Chaudhary Bansi Lal University

(A State University established under Haryana Act No. 25 of 2014)

Scheme of Examination
for
Physics (Semiconductor Technology) Subject
in
Undergraduate Programme

as per NEP 2020
Curriculum and Credit Framework for Undergraduate Programmes
(Multiple Entry-Exit, Internships and Choice Based Credit System
LOCF)

With effect from the session 2025-26 (in phased manner)

DEPARTMENT OF PHYSICS
Chaudhary Bansi Lal University, Prem Nagar-127031
Bhiwani
HARYANA, INDIA

Chaudhary Bansi Lal University, Bhiwani (HR)

Department of Physics

Programme: 4 year Bachelor of Science (Honours/Honours with research) in Physics (Semiconductor Technology)

Duration of the Programme: 3 Years/4 Years with multiple entry/exit options with Certificate (after one year), UG Diploma (after two years), UG Degree (after 3 years), UG Degree with Honours/Honours with Research (after 4 years)

Eligibility Criterion: Candidate shall have passed 12th Examination with Physics and Mathematics as a major subject with minimum 50% in aggregate (47.50% in case of SC/ST/Blind/ Visually Differently Abled etc. candidates). from a recognized board.

About Programme: Bachelor of Science (Honours/Honours with research) in Physics (Semiconductor Technology) program typically focuses on providing students with a strong foundation in the principles and practices of semiconductor device fabrication, design, and application along with focus on overall development through various types of interdisciplinary and multidisciplinary courses. Bachelor of Science (Honours) in Physics (Semiconductor Technology) program will equip students with the knowledge and skills needed to pursue careers in semiconductor manufacturing, research and development, electronics design, and related fields.

Vision:

The programme is aimed to cultivate a new generation of semiconductor technologists who are not only equipped with a deep understanding of the foundational principles of semiconductor physics and technology but are also adept at navigating the complexities of the modern semiconductor industry. Through rigorous academic curriculum, hands-on laboratory experiences, and industry collaborations, our program aims to empower students to become innovators and leaders in the semiconductor field.

Mission:

To realise its vision, it is to provide students:

1. A comprehensive education in semiconductor technology, equipping them with the knowledge, skills, and experiences necessary to excel in the dynamic semiconductor industry.
2. excellence in Education and Research through rigorous academic coursework, hands-on laboratory experiences, and opportunities for undergraduate research.
3. Industry relevant trainingthat prepares them for successful careers in semiconductor manufacturing, design, and research.
4. Values, professionalism, and ethical leadershipthrough coursework, mentorship, and experiential learning opportunities.

Chaudhary Bansi Lal University Bhiwani

Scheme of Examination for the 4 year Bachelor of Science (Honours/Honours with research) in Physics (Semiconductor Technology) Under Graduate Programme as per NEP 2020 Curriculum and Credit Frame work for Undergraduate Programmes (Multiple Entry-Exit, Internships and Choice Based Credit System LOCF) with effect from the session 2025-26 (in a phased manner)

Semester-I

Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs.) T+P
CC-1/ MCC-1	C	25UN-PHYSC-101	Solid State Physics	4	4	30	70	100	3
MCC-2	C	25UN-PHYSC-102	Optics and Optical Technology	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M1	C	From available Core course Minor as per NEP							
MDC1	C	From available pool of Multidisciplinary courses as per NEP							
AEC-1	C	From Available pool of Ability Enhancement Courses as per NEP							
SEC-1	C	From Available pool of Skill Enhancement Courses as per NEP							
VAC-1	C	From Available pool of Value Added Courses as per NEP							

Chaudhary Bansi Lal University Bhiwani

Scheme of Examination for the 4 year Bachelor of Science (Honours/Honours with research) in Physics (Semiconductor Technology) Under Graduate Programme as per NEP 2020 Curriculum and Credit Frame work for Undergraduate Programmes (Multiple Entry-Exit, Internships and Choice Based Credit System LOCF) with effect from the session 2025-26 (in a phased manner)

