, Flux quantization on a superconducting ring, Duration of persistent current, Josephson effect: dc Josephson effect, ac Josephson effect, macroscopic quantum interference, Superconducting magnet and SQUID, High temperature superconductors: Structure and properties.

Unit - IV

Interaction of light with solids, Atomic and electronic interactions, Optical properties of metals and non-metals: Reflection, Refraction, Absorption, Transmission, Fundamentals of direct and indirect

band gap, Exciton absorption, Free carrier absorption, Absorption process involving impurities, Photoconductivity, Luminescence, excitation and emission, Decay mechanisms, Thallium activated alkali halides, Sulphide phosphors.

Books Recommended:

1. An Introduction to Solid State Physics by C. Kittel-WielyEstem Ltd., New Delhi.
2. Solid State Physics by A.J. Dekkar-Maemillan India Ltd., New Delhi.
3. Material Science and Engineering by William D. Callister JR, Wiley
4. Elementary Solid State Physics by Omar, Addison Wesly.
5. Principles of Solid State Physics by R.A. Levy-New York Academy.
6. Solid State Physics by Aschroft and Mermin-New York Holt.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3394

NUCLEAR PHYSICS

Course Outcomes

Upon completion of this course, the student will be able to:

CO 1. Identify basic nuclear properties and outline their theoretical descriptions.

CO 2. Understand the nature of nuclear forces that bind atomic nuclei together and the structure and dynamics of nuclei.

CO 3. Apply the semi-empirical mass formula to evaluate the binding energy of a nucleus and other binding energy related properties.

CO 4. Describe the role of spin-orbit coupling in the shell structure of atomic nuclei, and predict the properties of nuclear ground and excited states based on the shell model.

CO 5. Understand the various decay properties of unstable nuclei such as beta decay, gamma decay, and parity violation.

CO 6. Compare different nuclear reaction mechanisms in relation to cross-sections, excitation functions and angular distributions.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

SEMESTER III

COURSE CODE: MPHL-3394

NUCLEAR PHYSICS

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on mid-semester test/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters for final examination: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

Unit-I

Properties of nucleus and nuclear forces: size, spin, parity, magnetic moment, quadrupole moment and binding energy of a nucleus. Two nucleon system, deuteron problem, tensor forces, pp and pn scattering experiments at low energy, scattering length, effective range theory, spin dependence of nuclear forces, charge independence and charge symmetry of nuclear forces, exchanges forces: Bartlett, Heisenberg, Majorana forces and potentials, meson theory of nuclear forces.

Unit-II

Nuclear Models: Liquid drop model, semi-empirical mass formula, Bohr-Wheeler theory of fission, experimental evidence for shell structure of nucleus, shell model, spin-orbit coupling, applications of shell model like angular momenta, parities, magnetic moments (Schmidt lines) of nuclear ground states, collective model, nuclear vibrations spectra and rotational spectra, Nilsson model.

Unit-III

Nuclear Decay: Beta decay: Types of beta decay, neutrino hypothesis, Fermi theory of beta decay, detection of neutrino, total decay rate, comparative half-lives, angular momentum and parity selection rules in beta decay, allowed and forbidden transitions, parity violation in beta decay. Gamma decay: Multipole transitions in nuclei, angular momentum and parity selection rules in gamma decay, internal conversion, nuclear isomerism.

Unit-IV

Nuclear Reactions: Introduction to nuclear reactions, conservations laws, cross sections in terms of partial wave amplitudes, compound and direct nuclear reaction mechanisms, Breit Winger one level formula, Resonance scattering. Nuclear fission, nuclear fusion.

Reference books:

1. Nuclear Physics by R.R. Roy and B.P. Nigam-New Age International Publishers
2. Introductory Nuclear Physics by K.S. Krane-Wiley, New York
3. Nuclear Physics by G.N. Ghoshal-S. Chand and Co.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3395

CONDERNSED MATTER LAB-II

Course Outcomes

Upon completion of this course, the student will be able to:

CO 1. Understand the mechanism of domain formation in ferromagnetic materials and to

CO 2. find the energy losses in various ferromagnetic materials

CO 3. Understand the concept of Curie temperature.

CO 4. Understand the concept of charge storage mechanism in p-n junction diodes

CO 5. Understand the phonon and photon interactions in materials

CO 6. Will learn to work with the travelling, transmission and reflection of microwaves.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3395

CONDERNSED MATTER LAB-II

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on mid-semester test/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

1. To determine the energy loss in transformer and ferrite cores using B-H curve.
2. To determine Curie temperature of ferrites.
3. To determine Stefan's constant using Boltzmann's Law.
4. To study the depletion capacitance and its variation with reverse bias in a p-n junction.
5. To determine the lattice dynamics and dispersion relation for the monatomic and diatomic lattices.
6. To find the Young's modulus of a material using ultrasonic interferometer for solids
7. Experiments with Microwaves set up.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3396

NUCLEAR PHYSICS LAB

Course Outcomes

Upon completion of this course, the student will be able to:

CO 1. Carry out experimental work using NaI (Tl) scintillation detector and GM counter in the field of radiation shielding and radioactive analysis of various materials.

