FACULTY OF SCIENCES

Physics Syllabi for Academic Council
Department of Physics
Session: 2023-24

The Heritage Institution

KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

(Under Continuous Evaluation System)

1. B.Sc. Non Medical and C.Sc. Sem III-VI
2. B.Sc.(Hons) Physics Sem Vand VI
3. B.Sc. Home Science Sem III and IV

(Under Credit Based Continuous Evaluation Grading System)

1. B.Sc. Non Medical and C.Sc. Sem I-II
2. M.Sc. Physics Sem I-II (For session 2023-24)
3. M.Sc. Physics Sem III-IV (For session 2023-24)
4. B.Sc. Hons Maths Sem I and II

Annexure E

FACULTY OF SCIENCES

SYLLABUS

of

Physics

For

Bachelor of Science Non-Medical & Computer Science

(Semester III to VI)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2023-24

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-2023-24

Physics Semester III

Course Name	Program Name	Course Code		Course Type	Marks					Examination time (in Hours)
					Total	Paper	Ext.		CA	
							L	P		
Physics	Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BSNM-3395 BCSM-3395	I	C	100	Statistical Physics and Thermodynamics	30	-	20	3
			II			Optics and Laser	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	Bachelor of Science (Non Medical) Bachelor of Science (Computer Science)	BSNM-4395 BCSM-4395	I	C	100	Quantum Mechanics	30	-	20	3
			II			Atomic and Molecular Spectra	30	-		3
			P			Physics Practical	-	20		3

Bachelor of Science 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	Bachelor of Science (Non Medical) Bachelor of Science (Computer Science)	BSNM-5395 BCSM-5395	I	C	100	Physics (Condensed Matter Physics)	30	-	20	3
			II			Physics (Electronics)	30	-		3
			P			Physics Practical	-	20		3

Bachelor of Science 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	Bachelor of Science (Non Medical) Bachelor of Science (Computer Science)	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

Bachelor of Science (Semester System) (12+3 System of Education)
(Session-2023-24)
Course code: BSNM-3395 (I) for Bachelor of Science (Non Medical)
BCSM-3395 (I) for Bachelor of Science (Computer Science)

Course Outcomes: PHY-Statistical Physics and Thermodynamics

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.

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

SEMESTER-III

(Session-2023-24)

Course code: BSNM-3395 (I) for Bachelor of Science (Non Medical)
BCSM-3395 (I) for Bachelor of Science (Computer Science)

STATISTICAL PHYSICS AND THERMODYNAMICS

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.

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

SEMESTER-III

(Session-2023-24)

Course code: BSNM-3395 (II) for Bachelor of Science (Non Medical)
BCSM-3395 (II) for Bachelor of Science (Computer Science)

PHYSICS (OPTICS AND LASER)

Course Outcomes:

After passing this programme the students will be able to:

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

CO2: understand the Huygen's Fresnel theory and diffraction, Fraunhoffer diffraction due to single slit, double slit and n slits, the concept of resolving power.

CO3: understand the concept the polarization of light and types of polarisers.

CO4: understand the fundamentals of lasers and its processes. The knowledge of different components and types of lasers and its applications

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

SEMESTER-III

(Session-2023-24)

Course code: BSNM-3395 (II) for Bachelor of Science (Non Medical)
BCSM-3395 (II) for Bachelor of Science (Computer Science)

PHYSICS (OPTICS AND LASER)

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, Conditions for sustained interference pattern, Coherent sources of light, Interference pattern by division of wave front, Fresnel Biprism, Displacement of fringes, Change of phase on reflection, Interference in thin films due to reflected and transmitted light, non reflecting films, Newton's Rings. Michelson Interferometer.

UNIT–II

Diffraction:
Huygen's Fresnel theory, half-period zones, Zone plate, Distinction between Fresnel and Fraunhoffer diffraction. Fraunhoffer diffraction due to single slit, rectangular and circular apertures, Effect of diffraction in optical imaging, Resolving power of telescope in diffraction grating, its use as a spectroscopic element and its resolving power, Resolving power of microscope

UNIT–III

Polarization:
Plane Polarized light, Elliptically polarized light, wire grid polarizer, Sheet polarizer, Mauls' Law, Brewester Law, Polarization by reflection and scattering, Double reflection, Nicol prism, Retardation plates, Production and Analysis of polarized light, Quarter and half wave plates.

UNIT–IV

Laser Fundamentals:
Derivation of Einstein relations, Concept of stimulated emission and population inversion, broadening of spectral lines, three level and four level laser schemes, Threshold and Schawlow Tonnes condition, Components of laser devices, types of lasers, Ruby and Nd:YAG lasers, He-Ne and CO_2 lasers construction, mode of creating population inversion and output characteristics, application of lasers –a general outline.

Text Reference Books:

1.Fundamentals of Optics: F.A. Jenkins and Harvey E White, (Megraw Hill) 4th Edition, 2001.
2. Optics: Ajoy Ghatak, (McMillan India) 2nd Edition, 7th Reprint, 1997
3. Optics: Born and Wolf, (Pergamon Press) 3rd Edition, 1965.
4. Laser Fundamentals: W.T. Silfvast (Foundation Books), New Delhi, 1996.
5. Laser and Non-Liner Optics: B.B. Laud (New Age Pub.) 2002
6. Laser: Svelto, Plenum Press) 3rd Edition, New York

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

SEMESTER-III

(Session-2023-24)

Course code: BSNM-3395 for Bachelor of Science (Non Medical)
BCSM-3395 for Bachelor of Science (Computer Science)

PHYSICS (PRACTICAL)

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.

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

SEMESTER-III

(Session-2023-24)

Course code: BSNM-3395 for Bachelor of Science (Non Medical)

BCSM-3395 for Bachelor of Science (Computer Science)

PHYSICS (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/ 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

Bachelor of Science (Semester System) (12+3 System of Education)
SEMESTER-IV
(Session-2023-24)
Course code: BSNM-4395 (I) for Bachelor of Science (Non Medical)
BCSM-4395 (I) for Bachelor of Science (Computer Science)
PHYSICS (**Quantum Mechanics)**

Course Outcomes: Quantum Mechanics

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 be able to find the solution of Schrödinger wave equation for simple systems in three dimensions and for Hydrogen atom in spherical coordinates.

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

SEMESTER–IV

(Session-2023-24)

PHYSICS

Course code: BSNM-4395 (I) for Bachelor of Science (Non Medical)
BCSM-4395 (I) for Bachelor of Science (Computer Science)

QUANTUM MECHANICS

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, 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

Application of Schrodinger wave equation to one dimensional problems:

Application of Schrodinger Equation for solving one dimensional Particle in a box, One dimensional step potential for $E>V0$, one dimensional step potential for $0<E<V0$,
one dimensional potential barrier of finite height and width, Quantum mechanical tunnelling effect, one dimensional square well of finite depth

UNIT–IV

Application of Schrodinger equation to three dimensional problems:

Free particle in three dimensional rectangular box, Eigen wave function, Eigen values of momentum, energy and degeneracy, three dimensional harmonic oscillator (Cartesian coordinates) wave function, energy levels, degeneracy, Schrodinger's wave equation in spherical polar co-ordinates, Schrodinger wave equation for spherically symmetric potential for hydrogen atom, wave function of H atom, $\phi(\Phi)$,θ (Θsolution of R(r), equations.

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.

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

SEMESTER–IV

(Session-2023-24)

PHYSICS (ATOMIC AND MOLECULAR SPECTRA)

Course code: BSNM-4395 (II) for Bachelor of Science (Non Medical)
BCSM-4395 (II) for Bachelor of Science (Computer Science)

Course Outcomes: PHY- ATOMIC AND MOLECULAR SPECTRA

(Session-2023-24)

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

CO2: understand spectra of alkali atoms and Zeeman effect

CO3: demonstrate understanding of exchange symmetry of wave function, different coupling schemes and spectra of atoms with more than one electron.