Semester-II

Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs.) T+P
CC-2/ MCC-3	C	25UN-PHYSC-201	Electricity and Magnetism & EM Theory	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
DSEC-1	C	25UN-PHYSC-202	Classical, and Nuclear Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M2	C	From available Core course Minor as per NEP							
AEC-2	C	From Available pool of Ability Enhancement Courses as per NEP							
SEC-2	C	From Available pool of Skill Enhancement Courses as per NEP							
VAC-2	C	From Available pool of Value Added Courses as per NEP							
Internship	C	25UN-PHYSC-203	Internship of 4 Credits of 4-6 weeks duration after 2nd Semester (Mandatory in case of exit)						

Syllabi

Semester-I

Course Title:	**Solid State Physics**
Course Code:	**25UN-PHYSC-101**
Course type:	**CC/MCC**

Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**	**Time:3hrs**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Bonding in solids:** Force between atoms, Cohesion of atoms and cohesive energy, Crystal of inert gases, Van der Waal interaction, Repulsive interaction, Equilibrium lattice constants, Ionic crystals, Lattice energy of ionic crystal, Madelung constant of ionic crystal, Covalent crystals, metals, Hydrogen Bonds, Atomic radii.	10
II.	**Unit-II: Crystal Structure:** Introduction to crystalline, amorphous solids, crystal lattice and translation vectors, unit cell and basis, primitive and non-primitive lattices, symmetry operations, point groups and space groups, bravais lattices in 2D and 3D, lattice planes, miller Indices, inter planar spacing, crystal structures: sc, bcc, fcc and hcp, examples: NaCl, CsCl, Diamond and ZnS structure.	10
III	**Unit-III: Reciprocal lattice:** reciprocal lattice, Bragg's law, diffraction condition in reciprocal space, Laue's equations, Ewald construction, Brillioun zones and Weigner Seitz cell concepts, Brillioun zones construction, reciprocal lattice (sc, bcc, fcc), X-ray diffraction method: Laue, Rotating and powder crystal methods.	10
IV	**Unit-IV: Magnetic Properties:** Origin of magnetism, Types of magnetism, Dia-, Para-, Ferri-, Ferro and antiferromagnetic materials, Curie's law, Exchange interactions, Spin waves- magnons, Ferromagnetic domains: Magnetization curve, Bloch wall, Origin of domains.	10

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory(30Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05 Marks** • Mid-TermExam:**20 Marks**	**End Term Examination :70 Marks**

Part C-Learning Resources
Recommended Books/e-resources/LMS: 1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd. 2. Solid State Physics: An Introduction to Theory and Experiment by H. Ibach and H. Luth 3. Neil W Ashcroft and N David Mermin, Solid State Physics, Holt Saunders International Edn, 1976. 4. BD Cullity, Introduction to Magnetic Materials, Addison-Wesley, 1972. 5. Solid State Physics, M.A. Wahab, 2011, Narosa Publications.

Course Title: Optics and Optical Technology
Course Code: 25UN-PHYSC-102
Course type: CC/MCC

Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**	**Time:3hrs**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Coherence and Interference:** Introduction to optics, Spatial Coherence, Temporal coherence, Coherence length, Coherence time and 'Q'factor for light.Young's double slit experiment and Fresnel's .biprism and its application. Plane parallel thin film, wedge shaped film, Newton's rings and its applications. Anti-reflection Coatings, Interference Filters.	10
II	Fraunhofer diffraction: Single slit diffraction, plane transmission grating spectrum, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of a grating. Fresnel's diffraction: Huygens-Fresnel's theory, Fresnel's assumptions, rectilinear propagation of light, diffraction at a straight edge, rectangular slit and diffraction at a circular aperture.	10
III	**Polarization:** Polarization, Malus Law, double refraction, Huygens's wave theory of double refraction (Normal and oblique incidence), Nicol prism, Retardation plate, production and detection of polarized light. Optical activity, Fresnel's theory of optical rotation, Specific rotation, Half shade and Biquartz Polarimeters.	10
IV	**Lasers:** Basic concept of absorption and emission of radiations, amplification and population inversion; Metastable state, Laser action, He-Ne Laser, Semiconductor Laser, Applications of Lasers. **Fibre optics:** Basic principle of Optical fibres and their properties, Maximum Acceptance angle and numerical aperture, Types of optical fibres, Advantages and Disadvantages of optical fibres, Applications of optical fibres.	10