CO 2. Understand the interaction of beta particles, alpha particles and gamma ray with matter.

CO 3. Understand the importance of statistical nature of radioactivity in the field of radioactive analysis.

CO 4. Investigate the attenuation power of various materials for alpha, beta and gamma radiation.

Master of Science (Physics)

SEMESTER III

(SESSION 2021-22)

COURSE CODE: MPHL-3396

NUCLEAR PHYSICS LAB

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on mid-semester test/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

1. Pulse-Height Analysis of Gamma Ray Spectra.
2. Energy calibration of Scintillation Spectrometer.
3. Least square fitting of a straight line.
4. Study of absorption of gamma rays in matter.
5. Study of the characteristics of a G.M. Counter.
6. Study of the Dead time of a G.M. Counter.
7. Study of absorptions of Beta Particles in Matter.
8. Window thickness of a G.M. Tube.
9. Investigation of the statistics of radioactive measurements.
10. Study of Poisson Distribution.
11. Study of Gaussian Distribution.
12. Study of absorption alpha-particles in matter.

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL-4391

PARTICLE PHYSICS

Course Outcomes

CO1: After completing this course the students will understand the fundamental principles and concepts governing particle physics. The students will learn various experimental techniques used in discovering the elementary particles and their various properties such as mass, lifetime, parity and spin.

CO2: Students will be able to understand the role of symmetries in particle physics. They will acquire basic knowledge on the fundamental forces of universe and various conservation laws followed in these forces (interactions).

CO3: Students will also learn the concept of CP violation in detail which will lead them to their knowledge about current area of research on the missing antimatter of universe.

CO4: The students will learn the Feynman rules and their application in calculating the cross sections for various particle interactions.

CO5: They will also be able to understand the theory of spontaneous breaking symmetry and its application to Higgs mechanism. Students will also have a broad overview of the standard model of particle physics and its predictions.

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL-4391

PARTICLE PHYSICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on mid-semester test/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters for final examination: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

Unit-I

Elementary Particles and Their Properties: Historical survey of elementary particles and their classification, fundamental forces of nature, determination of mass, life time, decay mode, spin and parity of muons, pions, kaons and hadrons, introduction to antiparticles, relativistic kinematics.

Unit-II

Symmetries and Conservation Laws: Conserved quantities and symmetries, the electric charge, baryon number, lepton number, hypercharge (strangeness), the nucleon isospin, isospin invariance, isospin of particles, Gellmann-Nishijima formula, parity operation, charge conjugation, positronium decay, CP violation and $K^o - \overline{K^o}$ doublet, time reversal invariance, CPT theorem, Gellmann's eightfold way of hadrons, quark model.

Unit-III

Week Interactions: Classification of weak interactions, τ-θ puzzle, parity violation in beta decay, parity violation in Λ-decay, the two component neutrino theory, measurement of neutrino helicity (Goldhaber's experiment), the V-A interaction, weak decays of strange-particles and Cabibbo's theory, GIM mechanism, CKM matrix.

Unit-IV

Gauge theory and neutrino oscillation: Gauge symmetry, field equations for scalar (spin 0), spinor (spin ½), vector (spin-1) and fields, global gauge invariance, local gauge invariance, Feynmann rules, spontaneously broken symmetries in the field theory, Higgs mechanism, neutrino mass, neutrino oscillations.

Reference books:

1 Introduction to Elementary Particles by D. Griffiths-Wiley-VCH.
2 Introduction to High Energy Physics by D.H Perkins-Cambridge University Press.
3 Nuclear Physics by S.N. Ghoshal-S. Chand and Co.

Master of Science (Physics)

SESSION 2021-22

SEMESTER-IV

COURSE CODE: MPHL-4392

STATISTICAL MECHANICS

Course

After passing this course, students will be able to understand:

CO1: Why statistical mechanics arose, its basic contact with thermodynamics. How the diffusion problem of different and similar gases was resolved i.e. Gibbs paradox. The movement of phase points i.e. Liouville's theorem.

CO2: Students will understand the ensemble language of statistical mechanics i.e. micro canonical, canonical and grand canonical ensemble. Their description in terms of partition function and various areas where they are implied such as classical ideal gas, system of harmonic oscillators, paramagnetic behavior of gases, cluster expansion of classical gas. The need of switching from micro canonical to canonical and hence from canonical to grand canonical ensemble has also been explained.

CO3: Till now only the classical description of statistical mechanics has been explained, but now the students will understand about the quantum description also in terms of density matrix, also the quantum statistics of various ensembles. Various examples have also been explained.

CO4: Quantum description of classical gas has been fully described. Detailed quantum analysis of Bose Einstein statistics and Fermi Dirac statistics has been studied. Students will be able to understand the phenomenon of Bose Einstein condensation, gas of photons and phonons. Fermi Dirac Statistics has been explained through electron gas in metals, paramagnetic behavior of gases and about the life cycle of white dwarf stars.