CO4: Students will understand concept of X rays spectra and molecular spectra including rotational, vibrational and Raman Spectra

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

SEMESTER–IV

(Session-2023-24)

PHYSICS (ATOMIC AND MOLECULAR SPECTRA)

Course code: BSNM-4395 (II) for Bachelor of Science (Non Medical)
BCSM-4395 (II) for Bachelor of Science (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

Introduction to Atomic Spectra:

Observation of spectra, Types of spectra, Spectral analysis, Units in spectroscopy, Bohr's Theory and Hydrogen spectrum, Spectral series, Bohr's correspondence Principle, quantum numbers, The Spinning electron and the vector model, Stern Gerlach Experiment, Total Quantum number, Term values, Magnetic moment(Orbital, Spin and Total)

UNIT–II

One Electron Atomic Spectra:

Electron Spin orbit interaction, Fine and Hyperfine structure of Hydrogen atom, Energy level and different series of alkali spectra, Doublet structure in alkali Spectra (Fine Structure), Selection rules for doublets, Zeeman Effect and its experimental setup, Classical theory of Normal Zeeman effect, Quantum theory of Normal and anomalous Zeeman effect

UNIT–III

Many Electron System Spectra:

Exchange symmetry of wave function, Pauli's Exclusion principle, Electronic configuration and atomic states, shells, subshells 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–IV

X Ray and Molecular Spectra:

Production of X-rays and Types of X-ray spectra, Mosley law, Molecular bonding, Molecular spectra, selection rules, symmetric structure, Rotational Vibrational, electronic level and spectra of molecules, Raman spectra. Introduction to Raman spectra.

Text Reference Books:

1. Introduction to Atomic Spectra 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)

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

SEMESTER–IV

(Session-2023-24)

Course Outcomes: PHYSICS Lab Sem IV

Course code: BSNM-4395 for Bachelor of Science (Non Medical)
BCSM-4395 for Bachelor of Science (Computer Science)

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.

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

SEMESTER–IV

(Session-2023-24)

PHYSICS

(PRACTICAL)

Course code: BSNM-4395 for Bachelor of Science (Non Medical)

BCSM-4395 for Bachelor of Science (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 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-2023-24))
PHYSICS (CONDENSED MATTER PHYSICS)
(THEORY)

Course code: BSNM-5395 (I) for Bachelor of Science (Non Medical)
BCSM-5395 (I) for Bachelor of Science (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 2023-24)
PHYSICS (CONDENSED MATTER PHYSICS)
(THEORY)

Course code: BSNM-5395 (I) for Bachelor of Science (Non Medical)
BCSM-5395 (I) for Bachelor of Science (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, One Dimensional Monoatomic Lattice, Dispersion relation, phonons, phonon momentum during elastic and inelastic scattering, Inelastic scattering of photons by phonons, Specific heat of solids, Classical Model of specific heat of solids (Dulong and Petit's Law), Einstein and Debye Models of Specific Heat of Solids. T3 law.

UNIT–IV

Free electron model of metals, Free electron, Fermi gas and Fermi energy. 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 2023-24)
PHYSICS (ELECTRONICS)
Course code: BSNM-5395 (II) for Bachelor of Science (Non Medical)
BCSM-5395 (II) for Bachelor of Science (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 2023-24)
PHYSICS (ELECTRONICS)
Course code:BSNM-5395 (II) for Bachelor of Science (Non Medical)
BCSM-5395 (II) for Bachelor of Science (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, photo diode 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 2023-24)
PHYSICS PRACTICAL
Course code: BSNM-5395 for Bachelor of Science (Non Medical)
BCSM-5395 for Bachelor of Science (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 2023-24)
PHYSICS PRACTICAL
Course code: BSNM-5395 for Bachelor of Science (Non Medical)
BCSM-5395 for Bachelor of Science (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, 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.

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 2023-24)
PHYSICS (NUCLEAR PHYSICS)
(THEORY)

Course code: BSNM-6395 (I) for Bachelor of Science (Non Medical)
BCSM-6395 (I) for Bachelor of Science (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 2023-24)
PHYSICS (NUCLEAR PHYSICS)
(THEORY)
Course code: BSNM-6395 (I) for Bachelor of Science (Non Medical)
BCSM-6395 (I) for Bachelor of Science (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 2023-24)
PHYSICS (RADIATION AND PARTICLE PHYSICS)
Course code:BSNM-6395 (II) for Bachelor of Science (Non Medical)
BCSM-6395 (II) for Bachelor of Science (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 model.

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

(Semester–VI) (Session 2023-24)

PHYSICS (RADIATION AND PARTICLE PHYSICS)

Course code: BSNM-6395 (II) for Bachelor of Science (Non Medical)
BCSM-6395 (II) for Bachelor of Science (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

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–VI)
(Session 2023-24)
PHYSICS PRACTICAL
Course code: BSNM-6395 (P) for Bachelor of Science (Non Medical)
BCSM-6395 (P) for Bachelor of Science (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 2023-24)

PHYSICS PRACTICAL

Course code: BSNM-6395 (P) for Bachelor of Science (Non Medical)
BCSM-6395 (P) for Bachelor of Science (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, 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 isto 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 F

Faculty of Sciences

Syllabus for

Bachelor of Science (Honours) Physics

(Under Continuous Evaluation System)

(SEMESTER: III-VI)

Session – (2023-24)

Kanya Maha Vidyalaya, Jalandhar
(Autonomous)
The Heritage Institution

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Honours) Physics

Session-2023-24

Semester V

Sr. No.	Course Code	Course Type	Course Title	Max Marks				Examination time in Hours)
				Total	Ext		Int	
					L	P		
1	BOPL-5391	C	Condensed Matter Physics – I	75	60	-	15	3
2	BOPL-5392	C	Quantum Mechanics	75	60	-	15	3
3	BOPL-5393	C	Nuclear Physics	75	60	-	15	3
4	BOPL-5394	C	Electronics	75	60	-	15	3
5	BOPP -5395	C	Physics Lab-V	50	-	40	10	3
6	BOPS-5396	C	Seminar and Assignment	50	-	40	10	3
7	SECJ-5551	AC	Job Readiness Course	25	20	-	5	1
	Total			**400**				

Semester VI

Sr. No.	Course Code	Course Type	Course Title	Max Marks				Examination time in Hours)
				Total	Ext		Int	
					L	P		
1	BOPL-6391	C	Radiation and Particle Physics	75	60	-	15	3
2	BOPL-6392	C	Condensed Matter Physics – II	75	60	-	15	3
3	BOPL-6393	C	Molecular Spectroscopy and Laser	75	60	-	15	3
4	BOPL-6394	C	Digital Electronics and Applications	75	60	-	15	3
5	BOPP -6395	C	Physics Lab-VI	50	-	40	10	3
6	BOPP-6396	C	Physics Lab-VII	50	-	40	10	3
	Total			**400**				

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

BACHELOR OF SCIENCE (HONOURS) PHYSICS

SEMESTER–V

SESSION 2023-24

CONDENSED MATTER PHYSICS – I

Course No. BOPL- 5391

Course Outcomes: CONDENSED MATTER PHYSICS – I

After passing this course, students will be able to:

CO 5. Understand basics about crystal structures in solids, various types of crystal structure, unit cells and symmetry operations.

CO 6. Student will also understand the experimental methods to determine crystal structures, reciprocal lattice, Brillouin zones and form factor.

CO 7. Student will understand the concept of free electron model and its applications in explaining concepts of electric conductance.

CO 8. Build concept about Kronig Penny model and its application to band theory to differentiate insulators, semiconductors and conductors, Hall effect

BACHELOR OF SCIENCE (HONOURS) PHYSICS (**SESSION 2023-24**)
SEMESTER- V
COURSE CODE: BOPL- 5391

CONDENSED MATTER PHYSICS – I

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 35% **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. **Each question carries 12 marks.**

Note: Students can use scientific calculators or logarithmic tables.

Unit – I

Crystal structure, Symmetry operations for a two 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, Brillouin zones and its derivation in two dimensions, atomic from factor and Structure factor.

Unit – III

Free Electron Theory: Drude-Lorentz theory, the electrical conductivity and Ohm's Law, the thermal conductivity of metals. Wiedemann Frenz law, Sommerfeld model, the Fermi-Dirac distribution, density of electronic states, Fermi energy for one and three dimensions, average kinetic energy

Unit – IV

Band Theory: Formation of energy bands, Bloch theorem, Kronig - Penney model of an infinite one dimensional crystal, band structures, effective mass, classification of insulators, semiconductors and metals. P and N type of semiconductors, conductivity of semiconductors, mobility, P and N type of semiconductors, conductivity of semiconductors, Fermi levels in P and N type of semiconductors, Hall effect, Hall coefficient.

