Annexure C

FACULTY OF SCIENCES

SYLLABUS
of
Physics
For

Bachelor of Science Non-Medical & Computer Science

(Semester V & VI)

(Under Continuous Evaluation System)
(12+3 System of Education)

Session: 2024-25

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-2024-25

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)

(Semester–V)

(Session-2024-25))

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 2024-25)
PHYSICS (CONDENSED MATTER PHYSICS)
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 2024-25)
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 2024-25)
PHYSICS (ELECTRONICS)
Course code:BSNM-5395 (II) for Bachelor of Science (Non Medical)
BCSM-5395 (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

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 2024-25)
PHYSICS PRACTICAL
Course code: BSNM-5395(P) for Bachelor of Science (Non Medical)
BCSM-5395(P) for Bachelor of Science (Computer Science)

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

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

Bachelor of Science (Semester System) (12+3 System of Education)
(Semester–V)
(Session 2024-25)
PHYSICS (PRACTICAL)
Course code: BSNM-5395(P) for Bachelor of Science (Non Medical)
BCSM-5395(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, 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. 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 2024-25)
PHYSICS (NUCLEAR PHYSICS)
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 2024-25)
PHYSICS (NUCLEAR PHYSICS)
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 2024-25)
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 2024-25)
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)

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 2024-25)
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 2024-25)

PHYSICS (PRACTICAL)
Course code: BSNM-6395 (P) for Bachelor of Science (Non Medical)
BCSM-6395 (P) for Bachelor of Science (Computer Science)

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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.