Master of Science (Physics)

SESSION 2021-22

SEMESTER-IV

COURSE CODE: MPHL-4392

STATISTICAL MECHANICS

Maximum Marks: External 80 | Examination Time: 3 Hours
Internal 20 | Total Teaching hours: 60
Total 100 | Pass Marks: 40

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I: Classical Statistical Mechanics I

Foundations of statistical mechanics; specification of states in a system, contact between statistics and thermodynamics, the classical ideal state, the entropy of mixing and Gibbs paradox. The phase space of a classical system, Liouville's theorem and its consequences.

15 Lectures

UNIT-II: Classical Statistical Mechanics II

The microcanonical ensemble with examples. The canonical ensemble and its thermodynamics, partition function, classical ideal gas in canonical ensemble theory, energy fluctuations in the canonical ensemble. A system of harmonic oscillators. The statistics of paramagnetism. The grand canononical ensemble, the physical significance of the statistical quantities, examples, fluctuation of energy and density. Cluster expansion of classical gas, the virial equation of state.

15 Lectures

UNIT-III: Quantum Statistical Mechanics I

Quatum states and phase space, the density matrix, statistics of various ensembles. Example of electrons in a magnetic field, a free particle in a box and a linear harmonic oscillator. Significance of Boltzamann formula in classical and quantum statistical mechanics.

15

Lectures UNIT-IV: Quantum Statistical Mechanics II

An ideal gas in quantum mechanical microcanonical ensemble. Statistics of occupation numbers, concepts and thermodynamical behaviour of an ideal gas. Bose Einstein condensation. Discussion of a gas of photons and phonons. Thermodynamical behaviour of an ideal fermi gas, electron gas in metals, Pauli's paramagnetism, statistical equilibrium of white dwarf stars.

15

Lectures

Text and Reference Books

1. Statistical Mechanics . Patharia Butterworth-Heineman, 1996
2. Statistical Mechanics: Kerson Huang-Wiley-1963.

Master of Science (Physics)

SESSION 2021-22

SEMESTER-IV

COURSE CODE: MPHL-4393/94 (OPT-1)

OPTICS AND PHOTONICS

Course Outcomes:

After completing this course, the students will be able to :

CO1: understand basics idea about different types of wave guides.

CO2: understand basics of Gaussian Beam Propagation and electromagnetic propagation in anisotropic media

CO3: understand basics of Electro-optics and Acoustic-optics.

CO4: understand basic optoelectronics devices.

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SESSION 2021-22

SEMESTER-IV

COURSE CODE: MPHL-4393/94 (OPT-1)

PHOTONICS

Maximum Marks: External 80 Examination Time: 3 Hours

Internal 20 Total Teaching hours: 60

Total 100 Pass Marks: 40

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four

Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

UNIT I

Guided Wave Optics: Planar slab waveguides, Rectangular channel waveguides, Single and multimode optical fibers, waveguide modes and field distributions, waveguide dispersion, pulse propagation

UNIT II

Gaussian Beam Propagation: ABCD matrices for transformation of Gaussian beams, applications to simple resonators

Electromagnetic Propagation in Anisotropic Media: Reflection and transmission at anisotropic interfaces, Jones Calculus, retardation plates, polarizers

UNIT III

Electro-optics and Acousto-optics: Linear electro-optic effect, Longitudinal and transverse modulators, amplitude and phase modulation, Mach-Zehnder modulators, Coupled mode theory, Optical coupling between waveguides, Directional couplers, Photoelastic effect, Acousto-optic interaction and Bragg diffraction, Acousto-optic modulators, deflectors and scanners

UNIT IV

Optoelectronics: p-n junctions, semiconductor devices: laser amplifiers, injection lasers, photoconductors, photodiodes, photodetector noise.

Recommended Books

1. Fundamentals of Photonics by B. E. A. Saleh and M. C. Teich (2nd Edition), John Wiley (2007)

2. Photonic Devices by J-M. Liu, Cambridge (2009)

3. Photonics: Optical Electronics in Modern Communications by A. Yariv and P. Yeh, Oxford (2006)

4. Optics by E. Hecht (4thEdition), Addison-Wesley (2001)

Master of Science (Physics)

SESSION 2021-22

COURSE CODE: MPHL-4392

SEMESTER IV

COURSE CODE: MPHL- 4393/94 (OPT-II)

COURSE TITLE: RADIATION PHYSICS

Course outcomes

CO 1. Radiation Physics aim at study the knowledge of ionizing Radiation and Radiation Quantities.

CO 2. Make students familiar with various types of dosimeters.

CO 3. The students will have knowledge of Radiation effects and its protection.

CO 4. Develop a knowledge and understanding of the radiation shielding.

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94 (OPT-II)

COURSE TITLE: RADIATION PHYSICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**

Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

Unit – 1

Ionizing Radiations and Radiation Quantities:

Types and sources of ionizing radiation, fluence, energy fluence, kerma, exposure rate and its measurement - The free air chamber and air wall chamber, Absorbed dose and its measurement ; Bragg Gray Principle, Radiation dose units - rem, rad, Gray and sievert dose commitment, dose equivalent and quality factor.

Unit- II

Dosimeters:

Pocket dosimeter, films, solid state dosimeters such as TLD, SSNTD, chemical detectors and neutron detectors. Simple numerical problems on dose estimation.