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.

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER– V
SESSION 2023-24

QUANTUM MECHANICS

Course No. BOPL- 5392

Course Outcomes: Quantum Mechanics

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

CO1: Understand about the need of quantum mechanics and wave nature exhibited by the quantum particle. They will also learn to define a wavefunction of a free particle and under potential

CO2: Understand the concept of operators and expectation values, and their applications in quantum mechanics. They will also be capable of applying the concept of eigen functions, eigen values.

CO3: Apply Schrodinger's wave equation to solve one dimensional probems in quantum mechanics and to understand the concept of uncertainty in quantum mechanic.

CO4: Apply Schrodinger's wave equation to three dimensional problems and understand the concept of spherically symmetric potentials. They will be able to apply the concept to solve spherical potentials using the spherical coordinates system.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (**SESSION 2023-24**)
SEMESTER– V

COURSE CODE: BOPL- 5392
QUANTUM MECHANICS

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 35% **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. Each question carries 12 marks.

Note: Students can use scientific calculators or logarithmic tables.

UNIT-I

The Schrodinger Wave equation: Classical versus quantum mechanics, Quantum theory of light: photoelectric effect and Compton scattering, Debroglie wavelength and matter waves: Davisson-Germer experiment, Wave description of particles by wave packet, Group and phase velocities and relation between them, Fundamental postulates of quantum mechanics, Schrodinger Wave equation - one dimensional time dependent Schrodinger equation for free particle and particle under a potential V(x), time independent Schrodinger equation for free particle and particle under a potential V(x), time dependent and time independent 3D Schrodinger wave equation, physical interpretation of wave function, Characteristics to the solution of Schrodinger Wave equation, normalization of wave function, stationary state, conservation of probability, probability current density, conditions of admissibility of the wave function.

UNIT–II

Operator formalism in Quantum mechanics: Operators- operator algebra, linear operators, Laplacian operator, Null operator, identity operator, Hermitian operator, Adjoint or Hermitian conjugate of an operator, Parity operator, operators corresponding to different dynamical variables-Linear Momentum operator, Energy operator, angular momentum operator (in Cartesian and in Spherical polar coordinates), eigen functions and eigen values, commutators- commutator algebra, commutator for position and momentum, commutator for energy and time, Expectation value of dynamical quantities, Gaussian wave packet, Motion of wave packet or Ehrenfest Theorem, properties of Gaussian wave packet, Schwarz inequality, exact statement and proof of uncertainty principle for wave packets.

UNIT–III

Application of Schrodinger wave equation to 1D problems: Particle in one dimensional box, A single step potential, one dimensional rectangular potential barrier, Quantum mechanical tunnelling effect, Application to barrier penetration α decay, One dimensional square well potential , linear harmonic oscillator- energy of oscillator, classical and quantum

mechanical treatment and eigen values, significance of zero point energy, uncertainty relation, and wave function, application of linear harmonic oscillator.

UNIT–IV

Application of Schrodinger equation to three dimensional problems: Hydrogen atom - Particle in spherical symmetric potential, solution of R, θ, φ equations, spherical harmonics, wave function of H atom, solution of θ, φ, R equations,, complete wave function, radial probability density, energy values of H atom, degeneracy, polar graphs of probability distribution function, Physical significance of quantum numbers, Free particle in three dimensional rectangular box, wave function and degeneracy, three dimensional harmonic oscillator (Cartesian and spherical polar coordinates) : Isotropic and anisotropic, transition between states the rigid rotator, eigen function and eigen values, rigid rotator in fixed plane.

Books Suggested

1. Quantum mechanics by Powell and Crasemann (Narosa Addison Wesley)
2. Quantum Mechanics by E. Merzbacher (Wiley)
3. Quantum mechanics by Mathews and Venketsan (Tata Mc GrawHill)
4. Perspectives of Quantum Mechanics by S. P Kulia (New Central Book Agency)
5. Quantum Mechanics Concepts and Applications by Nouredine Zettili (JohnWiley and Sons.)
6. Quantum Mechanics by Albert Messiah (Dover Books on Physics)
7. Modern Physics by A. K. Sikri (Pardeep Publications)

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER–V

SESSION 2023-24

NUCLEAR PHYSICS

Course No. BOPL- 5393

Course Outcomes: NUCLEAR PHYSICS

After passing this course, students will be able to:

CO 5. Understand basic properties of nucleus and nuclear forces and various hypothesis of nucleus constituents

CO 6. Understand about radioactivity, theories of alpha, beta and gamma decay, neutrino hypothesis.

CO 7. Understand concepts and types about nuclear reactions, reactions cross section, fission and fusion

CO 8. Understand nuclear models (Liquid drop, Fermi gas model and Shell model) and their failures and successes.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (**SESSION 2023-24**)

SEMESTER- V

COURSE CODE: BOPL- 5393

NUCLEAR PHYSICS

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 35% **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. **All questions carry 12 marks.**

Note: Students can use scientific calculators or logarithmic tables.

UNIT–I

Nuclear Properties: Constituents of nucleus, classification of nuclei, Intrinsic properties of nucleus: nuclear charge, size, mass, density, angular momentum, magnetic dipole moment and electric quadruple moment of the nucleus, Wave mechanical properties of nucleus; statistics and parity, mass defect, packing fraction, binding energy and its variation with mass number, properties of nuclear forces, meson theory of nuclear forces. Proton-electron hypothesis, its failure, proton-neutron hypothesis.

UNIT–Il

Radioactive Decays: Radioactivity and decay laws, units of radioactivity, radioactive decay series, successive disintegration, radioactive equilibrium, modes of radioactive decay, Alpha decay: barrier penetration as applied to alpha decay, Gamow's theory of alpha decay, its application to Geiger Nuttal law. Beta decays: β-, β+ and electron capture decays, nature of Beta particle spectrum, Neutrino hypothesis, Fermi's theory, angular momentum and parity selection rules, Difference between neutrino and antineutrino, Detection of neutrino, non- conservation of parity in beta decay and its experimental verification. Gamma decay: Gamma emission, internal conversion, internal pair conversion, Auger electron, Radioisotopes and their applications, radioactive dating.

UNIT–Ill

Nuclear Reactions: Types of nuclear reactions, conservation laws, energetics of nuclear reactions, examples of nuclear reactions, Q-value and its physical significance, threshold energy for exoergic and endoergic reactions, Nuclear fission, neutron reactions, chain reactions, Nuclear reactor, reactor criticality, moderators, Nuclear fusion (Qualitative only), reaction cross section, microscopic and macroscopic cross-section.

UNIT–IV

Nuclear Models: Liquid drop model: similarities and differences between nucleus and liquid drop, semi-empirical mass formula, Applications of semiempirical mass formula: stability of nuclei against beta and alpha decay, condition for most stable isobar, stability against spontaneous fission, failure of the liquid drop model. Nuclear stability curve, The Fermi gas model, experimental evidence for nuclear magic numbers, development of Shell Model, energy level scheme, predictions of the Shell model: angular momenta, parity and magnetic moment of nuclear ground states, electric quadrupole moments and nuclear isomerism. Limitations of Shell model.

Reference Books:

1. Basic Ideas and Concepts in Nuclear Physics by K. Hyde
2. Introduction to Nuclear Physics : H.A. Enge
3. Nuclear Physics : I. Kaplan (Addison Wesley)
4. Nuclei and Particles by E. Segre5. Nuclear and Particle Physics: Kulwant S. Thind, Manmohan Singh, Vijay Kumar, Leif Gerward

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER– V
SESSION 2023-24
ELECTRONICS

Course No. BOPL- 5394

Course Outcomes: Electronics

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: able to understand LC and RC oscillators and their comparison, operational amplifiers and working of CRO

BACHELOR OF SCIENCE (HONOURS) PHYSICS (**SESSION 2023-24**)
SEMESTER– V

COURSE CODE: BOPL- 5394

ELECTRONICS

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 35% **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. **All questions carry 12 marks.**

Note: Students can use scientific calculators or logarithmic tables.