Unit- III

Radiation Effects and Protection:

Biological effects of radiation at molecular level, acute and delayed effects, stochastic and nonstochastic effects, Relative Biological Effectiveness (RBE), Linear energy transformation (LET), Dose response characteristics. Permissible dose to occupational and non-occupational workers, maximum permissible concentration in air and water, safe handling of radioactive materials, The ALARA, ALI and MIRD concepts, single target, multitarget and multihit theories, Rad waste and its disposal, simple numerical problems.

Unit - IV

Radiation Shielding:

Thermal and biological shields, shielding requirement for medical, industrial and accelerator facilities, shielding materials, radiation attenuation calculations-The point kernal technique, radiation attenuation from a uniform plane source. The exponential point-Kernal. Radiation attenuation from a line and plane source. Practical applications of some simple numerical problems.

Books :

1. Nuclear Reactor Engineering by . S. Glasstone and A. Sesonke ,Van Nostrand Reinhold.
2. Radiation Theory by Alison. P. Casart
3. Radiation Biology-Radiation Bio by A. Edward Profio /Prentice Hall.
4. Introduction to Radiological Physics and Radiation Dosimetry by F.H. Attix -Wiley-VCH.

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SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94 (OPT-III)

COURSE TITLE: REACTOR PHYSICS

Course Outcomes-

CO1. Reactor Physics aims to give an insight on functioning of Reactors.
CO2. To learn about Reactor safety and control
CO3.Types of reactors and detailed working of Indian nuclear reactors

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SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94(OPT-III)

COURSE TITLE: REACTOR PHYSICS

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

Interaction of Neutrons with Matter in Bulk:
Thermal neutron diffusion, Transport and diffusion equations, transport mean free path, solution of diffusion equation for a point source in an infinite medium and for an infinite plane source in a finite medium, extrapolation length and diffusion length-the albedo concept.

Lectures 15

Moderation of Neutron:
Mechanics of elastic scattering, energy distribution of thermal neutrons, average logarithmic energy decrement, slowing down power and moderating ration of a medium. Slowing down density, slowing down time, Fast neutron diffusion and Fermi age theory, solution of age equation for a point source of fast neutrons in an infinite medium, slowing down length and Fermi age.

Lectures 15

Theory of Homogeneous Bare Thermal and Heterogeneous Natural Uranium Reactors
Neutron cycle and multiplication factor, four factor formula, neutron leakage, typical calculations of critical size and composition in simple cases, The critical equation, material and geometrical bucklings, effect of reflector, Advantages and disadvantages of heterogeneous assemblies, various types of reactors with special reference to Indian reactors and a brief discussion of their design feature.

Lectures 15

Power Reactors Problems of Reactor Control
Breeding ratio, breading gain, doubling time, Fast breeder reactors, dual purpose reactors, concept of fusion reactors, Role of delayed neutrons and reactor period, In hour formula, excess reactivity, temperature effects, fission product poisoning, use of coolants and control rods.

Lectures 15

Books:

1. The elements of Nuclear reactor Theory by Glasstone & Edlund-VamNostrand, 1952.
2. Introductions of Nuclear Engineering by Murray-Prentice Hall, 1961.

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SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94(OPT-IV)

COURSE TITLE: NANOTECHNOLOGY

Course Outcomes :

After completion of this course the students will be able to :

CO1: understand basic ideas of nanotechnology and synthesis techniques of nano materials.

CO2: understand the basics of various characterisation techniques for nano materials.

CO3: understand the preparation methods and applications of Carbon Nanotubes and other Carbon based materials.

CO4:understand properties of Nanosemiconductors and their applications as Nano sensors.

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94(OPT-IV)

COURSE TITLE: NANOTECHNOLOGY

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

SECTION-A

Introduction and Synthesis of Nano Materials:

Introduction, Basic idea of nanotechnology, nanoparticles, metal Nanoclusters, Semiconductor nanoparticles, Physical Techniques of Fabrication, inert gas condensation, Arc Discharge, RF plasma, Ball milling, Molecular Beam Epitaxy, Chemical Vapour deposition, Electro deposition, Chemical Methods-Metal nanocrystals by reduction, Photochemical synthesis,

Electrochemical synthesis, Sol-gel, micelles and microemulsions, Cluster compounds. Lithographic Techniques- AFM based nanolithography and nanomanipulation, E-beam lithography and SEM based nanolithography, X ray based lithography.

(Lectures 15)

SECTION-B

Characterization Techniques:

X-ray diffraction, data manipulation of diffracted X-rays for structure determination, Scanning Probe microscopy, Scanning Electron microscopy, Transmission Electron Microscopy, ScanningTunneling Microscopy, Optical microscopy, FTIR Spectroscopy, Raman Spectroscopy, DTA, TGA and DSC measurements

(Lectures 15)

SECTION-C

Carbon Nanotubes and other Carbon based materials:

Preparation of Carbon nano tubes, CVD and other methods pf preparation of CNT, Properties of CNT; Electrical, Optical, Mechanical, Vibrational properties etc. Application of CNT; Field emission, Fuel Cells, Display devices. Other important Carbon based materials; Preparation and Characterization of Fullerence and other associated carbon clusters/molecules, Graphene preparation, characterization and properties, DLC and nano diamonds.