UNIT–I

Concepts of current and voltage sources, Intrinsic and Extrinsic semiconductors, Fermi level, Charge carriers in semiconductors, p-n junction, p-n junction fabrication techniques, Depletion region, Biasing of diode, V-I characteristics, Voltage-current equation for p-n junction, Ideal diode, Static and Dynamic resistance of a Junction Diode, Transition and diffusion capacitance, Avalanche breakdown and Zener breakdown, Introduction to Zener diode and voltage regulation, V-I characteristics of Tunnel Diode, Rectification: half wave rectifier, Full wave rectifiers (Centre tapped and bridge rectifiers), Efficiency, Ripple factor, Qualitative ideas of filter circuits (L-filter, Shunt capacitor filter, LC and π filters), Photonic devices (solar cell, photodiode and LED).

UNIT–II

Junction transistor : Transistor fabrication techniques, 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, Accurate expressions for collector current, Transistor load line analysis, Thermal runaway and heat sink, Transistor biasing and stabilization of operating point, Elementary idea about Fixed bias, Base bias with emitter feedback, Collector to base bias. Voltage divider biasing circuit in detail. Structure and characteristics of JFET, Comparison of BJT and FET.

UNIT–III

Transistor as an amplifier, Working of CB and CE amplifier, Coupled Amplifier: RC-coupled amplifier and its frequency response. Concept of hybrid parameters, Amplifier analysis using h- parameters, Equivalent circuits, Determination of current gain, voltage gain, Power gain, Input resistance, output resistance, overall voltage gain, FET amplifier (common source configuration and common drain configuration) and its voltage gain, Feedback in amplifiers, Different types, Voltage gain, Advantage of negative feed back, Emitter follower as negative feed back circuit

UNIT–IV

Barkausen criterion of sustained oscillations, LC oscillator (tuned collector, tuned base Hartley), RC oscillators, phase shift and Weinbridge.

Operational Amplifiers (Black Box approach): Characteristics of an Ideal and practical Op-Amp (IC 741), Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground, Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector. Introduction to CRO: Block Diagram of CRO, Electron Gun, Deflection System and Time Base, Deflection Sensitivity, Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current and Frequency

Books Suggested:

1. Electronc Devices and Circuits-J. Milkman and C. C. Halkias(Tata McgrawHill)

1. Basic Electronics and Linear Circuits by N.N. Bhargave, D.C. Kulshreshtha andS.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.)
4. Principles of Electronics by V.K. Mehta & Rohit Mehta (S. Chand Publishers)
5. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall

BACHELOR OF SCIENCE (HONOURS) PHYSICS (SESSION 2023-24)
SEMESTER-V

COURSE CODE: BOPP-5397

PHYSICS LAB-V

Course Outcomes : Physics Lab Sem V

CO 5. 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 6. Student will be able to use CRO for AC voltage and frequency.

CO 7. Students will be able to characterize Common base and common emitter transistors and their use as amplifier.

CO 8. Students will be able to use diodes as basic gates.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (SESSION 2023-24)
SEMESTER-V

COURSE CODE: BOPP-5395

PHYSICS LAB-V

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 35% **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.

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 measure (a) AC Voltage, and (b) Frequency of a periodic waveforms using CRO
3. Study the variable DC power supply using CRO and obtain the graph between DC voltmeter and CRO measurements.
4. To draw forward and reverse bias characteristics of a p-n junction diode.
5. To study diode as a clipping element.
6. To measure the efficiency and ripple factors for (a) halfwave (b) full wave and (c) bridge rectifier circuits.
7. To study the reduction in the ripple in the rectified output with RC, LC and л filters.
8. To draw the characteristics of a Zener diode.
9. To study the stabilization of output voltage of a power supply with Zener diode.
10. To study characteristics of Common Base transistor. and to find input resistance, output resistance, voltage gain and current gain.
11. To study characteristics of Common Emitter transistor. and to find h-parameters.
12. To draw output and mutual characteristics of an FET (Experiments) and determine its parameters.
13. To study Hartley oscillator.
14. To study the gain of an amplifier at different frequencies and to find Band width.
15. To study the response of RC circuit to various input voltage (square, sine and triangular).

Reference Books:

1. Practical Physics by CL Arora S. Chand Publications
2. Practical Physics by S P Singh Pragati Parkashan Meerut.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (SESSION 2023-24)
SEMESTER-V

Seminar and Assignment

Course No. BOPS-5396

Maximum Marks: 50 (External 40 + Internal 10) **Periods: 6 Periods/week**

Pass Marks: 35%

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER– VI
SESSION 2023-24

RADIATION AND PARTICLE PHYSICS

Course No. BOPL- 6391

Course Outcomes: Particle Physics

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

CO1: understand about elementary particles, different types of interactions and quark model.

CO2: understand interaction of radiation and charged particles with matter.

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

CO4: understand theory and working of various types of nuclear detectors like gas filled, semiconductor, solid state track detectors and nucleus emulsions.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (**SESSION 2023-24**)

SEMESTER– VI

COURSE CODE: BOPL- 6391

Radiation and Particle Physics

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

Pass Marks: 35% **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 scientific calculators or logarithmic tables.

UNIT-I

Elementary Particles and their Properties- Historical introduction, particles and antiparticles, classification of particles, Properties of different baryons, Hyperons, Leptons and Mesons like life time, mass, spin parity and conservation law. Observation of Strange particles production and decay, Introduction to quarks and their types, Quark contents of baryons and mesons, Discovery of cosmic rays: hard and soft components, Primary and secondary cosmic Rays, cosmic ray showers, effect of altitude and earth's magnetic field on the cosmic ray trajectories, east-west symmetry.

UINT-II

Interaction of Radiation and Charged Particles with Matter: Types of interactions, electromagnetic, weak, strong interactions, gravitational interactions, Basic resonance particles. Stopping power of heavy charged particle, derivation of Bethe-Bloch formula, range of particle, Bragg curve, range straggling, Geiger Nuttal's law, Energy loss of electrons and positrons, Positrons annihilation in condensed media, interaction of gamma rays with matter: photoelectric effect, Compton scattering, pair production.

UNIT-III

Accelerators - Accelerators, linear accelerators, Cockcroft-Walton accelerator, Van de Graff accelerator, cyclic accelerators, Cyclotron, Betatron, Synchro-cyclotron, focusing, Phase stability, electron synchrotron, CERN Super Proton Synchrotron (SPS), Larger Hadron collider (LHC), Tevatron.

UNIT-IV

Nuclear Radiation Detection - Gas-filled detectors, Proportional and Geiger-Muller counters, Scintillation detectors, Semiconductor detectors, Cherenkov effect, Electromagnetic and hadronic calorimeter, solid state nuclear track detectors, bubble chambers, spark counter, nuclear emulsions.

Books:

1. Introduction to Elementary Particles by D. Griffth (Wiley-VCH)
2. Introduction to High Energy Physics by D.H. Perkins (Cambridge University Press)
3. Elementary Particles by I.S. Hughes (Cambridge University Press)

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER– VI
SESSION 2023-24

CONDENSED MATTER PHYSICS – II

Course No. BOPL- 6392

Course Outcomes: Condensed Matter Physics – II

After completing this course student will be able to

CO1: understand the concept of phonons, and role of lattice vibrations in specific heat of solids.

CO2: understand the basic concepts related to super conductivity.

CO3: understand the concept of dielectric polarisation types and frequency dependence.

CO4: understand the basics about nanomaterials and some characterisation techniques.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (**SESSION 2023-24**)
SEMESTER– VI

COURSE CODE: BOPL- 6392

CONDENSED MATTER PHYSICS – II

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 35% **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 scientific calculators or logarithmic tables.

UNIT –I

Lattice vibrations, One Dimensional Monoatomic Lattice, Dispersion relation, phonons, phonon momentum during elastic and inelastic scattering, Inelastic scattering of photons by phonons, Specific heat of solids, Classical Model of specific heat of solids (Dulong and Petit's Law), Einstein and Debye Models of Specific Heat of Solids. T^3 law.

UNIT – II

Superconductivity, Comparison of electrical, magnetic and thermodynamical properties of superconductors and normal conductors. Persistent Currents, Effect of magnetic field on super conductor, Meisner effect, Types of Super Conductors, London's equation and penetration depth, Thermodynamics of Superconductors, BCS theory (formation of cooper pairs), ground state and energy gap. High Temperature Superconductors.

UNIT – III

Polar and Non Polar Molecules, Dielectric Polarization, Electric displacement vector and dielectric constant, Local Electric Field, Clausius Mosotti equation, Different contribution to polarization: dipolar, electronic and ionic polarizabilities, frequency dependence Ferroelectric crystals: Classifications and their general properties

UNIT – IV

Basic ideas of materials at nanoscale, Difference from bulk material properties, Nanoparticles, Applications of nanotechnology in various fields. (Qualitative only) Characterization techniques: X-Ray Diffraction. Optical Microscopy. Scanning

Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.

Books Suggested :

1. Introduction to Solid State Physics by C. Kittel (WileyEastern)
2. Elements of Modern Physics by S.H. Patil (TMGH,1985).
3. Solid State Physics by Puri and Babbar.
4. K. P. Jain Physics of Semiconductor Nanostructures. New Delhi: Narosa Publishing House, 1997.
5. Solid State Physics: J.P. Srivastva-Prentice Hall, 2007.
6. Introduction to nanoscience and Nanotechnology: K.K. Chattopadhyay and A.N. Banerjee- PHI Learning Pvt. Ltd. 2009

BACHELOR OF SCIENCE (HONOURS) PHYSICS

SEMESTER–VI

SESSION 2023-24

MOLECULAR SPECTROSCOPY AND LASER

Course No. BOPL- 6393

Course Outcomes: MOLECULAR SPECTROSCOPY AND LASER

After passing this course, students will be able to:

CO 1: understand the basics of microwave and infrared spectroscopy and their applications.

CO 2: understand the Raman and electronic spectroscopy, applications and comparison.

CO3: understand the basics of principle and theory of working of LASERs.

CO 4: understand different types of LASER and basics of Q Switching and holography.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (**SESSION 2023-24**)

SEMESTER- VI

COURSE CODE: BOPL- 6393

MOLECULAR SPECTROSCOPY AND LASER

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 35% **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 scientific calculators or logarithmic tables.

UNIT–I

Microwave and Infra-Red Spectroscopy

Types of molecules, Types of molecular spectra, Born Oppenheimer approximation, rotation of molecules, origin of rotational spectra, rotational spectra of diatomic molecules as a rigid rotator, Thermal distribution of rotational energy levels, Effect of isotopic substitution, diatomic molecule as non-rigid rotator, technique and instrumentation of microwave spectroscopy, The vibrating diatomic molecule: Energy of a diatomic molecule, simple harmonic oscillator, isotopic effect, anharmonic oscillator, Outline of technique and instrumentation, Applications of Infrared spectroscopy.

UNIT–II

Raman and Electronic Spectroscopy:

Nature of the Raman spectra, characteristic properties of Raman lines, Experimental arrangement for Raman spectra, Quantum and classical theories of Raman Effect, Pure rotational Raman spectra, Rule of mutual exclusion, applications of Raman and infra-red spectroscopy, Electronic spectra: Salient features of molecular electronic spectra, origin of electronic spectra, Electronic spectra of diatomic molecule, Outline of technique and instrumentation of electronic spectroscopy,

UNIT–III

Laser Fundamentals:

Concept of laser, unique properties of lasers, Absorption and spontaneous emission, Einstein coefficients and their relations, light amplification Concept of stimulated emission and population inversion, components of laser and lasing action, three and four level lasing techniques, Principal pumping schemes, Fauchber Ledenberg formula, Threshold and Schawlow Townes condition,

UNIT–IV

Laser Systems: Types of lasers, Ruby and Nd: YAG lasers, He-Ne and CO_2 and dye lasers

construction and their working, laser beam characteristics. Applications of lasers, Q switching Holography: The underlying principle, applications of Holography

Text Reference Books:

1. Fundamentals of Molecular Spectroscopy: C.B. Banwell-Tata McGraw Hill,1986.
2. Spectroscopy Vol. I, II & III: Walker &Straughen
3. Introduction to Molecular Spectroscopy: G.M. Barrow-Tokyo McGraw Hill,1962.
4. Spectra of Diatomic Molecules: Herzberg-New York,1944.
5. Molecular Spectroscopy: Jeanne LMcHale.
6. Atomic and molecular spectra: laser by Rajkumar
7. Laser Fundamentals by W.T. Silfvast (Foundation Books), New Delhi, 1996
8. Laser and Non-Liner Optics by B.B. Laud (New Age Pub.) 2002
9. Laser, Svelto by (Plenum Pres) 3rd edition, New York

BACHELOR OF SCIENCE (HONOURS) PHYSICS

SEMESTER–VI

(Session-2023-24)

DIGITAL ELECTRONICS AND APPLICATIONS

Course No. BOPL- 6394

Course Outcomes: DIGITAL ELECTRONICS AND APPLICATIONS

After passing this course, students will be able to:

CO 1: understand the basics of ICs, binary to digital and digital to binary conversions, different number systems, addition and subtraction in binary system.

CO 2: understand different gates, Boolean laws, K maps.

CO3: understand the basics of gates as adders, subtractor, comparator, multiplexer, demultiplexer, encoder, decoder and flip-flops.

CO 4: understand IC 555: multivibrators, registers, Counters, Semiconductor Memories.

BACHELOR OF SCIENCE (HONOURS) PHYSICS
SEMESTER–VI
SESSION 2023-24

DIGITAL ELECTRONICS AND APPLICATIONS

Course No. BOPL- 6394

Maximum Marks: 75 (External 60 + Internal 15) **Examination Time: 3 Hours**
Pass Marks: 35% **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. Each question carry 12 marks.

Note: Students can use scientific calculators or logarithmic tables.

UNIT–I

Integrated Circuits (Qualitative treatment only): Distinction between analog and digital signal, Applications and advantages of digital signals, Advantages and drawbacks of ICs, Classification of ICs, Digital circuit, Binary number system, Decimal to binary conversion, Binary to decimal conversion, Octal number system, Hexa decimal number system, Binary coded decimal code (BCD code), Binary Addition, Binary Subtraction using 2's Complement, A/D Conversion (successive approximation), BCD addition.

UNIT–II

Digital Circuits and Boolean algebra: Definition, symbols and truth table of AND, OR and NOT Gates (realization using Diodes and Transistor); NAND and NOR Gates as Universal Gates; XOR and XNOR Gates and application as Parity Checkers; De Morgan's Theorems; Boolean Laws; Simplification of Logic Circuit using Boolean Algebra; Fundamental Products, Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map (up to 4 variables)

UNIT–III

Arithmetic and Logic circuits: half adder, full adder, half subtractor, full subtractor, comparator, multiplexer, demultiplexer, encoder, decoder, **Flip-flop:** Introduction to sequential circuits; flip flops, RS flip-flop, Clocked RS flip-flop, D flip-flop, Latches, level triggered & edge triggered flip-flops, positive and negative edge triggering, limitations of JK flip-flop, race-around condition. Applications of flip flops.

UNIT–IV

Timers: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator. Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel in-Parallel-out Shift Registers (only up to 4 bits), Counters (4 bits): Ring Counter,

Asynchronous counters, Decade Counter. Synchronous Counter. **Semiconductor Memories:** Introduction, Memory organization, Classification and characteristics of memories. Read/write memory, ROM, RAM, EPROM, EEPROM, Basic idea of static dynamic memory,

Reference Books:

1. A. P. Malvino,and D. P. Leach, Digital Principles and Applications. New Delhi: Tata

2. McGraw Hill, 1986.

3. A. P. Malvino, Digital Computer Electronics. New Delhi: Tata McGraw Hill, 1986.

4. W. H. Gothmann, Digital Electronics. New Delhi: Prentice Hall, 1980.

5. J. Millman,and H. Taub, Pulse, Digital and Switching Waveforms. New Delhi: Tata

6. McGraw Hill, 1992.

7. A. Mottershead, Electronic Devices and Circuits. New Delhi: Prentice Hall, 1977.

8. R. S. Gaonkar, Microprocessor Architecture, Programming and Applications with

8085. New Delhi: Prentice Hall, 2002.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (SESSION 2023-24)
SEMESTER-VI

PHYSICS LAB-VI

Course No. BOPP-6395

COURSE OUTCOMES

After completing this lab student will be able to:

CO1: use GM counter as detector

CO2: Characterise Thermistor, diode, LDR and to find magnetic parameters using CRO.