(Lectures 15)

SECTION-D

Nanosemiconductors and Nano sensors:

Semiconductor nanoparticles-applications; optical luminescence and fluorescence from direct band gap semiconductor nanoparticles, carrier injection, polymers-nanoparticles, LED and solarcells, electroluminescence. Micro and nanosensors; fundamentals of sensors, biosensor, microfluids, MEMS and NEMS, packaging and characterization of sensors.

(Lectures 15)

Books:

1. Solid State Physics: J.P. Srivastva-Prentice Hall, 2007.
2. Introduction to nanoscience and Nanotechnology: K.K. Chattopadhyay and A.N. Banerjee- PHI Learning Pvt. Ltd. 2009
3. Nanotechnology Fundamentals and Applications: Manasi Karkare, I.K.- International Publishing House, 2008.
4. Nanomaterials: B. Viswanathan- Narosa, 2009.
5. Encyclopedia of Nanotechnology: H.S. Nalwa-American Scientific Publishers, 2004.
6. Introduction to Nanotechnology: Charles P. Poole Jr. and Franks J. Qwens,-John Wiley & Sons, 2003.
7. Nanostructures and Nanomaterials, Synthesis, Properties and Applications: Guoahong Cao- Imperial College Press, 2004.
8. Springer Handbook of Nanotechnology: Bharat Bhushan-Springer, 2004.
9. Science of Engineering Materials: C.M. Srivastva and C. Srinivasan-New Age International, 2005.
10. The Principles and Practice of electron Microcopy: Ian. M. Watt-Cambridge University Press, 1997.
11. Ultrasonic Testing of Materials: J.K. Krammer and H.K. Krammer-Springer Verlag,

1996.
12. Physical Properties of Carbon Nanotube: R. Satio, G. Dresselhaus and M. S. Dresselhaus- Imperial College Press, 1998.
13. Sensors Vol. 8, Micro and Nanosensor Technology: H. Meixner and R. Jones (Editor)- John Wiley and Sons, 2000.

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94(OPT-V)

COURSE TITLE: MATERIAL SCIENCE

Course Outcomes:

After successful completion of this course, the students will be able to:

CO1: understand basics about thin films and various methods used to prepare thin films.

CO2: understand basics of Polymers and Ceramics and their characeristics.

CO3: **understand** Spectroscopic techniques like UV-VIS, NMR & Photoluminescence Transmission electron microscopy (TEM), Scanning electron microscopy (SEM)

CO4: understand the characterisation techniques like XRD, Auger electron spectroscopy (AES), X-ray photoelectron spectroscopy (XPS), Secondary ion mass spectroscopy (SIMS)

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94(OPT-V)

COURSE TITLE: MATERIAL SCIENCE

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

UNIT I

Thin Film Technology: Classification of Thin films configurations; Film deposition method: Physical vapor deposition, Chemical vapor deposition, Spray pyrolysis, Sputtering (RF, DC); Modes of film growth by vapor deposition: from vapor to adatoms, from adatoms to film growth, growth modes based on surface energies; film microstructure: Epitaxial films, polycrystalline films

UNIT II

Polymers & Ceramics: Characteristics, Application and Processing of polymers; Polymerization, Polymer types: Stress- Strain behaviour, melting and glass transition, thermosets and thermoplasts; Characteristics, Application and Processing of Ceramics, glasses and refractories.

UNIT III

Characterization Techniques-I: Spectroscopic techniques: UV-VIS, NMR & Photoluminescence spectroscopy for characterization of materials. Transmission electron microscopy (TEM), Scanning electron microscopy (SEM)

UNIT IV

Characterization Techniques-II: X-ray diffraction, data manipulation of diffracted X-rays for structure determination; X-ray fluorescence spectrometry for element detection with concentration; Auger electron spectroscopy (AES), X-ray photoelectron spectroscopy (XPS), Secondary ion mass spectroscopy (SIMS)

Text and Reference Books:

1. Thin Film Materials-Stress, defect, formation and surface evolution: L.B. Freund and S. Suresh- Cambridge,

2. Thin Film Phenomena :K.L. Chopra-Mc Graw Hill Book, Comp.,1979.

3. Thin Film fundamentals: A. Goswami-New age International, 2007

4. Material Science and Engg :W.D. Callister-John Wiley, 2001

5. Elements of X-ray Diffraction (3rd edition) : B.D. Cullity, S.R. Stock-Prentice Hall, 2001.

6. X-ray Fluorescence spectroscopy: R. Jenkins-Wiley Interscience, New York, 1999.

7. Methods of Surface Analysis : J.M. Walls- Cambridge University Press, 1989.

8. The principles and Practice of Electron Microscopy: Ian M. Watt-Cambridge University Press, 1997

9. Modern techniques for surface science: D.P. Woodruff and T.A. Delchar- Cambridge University Press, 1994.

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94(OPT-VI)

COURSE TITLE: SPACE SCIENCE

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: understand Hydrostatics , Emission mechanisms and Excitation mechanism of the atmosphere of Earth.