CO3: understand Hall effect and Boltzmann's coefficient, photo electric effect

CO4: To use OP-Amps as inverting and non inverting amplifiers and its application in zero cross detector and comparator.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (SESSION 2023-24)
SEMESTER-VI

PHYSICS LAB-VI

Course code: BOPP- 6395

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 35% **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.

LIST OF EXPERIMENTS-

1. To draw the plateau of a GM counter and find its dead time.
2. Study of counting statistics using background radiation using GM counter.
3. To study the absorption of beta particles in aluminium using GM counter and determine the absorption coefficient of beta particles from it.
4. To study the characteristics of a thermistor and find its parameters.
5. To trace the B-H curves for different materials using CRO and find the magnetic parameters from these.
6. To determine the wavelength of laser light using a plane diffraction grating.
7. To determine the Boltzmann constant using V-I characteristics of PN junction diode.
8. To determine the Hall coefficient of a semiconductor sample.
9. To study characteristics of light dependant resistor (LDR).
10. To measure the intensity using LDR in laser diffraction patterns of single and double slit.
11. To study photoelectric current vs intensity of light and cathode voltage using photocell.
12. To study photoelectric current vs wavelength of light using photocell and hence find Plank's constant.
13. To study an inverting and non-inverting amplifier using Op-amp (741) for a given dc voltage.
14. To study the zero-crossing detector and comparator.

Reference Books:

1. Practical Physics by CL Arora S. Chand Publications
2. Practical Physics by S P Singh Pragati Parkashan Meerut.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (SESSION 2023-24)
SEMESTER-VI

PHYSICS LAB-VII

Course No. BOPP-6396

COURSE OUTCOMES

After completing this lab student will be able to

CO1: understand logic gates and their truth tables

CO2: understand 2-bit comparator, adders, subtractors, parity generator and checker.

CO3: understand shift register, flip flops

CO4: understand A/D, D/A converters and counters.

BACHELOR OF SCIENCE (HONOURS) PHYSICS (SESSION 2023-24)
SEMESTER-VI

COURSE CODE: BOPP-6396

PHYSICS LAB-VII

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 35% **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 examinees in any group.

LIST OF EXPERIMENTS-

1. Study of logic gates using universal gates.

2. To form a half adder and a full adder using NAND gates and verify their truth tables.

3. To form a 2-bit comparator using NAND gates.

4. To study Half Adder, Full Adder and 4-bit binary Adder.

5. To study Parity generator and checker.

6. To study truth table of shift register.

7. To study the truth table of flip flop.

8. To study encoder, decoder circuit.

9. To study D/A and A/D convertors.

10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates

11. Study of bi-stable, mono-stable and astable multivibrators.

Reference Books:

1. Digital Electronics Circuit and System by V.K. Puri (TMH, New Delhi).
2. Digital Design by M. Morris Mano (PHI, New Delhi).

ANNEXURE-I

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: 2023-24

The Heritage Institution

KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

Scheme and Curriculum of Examination of Three Year Degree Programme
Physics for
Bachelor of Science (Home Science)

(Session 2023-24)

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

Bachelor of Science (Home Science)

BASIC PHYSICS (Semester –III)
(Theory)

(Session 2023-24)

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 2023-24)

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

Bachelor of Science (Home Science)

(Semester-III)

BASIC PHYSICS

(Session 2023-24)

(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)

(Session 2023-24)

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 basic concepts of optics

CO2: to understand basic light sources

CO3: to understand basic electricity based household devices

CO2: to understand the use of effects of electric current in house hold devices

Bachelor of Science (Home Science)

(Session 2023-24)

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

B.Sc. Home Science (Semester-IV)

APPLIED PHYSICS

(PRACTICAL)

Time: 3 Hrs. Marks: 10

Pds- 2 pds/ week

Note: Paper will be set on the spot by the examiner

Semester-III syllabus will also be included in the Practical.

1. Demonstration of light spectrum through prism.
2. Demonstration of repair/replacement of fuse in different household devices.
3. Demonstration of replacement of a capacitor in fan, starter in tube light, changes of a capacitor in fan.
4. To trace rays through a prism and prove that <i+<e=<A+<D.
5. To find refractive index.

Annexure D

FACULTY OF SCIENCES

SYLLABUS

of

Physics

For

Bachelor of Science

(Non-Medical & Computer Science)

(Semester I &II)

(Under Credit Based Continuous Evaluation Grading System)

(12+3 System of Education)

Session: 2023-24

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-2023-24

Semester -I										
Course Name	**Program Name**	**Course Code**	**Course Type**	**Total Marks**	**Marks**					
					Paper	**Credits**	**Ext.**		**CA**	**EXAM TIME In Hrs**
						L-T-P	**L**	**P**		
Physics	Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BSNM-1395(I) BCSM-1395(I)	C	75	**Mechanics**	**3-0-0**	**60**		**15**	**3**
		BSNM-1395(II) BCSM-1395(II)		50	**Electricity and Magnetism**	**2-0-0**	**40**		**10**	**3**
		BSNM-1395(P) BCSM-1395(P)		50	**Physics Lab**	**0-0-2**		**40**	**10**	**3**
Total				175		**5-0-2**			**35**	

Semester -II										
Course Name	**Program Name**	**Course Code**	**Course Type**	**Total Marks**	**Marks**					
					Paper	**Credits**	**Ext.**		**CA**	**EXAM TIME In Hrs**
						L-T-P	**L**	**P**		
Physics	Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BSNM-2395(I) BCSM-2395(I)	C	75	Relativity and Electromagnetism	**3-0-0**	**60**		**15**	**3**
		BSNM-2395(II) BCSM-2395(II)		50	Vibration And Waves	**2-0-0**	**40**		**10**	**3**
		BSNM-2395(P) BCSM-2395(P)		50	Physics Lab	**0-0-2**		**40**	**10**	**3**
				175		**5-0-2**			**35**	

Bachelor of Science

SEMESTER–I
Session-2023-24
PHYSICS
MECHANICS

Course code: BSNM-1395 (I) for Bachelor of Science (Non Medical)
BCSM-1395 (I) for Bachelor of Science (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.

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

(Session-2023-24)

(Bachelor of Science)

SEMESTER–IPHYSICS

(MECHANICS)

Course code: BSNM-1395 (I) for Bachelor of Science (Non Medical)
BCSM-1395 (I) for Bachelor of Science (Computer Science)

Credits: 3-0-0

Time: 3 Hours **Marks: 60**

Pass Marks: 21

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 **12 marks**. There should be 20% numerical in each paper.

Note: There should be 20% numerical in each paper. 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.

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

SEMESTER–I

(Session-2023-24)

PHYSICS

(ELECTRICITY AND MAGNETISM)

(THEORY)

Course code: BSNM-1395 (II) for Bachelor of Science (Non Medical)
BCSM-1395 (II) for Bachelor of Science (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.

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

SEMESTER–I

(Session-2023-24)

PHYSICS

(ELECTRICITY AND MAGNETISM)

(THEORY)

Course code: BSNM-1395 (II) for Bachelor of Science (Non Medical)
BCSM-1395 (II) for Bachelor of Science (Computer Science)

Time: 3 Hours **Marks: 40** **Pass Marks: 14**

Credits: 2-0-0

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 **8 marks.**

Note: There should be 20% numerical in each paper. 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.

UNIT–IV

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. Properties of Paramagnetic and Ferromagnetic materials

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.

5. Fields and Waves Electromagnetic by David K. Cheng.

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

SEMESTER–I

(Session-2023-24)

PHYSICS PRACTICAL

Course Code: BSNP-1395 for Bachelor of Science (Non Medical)
BCSP-1395 for Bachelor of Science (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.

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

SEMESTER–I
PHYSICS PRACTICAL
Course code: BSNP-1395 for Bachelor of Science (Non Medical)
BCSP-1395 for Bachelor of Science (Computer Science)
(**Session-2023-24)**

Credits: 0-0-2 (4 Hrs./week)
Maximum Marks: 50

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: 50**
i) One experiment **20 Marks**
ii) Brief Theory **10 Marks**
iii) Viva–Voce **10Marks**
iv) Record (Practical file) **10 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. 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.