CO2: understand the behaviour and properties of different layers of ionosphere

CO3: understand the Ionospheric Irregularities and disturbances and response of ionosphere to radio waves

CO4: know about the Sun and its active regions.

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

COURSE CODE: MPHL- 4393/94(OPT-VI)

COURSE TITLE: SPACE SCIENCE

Syllabus

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**

Out of 100 Marks, internal assessment (based on one mid-semester tests/ internal examinations, written assignment/project work etc. and attendance) carries 20 marks, and the final examination at the end of the semester carries 80 marks.

Note for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 16 marks.**

UNIT I

Hydrostatics, Heating of the upper atmosphere, Variations in the earth's atmosphere, Model atmosphere, The earth's exosphere.

Emission mechanisms, Airglow, Aurora, Morphology, Excitation mechanism, Auroral spectra.

UNIT II

Ionosphere: Ion-electron pair production, Ion-kinetics, Equilibrium, Ionospheric regions (D,E,F_1), Variations in these regions.

F_2 region: Formation of F_2-layer, Continuity equation, F_2-region anomalies, Thermal properties of the F_2-region.

UNIT III

Ionospheric Irregularities and disturbances: Spread-F, Travelling ionospheric disturbances, Perturbation by electromagnetic and corpuscular radiation, Ionospheric and magnetic storms.

Propagation of radio waves through ionosphere, Appleton Hartee equation. Faraday rotation.

UNIT IV

The Sun: Interior, A model, Outer atmosphere: Photosphere, Chromosphere, Transition region, Corona

Active Regions: Development and structure, Loops, Internal motions, Sunspots: Classification, Structure and evolution of sunspots, Solar cycle, Prominences, Solar flares (descriptive only).

Text Books:

1. Fundamentals of Aeronomy, R.C. Whitten & I.G. Poppoff, John Wiley & Sons Inc. 1971.
2. Priest, E.R., Solar Magnetohydrodynamics, D. Reidel Pub. Company, 1987
3. Introduction to Space Physics, Kivelson, M.G. and Russell, C.T., Cambridge University Press, 1996

Master of Science (Physics)

SESSION 2021-22

SEMESTER IV

ASSIGNMENT/PROJECT

Course No. MPHD-4395

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 20 **Total Teaching hours: 90**

Assignment and Project should be based on following techniques in:
1. Material Science
2. Computational Physics
3. Nuclear Physics
4. Advanced Theoretical Physics
5. Radiation Physics
6. Electronics

Note:
Evaluation committee will consist of following members:
1. External examiner
2. HOD, College/ Internal Examiner

FACULTY OF SCIENCES

SYLLABUS

Of

Physics for

Bachelor of Science (Home Science)

(Semester III & IV)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2021-22

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

Scheme and Curriculum of Examination of Three Year Degree Programme
Physics
Bachelor of Science (Home Science)

(Session 2021-22)

Semester-III							
Course Code	**Course Title**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		CA	
				L	**P**		
BHSL-3393	Basic Physics	C	50	40	-	10	3
Semester-IV							
BHSM-4396	Applied Physics	C	50	30	10	10	3+3

BASIC PHYSICS (Semester –III)
(Theory)

2021-22

Course Code : BHSL-3393

Course Outcome- After Completing this course the students will be able to

CO1: to understand the role of physics in working various household devices

CO2: to understand the natural phenomenon in our life.

Bachelor of Science (Home Science) (Semester –III) Session 2021-22

Course Title: BASIC PHYSICS
(Theory)

Course Code : BHSL-3393

Time: 3 Hours **External Marks: 40**
Internal Marks :10 **Pass Marks: 14**

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries eight marks.

CONTENTS

Unit-I

Measurements: S1 units and their advantages, Dimensions of basic physical quantities, simple idea of velocity, relative velocity, angular velocity, acceleration, angular acceleration, centripetal acceleration, centrifugal acceleration.

Unit-II

Force and Motion. Work, Power and Energy. Types of Energies. Friction and its use in daily life. Simple Machines: Lever, Wheel, pulley, inclined plane, wedges, gears, and their applications like Scissors, tongs, egg beater cork opener.

Unit-III

Concept of Pressure, Fluid pressure, atmospheric pressure and its consequences. Lift pump, gas stove, syringe flush tank, vacuum cleaner. Archimedes Principle. Concept of surface tension and viscosity and their role in daily life.

Unit- IV-

Heat: Expansion in solids, transmission of heat- conduction, convection, radiation, heat conductors and insulators (examples only).

Books Recommended:1. Avery House Physics.

2. Fundamentals of Physics Halliday Resnick, Walker.

3. N.C.E.R.T. Books of Physics For XI and XII

B.Sc. Home Science (Semester-III)

BASIC PHYSICS

(Practical)

(There Will be No Practical Exam in this Semester)

Pds- 2 pds/ week

1. Concept of least count and precise measurement of different instruments.

2. Measurement of diameter of a metallic share, cylinder, volume of a cube of a small glass slab, determine its density.

3. Measurement of diameter of a knitting needle, sewing needle, thickness of cloth, thickness of a coin using screw gauge.