Bachelor of Science (Semester System) (12+3 System of Education)
SEMESTER–II
(Session-2023-24)

RELATIVITY AND ELECTROMAGNETISM
(THEORY)

Course code: BSNM-2395 (I) for Bachelor of Science (Non Medical)
BCSM-2395 (I) for Bachelor of Science (Computer Science)

Course Outcomes: Relativity & Electromagnetism -Paper (I)

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.

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

SEMESTER–II

(Session-2023-24)

RELATIVITY AND ELECTROMAGNETISM

(THEORY)

Course code: BSNM-2395 (I) for Bachelor of Science (Non Medical)
BCSM-2395 (I) for Bachelor of Science (Computer Science)

Time: 3 Hours **Marks: 60** **Pass Marks: 21**

Credits: 3-0-0 (3 Hrs./week)

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 **12 marks.**

Note: There should be 20% numericals in each paper. 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 Doppler 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

Invariance of charge, E in different frames of references. Fields of a point charge moving with constant velocity, 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 incident.

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.

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

(**Session-2023-24)**

SEMESTER–II

VIBRATION AND WAVES

(THEORY)

Course code: BSNM-2395 (II) for Bachelor of Science (Non Medical)
BCSM-2395 (II) for Bachelor of Science (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.

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

SEMESTER–II

(Session-2023-24)

VIBRATION AND WAVES

(THEORY)

Course code: BSNM-2395 (II) for Bachelor of Science (Non Medical)
BCSM-2395 (II) for Bachelor of Science (Computer Science)

Time: 3 Hours **Marks: 40** **Pass Marks: 14**
Credits: 2-0-0

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 **8 marks.**

Note: There should be 20% numerical in each paper. 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.

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

SEMESTER–II

PHYSICS PRACTICAL

(**Session-2023-24)**

Course code: BSNP-2395 for Bachelor of Science (Non Medical)
BCSP-2395 for Bachelor of Science (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.

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

SEMESTER–II

PHYSICS PRACTICAL

(Session-2023-24)

Course code: BSNP-2395 for Bachelor of Science (Non Medical)
BCSP-2395 for Bachelor of Science (Computer Science)

Credits: 0-0-2
(4Hrs. /week)
Maximum Marks: 50

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: 50**
i) One experiment **20 Marks**
ii) Brief Theory **10 Marks**
iii) Viva–Voce **10 Marks**
iv) Record (Practical file) **10 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 LCR circuits for different R–value and calculate Q–value.
6. Resonance in a parallel LCR circuits for different R–value and calculate Q–value.
7. Capacitance by flashing and quenching of a neon lamp.
8. Measurement of capacitance, determination of permittivity of a medium air and relative permittivity by de–Sauty's bridge.
9. To determined L using Anderson Bridge.
10. To find the value of BH the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.
11. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.

ANNEXURE G

FACULTY OF SCIENCES

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

(Under Credit Based Continuous Evaluation Grading System)
(CBCEGS)

Session: 2023-24

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)

Master of Science (Physics)

Session 2023-24

SEMESTER-I										
Course Code	**Course Title**	**Course Type**	**Hours Per Week**	**Credits L-T-P**	**Total Credits**	**Marks**				**Examination time (in Hours)**
						Total	**Ext.**		**CA**	
							L	**P**		
MPHL-1391	Analog and Digital Electronics	C	4	4-0-0	4	100	80	-	20	3
MPHL-1392	Mathematical Physics	C	4	4-0-0	4	100	80	-	20	3
MPHL-1393	Classical Mechanics	C	4	4-0-0	4	100	80	-	20	3
MPHL-1394	Computational Techniques	C	4	4-0-0	4	100	80	-	20	3
MPHP-1395	Electronics Lab	C	6	0-0-3	3	100	-	80	20	3
MPHP-1396	Computer Lab	C	6	0-0-3	3	100	-	80	20	3
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4	100	70		30	3
Total				**22**		**600**				
IDEC-1101 IDEM-1362 IDEH-1313 IDEI-1124 IDEW-1275	Communication Skills Basics of Music (Vocal) Human Rights and Constitutional Duties Basics of Computer Applications Indian Heritage: Contribution to the world (Credits of these courses will not be added to SGPA)									

Master of Science (Physics) SEMESTER-II										
Course Code	**Course Title**	**Course Type**	**Hours Per Week**	**Hours Per Week L-T-P**	**Total Credits**	**Total**	**Ext.**		**CA**	**Examination time (in Hours)**
							L	**P**		
MPHL-2391	Quantum Mechanics-I	C	4	4-0-0	4	100	80	-	20	3
MPHL-2392	Electrodynamics-I	C	4	4-0-0	4	100	80	-	20	3
MPHL-2393	Condensed Matter Physics-I	C	4	4-0-0	4	100	80	-	20	3
MPHL-2394	Atomic and Molecular Spectroscopy	C	4	4-0-0	4	100	80	-	20	3
MPHP-2395	Condensed Matter Physics Lab -I	C	6	0-0-3	3	100	-	80	20	3
MPHP-2396	Spectroscopy Lab	C	6	0-0-3	3	100	-	80	20	3
Total				**22**		600				

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 2023-24)

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 2023-24)

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**
Credits: 4-0-0

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.

Hours 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

Hours 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.

Hours 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.

Hours 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 2023-24)

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 2023-24)

COURSE CODE: MPHL-1392
MATHEMATICAL PHYSICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40% **Total Teaching hours: 60**
Credits: 4-0-0

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.

Curvilinear 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 transforms of derivatives and integrals, Inverse Laplace transform, Application of Laplace Transform.

20Hours

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. **10Hours**

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.

20Hours

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) **10Hours**

Text and Reference Books

1. Mathematical Methods for Physicist by George Arfken-New York Academy,
2. Mathematical Physics by P.K. Chattopadhyay, New Age International, 1990.
3. Mathematical Methods in th Physical Sciences, 3ed Mary L. Boas

Master of Science (Physics)

Semester-1

(SESSION 2023-24)

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 2023-24)

COURSE CODE: MPHL-1393

CLASSICAL MECHANICS

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

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

Credits: 4-0-0

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: 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.

Hours 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).

Hours 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. **Hours 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. **Hours 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 2023-24)

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 2023-24)

COURSE CODE: MPHL-1394

COMPUTATIONAL TECHNIQUES

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40% **Total Teaching hours: 60**
Credits: 4-0-0

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: Script files, function files, Compiled files, p-code, variables, loops, branches, and control flow, Input/Output, Advanced data objects, structures, cells **Hours18**

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 **Hours12**

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. **Hours15**

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 **Hours15**

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 2023-24)

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 2023-24)

COURSE CODE: MPHP-1395
ELECTRONICS LAB

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40% **Total Teaching hours: 90**
Credits: 0-0-3

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 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 2023-24)

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 2023-24)

COURSE CODE: MPHP-1396
COMPUTER LAB

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40% **Total Teaching hours: 60**
Credits: 0-0-3

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.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 2023-24)

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 Hilbert spaces, and the theory of operator algebra and the concept that quantum states could be described in a vector space.

CO 2. The student will be able to understand the concept of time evolution and the relation between Hamiltonian and time evolution. They will be capable of learning the time evolution of quantum system.

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 applications the total angular momentum.

Master of Science (Physics) SEMESTER-II

(SESSION 2023-24)

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**

Credits: 4-0-0

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.

Hours18

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. **Hours12**

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. **Hours12**

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.

Hours18

Text and Reference Books

1. Modern Quantum Mechanics by J.J. Sakurai-Pearson Educaton Pvt.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

Master of Science (Physics)

SEMESTER-II

(SESSION 2023-24)

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 2023-24)

COURSE CODE: MPHL-2392

ELECTRODYNAMICS-I

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

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

Credits: 4-0-0

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. **Hours 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.

Hours 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

Hours 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.

Hours 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 2023-24)

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 2023-24)

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**

Credits: 4-0-0

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 2023-24)

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 broadening of spectral lines and the concept of Zeeman effect.

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.

Master of Science (Physics) SEMESTER-II

(SESSION 2023-24)

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**

Credits: 4-0-0

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.

15Hours

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.

15Hours

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.