4. Measurement of height of concave/convex mirror using spherometer.

5. Newton law of cooling of liquids.

6. Measurement of coefficient of friction.

7. Demonstration of centrifugal force in cloth dryer.

8. Verification of Archimedes' Principle.

9. Demonstration of atmospheric pressure and read atmospheric pressure from a barometer

in your laboratory

Bachelor of Science (Home Science)

2021-22

APPLIED PHYSICS (Semester IV)

(THEORY)

Course Code : BHSM-4396

Course Outcome- After Completing this course the students will be able to

CO1: to understand the role of physics in working various household devices

CO2: to understand the natural phenomenon in our life.

Bachelor of Science (Home Science)

2021-22

APPLIED PHYSICS (Semester IV)

(THEORY)

Course Code : BHSM-4396

Time: 3 Hours **External Marks: 30**
Internal Marks : 10 **Pass Marks: 11**

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. **Each question carries 6 marks.**

CONTENTS

UNIT -I

Thermostat, Concepts of home lighting: reflection, refraction, total internal refraction, diffusion of light, dispersion of light, Illumination, illumination intensity levels in different parts of the house.

UNIT-II

Sources of light, incandescent lamps, CFLs. Radiation and radiation spectra; uses of various radiations. (X- Rays, ultrasounds, microwaves, radio waves etc.

UNIT-III

Current Electricity, Principle of electrical energy generation and its transmission, Energy. meter, Fuse, Types of Fuses, Essential components of wiring, safety precautions while using electricity

UNIT-IV

Heating effect of current and its use in household devices, magnetic effect of current and its use in electric motor, grinder etc.

Books recommended:

1. Avery House Physics.
2. Fundamentals of Physics Halliday Resnick, Walker.
3. N.C.E.R.T. Books of Physics For XI and XII

FACULTY OF SCIENCES

Syllabus for

Bachelor of Science (Hons.) Mathematics

(Continuous Evaluation grading System)

(Semester I& II)

Session: 2021-22

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

Bachelor of Science (Hons.) Mathematics Semester–I &II

Session 2021-22

Semester I							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
BOMM-1396	**Mechanics**	C	100	60	20	20	3+3
Semester II							
BOMM- 2396	**Modern Physics**	C	100	60	20	20	3+3

Bachelor of Science (Hons.) Mathematics Semester–I

(2021-22)

Course Name: Mechanics

Course Code: BOMM-1396

Course Outcomes: Mechanics -Paper (A)

After passing this course, students will be able to:

CO1: Understand the various coordinate systems and its applications. Students will be able to know the conservations laws and the symmetries of space & time.

CO2: Know the fundamental forces of nature, concept of centre of mass, central forces and the motion of particle under central force and to determine the turning points of orbit.

CO3: Understand the frames of reference, coriolis forces and its applications and effect of rotation of earth on g.

CO4: understand the elastic collision in different systems, cross section of elastic scattering as well as Rutherford scattering and know the motion of rigid body.

Bachelor of Science (Hons.) Mathematics Semester–I

(2021-22)

Course Name: Mechanics

Course Code: BOMM-1396

Examination Time: 3 Hours **Total Teaching hours: 60**

Passing marks: 35% **Max. Marks: 100**
Theory:60 (External) **CA:20**

Instructions for Paper setter:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section. Each question carries 12 marks.

Section-A

Inertial Carterian and spherical polar co-ordinate systems: area, volume, displacement, velocity and acceleration in these systems, solid angles and frames of reference, Galilean transformation, Galilean Invariance of space & time intervals; fictitious forces. Effect of rotation of earth on 'g'. Effects of centrifugal and Coriolis forces produced as a result of earth's rotation.

Section-B

Internal forces and momentum conservation. Centre of mass. Elastic collisions in laboratory and center of mass systems; velocities, angles, energies in these systems and their relationships. Conservation of angular momentum and examples -shape of the galaxy, angular momentum of solar system. Torques due to internal forces, angular momentum about centre of mass. Cross-section of elastic scattering and impact parameter, Rutherford scattering.

Section-C

Forces in nature (qualitative). Central forces, Potential energy and force between a point mass and spherical shell, a point mass and solid sphere, gravitational and electrostatic self energy. Two body problem and concept of reduced mass. Motion of a body under central force; differential equation of the orbit, equation of orbit in inverse-square force field. Kepler's laws and their derivation.

Section-D

Equation of motion of a rigid body, Rotational motion of a rigid body in general and that of plane lamina. Rotation of angular momentum vector about a fixed axis. Angular momentum and kinetic energy of a rigid body about principal axis, Euler's equations.

Suggested Readings:

1. Mechanics-Berkeley Physics Course, Vol-I (second edition): C. Kittel, W. D. Knight, M. A. Ruderman, C. A. Helmholtz and R. J. Moyer-Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

2. Fundamentals of Physics: D. Halliday, R. Resnick and J. Walker (sixth edition)-Wiley India Pvt. Ltd., New Delhi, 2004.