15Hours

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) SEMESTER-II

(SESSION 2023-24)

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) SEMESTER-II

(SESSION 2023-24)

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: 90**

Credits: 0-0-3

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.

Master of Science (Physics) SEMESTER-II

(SESSION 2023-24)

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.

Master of Science (Physics) SEMESTER-II

(SESSION 2023-24)

COURSE CODE: MPHP-2396

SPECTROSCOPY LAB

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

Pass Marks: 40% **Total Teaching hours: 90**

Credits: 0-0-3

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

ANNEXURE H

FACULTY OF SCIENCES

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

(Under Credit Based Continuous Evaluation Grading System)
(CBCEGS)

Session: 2023-24

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 (2023-24)

	SEMESTER-III									
Course Code	**Course Name**	**Course Type**	**Hours Per Week**	**Credits L-T-P**	**Total Credits**	**Marks**				**Examination ime (in Hours)**
						Total	**Ext.**		**CA**	
							L	**P**		
MPHL-3391	Quantum Mechanics-II	C	4	4-0-0	4	100	80	-	20	3
MPHL-3392	Electrodynamics-II	C	4	4-0-0	4	100	80	-	20	3
MPHL-3393	Condensed Matter Physics-II	C	4	4-0-0	4	100	80	-	20	3
MPHL-3394	Nuclear Physics	C	4	4-0-0	4	100	80	-	20	3
MPHP-3395	Condensed Matter Physics Lab-II	C	6	0-0-3	3	100	-	80	20	3
MPHP-3396	Nuclear Physics Lab	C	6	0-0-3	3	100	-	80	20	3
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4	100	80		20	3
Total				**28**	**22**	**600**				
IDEC-3101 IDEM-3362 IDEH-3313 IDEI-3124 IDEW-3275	Communication Skills Basics of Music (Vocal) Human Rights and Constitutional Duties Basics of Computer Applications Indian Heritage: Contribution to the world (Credits of these courses will not be added to SGPA)									
	SEMESTER-IV									
Course Code	**Course Name**	**Course Type**	**Hours Per Week**	**Credits L-T-P**	**Total Credits**	**Total**	**Ext.**		**CA**	**Examination time (in Hours)**
							L	**P**		
MPHL-4391	Particle Physics	C	4	4-0-0	4	100	80	-	20	3
MPHL-4392	Statistical Mechanics	C	4	4-0-0	4	100	80	-	20	3
MPHL-4393 (OPT-_)	Student may choose any two subjects from the following list of options	C	4	4	4	100	80	-	20	3
MPHL-4394(OPT-_)		C	4	4	4	100	80	-	20	3
MPHD-4395	Assignment/ Project	C		0-0-6	6	100		80	20	3
Total				24	22	500				

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 8. 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 9. 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 10. 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 11. 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 12. 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 13. 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 14. **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 III
(SESSION 2023-24)

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 2023-24)

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**
Credits: 4-0-0

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 2023-24)

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 2023-24)

COURSE CODE: MPHL-3392

Electrodynamics-II

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**
Credits: 4-0-0

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 2023-24)

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 2023-24)

COURSE CODE: MPHL-3393

CONDENSED MATTER PHYSICS-II

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

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

Credits: 4-0-0

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 2023-24)

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 2023-24)

SEMESTER III

COURSE CODE: MPHL-3394

NUCLEAR PHYSICS

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

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

Credits: 4-0-0

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 2023-24)

COURSE CODE: MPHL-3395

CONDERNSED MATTER PHYSCICS 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 2023-24)

COURSE CODE: MPHP-3395
CONDERNSED MATTER PHYSICS LAB-II

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 90**
Credit: 0-0-3

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 2023-24)

COURSE CODE: MPHP-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 2023-24)

COURSE CODE: MPHP-3396
NUCLEAR PHYSICS LAB

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**
Credit: 0-0-3

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) SEMESTER IV

(SESSION 2023-24)

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4391

PARTICLE PHYSICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**
Credits: 4-0-0

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4392

STATISTICAL MECHANICS

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4392

STATISTICAL MECHANICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**
Credits: 4-0-0

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 Hours**

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 Hours**

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 Hours**

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 Hours**

Text and Reference Books

1. Statistical Mechanics . Patharia Butterworth-Heineman, 1996
2. Statistical Mechanics: Kerson Huang-Wiley-1963.

Master of Science (Physics) SEMESTER IV

(SESSION 2023-24)

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.

Master of Science (Physics) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-1)

PHOTONICS

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

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

Credits: 4-0-0

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-1I)

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-1I)

RADIATION PHYSICS

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

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

Credits: 4-0-0

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.

References :

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.

Master of Science (Physics) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-1II)

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

Master of Science (Physics) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-1II)

REACTOR PHYSICS

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**
Credits: 4-0-0

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.

Hours 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. **Hours 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. **Hours 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.

Hours 15

References:

1. The elements of Nuclear reactor Theory by Glasstone & Edlund-VamNostrand, 1952.
2. Introductions of Nuclear Engineering by Murray-Prentice Hall, 1961.

Master of Science (Physics) SEMESTER IV
(SESSION 2023-24)
COURSE CODE: MPHL-4393/94 (OPT-IV)
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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-IV)

NANOTECHNOLOGY

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**
Credits: 4-0-0

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 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.

(Hours 15)

Unit-II

Characterization Techniques:

X-ray diffraction, data manipulation of diffracted X-rays for structure determination, Scanning Probe microscopy, Scanning Electron microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Optical microscopy, FTIR Spectroscopy, Raman Spectroscopy, DTA, TGA and DSC measurements **(Hours 15)**

Unit-III

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.

(Hours 15)

Unit-IV

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. **(Hours 15)**

References:

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-V)

MATERIAL SCIENCE

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

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

Credits: 4-0-0

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 characteristics.

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-V)

MATERIAL SCIENCE

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

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

Credits: 4-0-0

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)

References:

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-V)

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) SEMESTER IV

(SESSION 2023-24)

COURSE CODE: MPHL-4393/94 (OPT-V)

SPACE SCIENCE

Maximum Marks: 100 (External 80 + Internal 20) **Examination Time: 3 Hours**
Pass Marks: 40 **Total Teaching hours: 60**
Credits: 4-0-0

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).

References:

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) SEMESTER IV

SESSION 2023-24

Course Code: MPHD-4395

ASSIGNMENT/PROJECT

Maximum Marks: 50 (External 40 + Internal 10) **Examination Time: 3 Hours**
Pass Marks: 20 **Total Teaching hours: 90**
Credits: 0-0-6

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

Annexure -J

FACULTY OF SCIENCES

Syllabus of Physics for

Bachelor of Science (Honours) Mathematics

(Credit Based Continuous Evaluation Grading System)

(Semester I & II)

Session: 2023-24

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

Bachelor of Science (Honours) Mathematics Semester–I &II

(Session 2023-24)

	Semester I							
Course Code	Course Name	Course Type	Credits L-T-P	Marks				Examination time (in Hours)
				Total	Ext.		CA	
					L	P		
BOMM-1396	Mechanics	C	3-0-1	100	60	20	20	3+3
Semester II								
BOMM-2396	Modern Physics	C	3-0-1	100	60	20	20	3+3

Bachelor of Science (Honours) Mathematics Semester–I

(Session 2023-24)

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 (Honours) Mathematics Semester–I

(Session 2023-24)

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**

Credits: 3-0-1

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 Cartesian 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 (Honours) Mathematics Semester–I

(Session 2023-24)

SEMESTER–I
PHYSICS
PHYSICS PRACTICAL
Course code: BOMM-1396 (P)
Credits : 0-0-1

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 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. (Honours) Mathematics Semester–II

(Session 2023-24)

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. (Honours) Mathematics Semester–II

(Session 2023-24)

Course Name: Modern Physics

Course Code: BOMM-2396

Examination Time: 3 Hours **L-T-P**

Total Teaching hours: 60 **3 -0 -1**

Passing marks: 35% **Max. Marks: 100**

Theory:60
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 **12 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. (Honours) Mathematics (Semester-II)
(Session 2023-24)
COURSE CODE: BOMM-2396(P)
Physics Lab-II
(Practical)

Maximum Marks: 20 Examination Time: 3 Hour
Credits : 1 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, 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.

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.