3. Analytical Mechanics: S. K. Gupta, Modern Publishers.

4. An Introduction to Mechanics. Daniel Kleppner & Robert Kolenkow Tata Mc Graw Hill Publishing Company Ltd., New Delhi

Bachelor of Science (Hons.) Mathematics Semester–I

(2021-22)

SEMESTER–I
PHYSICS
PHYSICS PRACTICAL
Course code:BOMM-1396 (P)

Instructions to Practical Examiner
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, KanyaMahaVidyalaya, Jalandhar

General Guidelines for Practical Examination
I. The distribution of marks is as follows: **Marks: 20**
i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 8 experiments out of which an examinee will mark 6 experiments andone of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

LIST OF EXPERIMENTS

1. To study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass).
2. To establish relationship between torque and angular acceleration using fly wheel.
3. To find the moment of inertia of a flywheel.
4. Study of bending of beams and determination of Young's modulus.
5. Determination of Poisson's ratio for rubber.
6. To determine energy transfer, coefficient of restitution and verify laws of conservation of linear momentum and kinetic energy in elastic collisions using one dimensional collisions of hanging spheres.
7. Measure time period as a function of distance of centre of suspension (oscillation) from centre of mass, plot relevant graphs, determine radius of gyration and acceleration due to gravity.
8. Find the value of 'g' by Kater's pendulum.
9. Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
10. To measure logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.

B.Sc. (Hons.) Mathematics Semester–II

(2021-22)

Course Name: Modern Physics-I

Course Code: BOMM-2396

Course Outcomes

On passing this course the students will be able to

CO1: understand wave particle duality and use of this duality in studying crystal structure.

CO2: understand radioactivity and use of radio isotopes and radiation.

CO3: understand working and uses of nuclear radiation detectors.

CO4: Know about elementary particles and cosmic rays, their properties and conservation rules.

B.Sc. (Hons.) Mathematics Semester–II

(2021-22)

Course Name: Modern Physics

Course Code: BOMM-2396

Examination Time: 3 Hours	**LTP**
Total Teaching hours: 60	**3 0 1**
Passing marks: 35%	**Max. Marks: 100**
	Theory:60
	Practical:20
	CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section. Each question carries 6 marks

Section-A

Dual Nature of Matter and Radiation: De Brogile's hypothesis, electron diffraction experiments of Davission and Germer, Wave group and particle velocities, Heisenberg's uncertainty principle, principle of the electron microscope, Diffraction of X-rays from crystals, Planck's quantum hypothesis, Bragg's law of determination of structure of simple crystals.

Section-B

Radioisotopes and their Application: Radioactive decay laws, Uranium and Carbon dating, introduction to α, β and γ decays, Radioisotopes, their production and separation, mass spectrograph, uses of radioisotopes in medicine, agriculture and geology Radiation doses and their units, Biological effects of radiation.

Section-C

Nuclear detection: Principle, construction and application of gas-filled detectors Ionization detector, proportional counter, Geiger Muller detector, Cloud chamber, Scintillation counter and photographic emulsions as detectors.

Section-D

Elementary particles and cosmic rays, Classification of elementary particles and their properties, conservation laws. Antiparticles, Origin and general characterization of cosmic rays (Primary and Secondary)

Suggested Readings:

1. Concepts of Modern Physics: A. Beiser.
2. Essentials of Modern Physics: V. Acota and C. L. Grown
3. Fundamentals of Modern Physics: B.D. Duggal and C. L. Chhabra
4. Radiation and Particle Physics by KS Thind, Vishal Publications

B.Sc. (Hons.) Mathematics (Semester-II)
(2021-22)
COURSE CODE: BOMM-2396(P)
Physics Lab-II
(Practical)

Maximum Marks: 20 Examination Time: 3 Hour

Pass Marks: 35%

Instructions to Practical Examiner
Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, KanyaMahaVidyalaya, Jalandhar

General Guidelines for Practical Examination
I. The distribution of marks is as follows: **Marks: 20**

i) One experiment **7 Marks**
ii) Brief Theory **3 Marks**
iii) Viva–Voce **5 Marks**
iv) Record (Practical file) **5 Marks**
II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.
III. Number of candidates in a group for practical examination should not exceed 12.
IV. In a single group no experiment is to be allotted to more than three examinees in any group.

1. To Study characteristics of a solar cell.
2. To determine the ionization potential of mercury.

3. To study the photoelectric effect and determine the value of Planck's constant.

4. Study of variation of light intensity with distance using photovoltaic cell (Inverse Square Law).

5.To determine e/m ratio of electron using long solenoid method.

6. To draw the plateau of a GM counter and find the operating voltage of GM tube.

7. To study the absorption coefficient beta particles in aluminium using GM counter and find the absorption coefficients.

8. Study of C.R.O. as display and measuring device, Study of Sine wave, square wave signals

9. To measure an accessible distance between two points using a sextant.

10.To measure an inaccessible distance between two points using a sextant.

Text and Reference Books:

1. Practical Physics Vol.II, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications
2. Practical Physics, C.L. Arora, S. Chand & Co.