Practicum

1. To determine Refractive index of the material of a prism using sodium source.
2. Determination of wavelength of sodium light using Newton's Rings.
3. To determine the dispersive power and Cauchy constants of the material of a prism using Mercury discharge source.
4. To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source.
5. Determination of wavelength of sodium light by using a diffraction grating.
6. Resolving power of a telescope.
7. Resolving power of a prism.
8. Resolving power of a grating.
9. Comparison of Illuminating Powers by a Photometer.
10. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
11. Ordinary and extraordinary refractive indices for calcite or quartz.
12. To find the equivalent focal length of a lens system by nodal slide assembly.

Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.

Suggested Evaluation Methods

Internal Assessment:

- **Theory(20Marks)**
  - Class Participation: **05Marks**
  - Seminar/presentation/assignment/quiz/classtestetc.:**05Marks**
  - Mid-TermExam:**10 Marks**
- **Practicum(10Marks)**
  - Class Participation: **Nil**
  - Seminar/Demonstration/Viva-voce/Lab records etc.: **10Marks**
  - Mid-Term Exam: **Nil**

End Term Examination :50Marks

20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Optics by Ajoy Ghatak, 2008, Tata McGraw Hill
2. Fundamentals of Optics, Jenkins and White, McGraw Hill Book Co. Ltd., New Delhi
3. Laser, Theory & Applications by K. Thyagarajan and A.K. Ghatak, Macmillan India limited
4. Arther Beiser, "Concept of Modern Physics" Tata McGrawHill, New Delhi, 5th edn. 1997.

Semester-II

Course Title:	**Electricity, Magnetism and Electromagnetic theory**
Course Code:	**25UN-PHYSC-201**
Course:	**CC/MCC**

Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**	**Time:3hrs**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Mathematical Tools:** Basics of vector operations, component form, scalar and vector product; Derivatives: gradient, divergence and curl of vector/scalar field; Line, surface and volume integrals, Fundamental theorem of gradient, divergence and curl; Cartesian, spherical and cylindrical coordinates. **Electrostatics:** Coulomb's law, Electric field, Gauss's law, Gauss's law in integral and differential form, application of Gauss's law, Electric potential, energy of electrostatic field, Poisson's and Laplace's equations. Electrostatic Boundary conditions (concept only).	12
II	**Magnetostatics:** Ampere's and Biot-Savart's law, magnetic field of a steady current (examples), divergence and curl of B, application of Ampere's Law, Magnetostatic boundary conditions (concept only), Lorentz force. **Magnetic Properties of Matter:** Magnetic dipole moment due to current loop, Field of a magnetic material, Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Para-, Dia- and Ferromagnetism, B-H curve and hysteresis.	11
III	**Electromagnetic induction:** Faraday's laws of induction, Self-inductance, Mutual inductance, and Energy stored in a Magnetic field; Derivation of Maxwell's equations, Displacement current, Maxwell's equations in differential and integral form and their physical significance. **Electromagnetic Waves:** Electromagnetic waves, Transverse nature of electromagnetic wave, energy transported by electromagnetic waves, Poynting vector, Poynting's theorem, Propagation of a Plane electromagnetic waves in a free space.	11

IV	**Unit-IV: Electrical Circuits:** Kirchoff's law, network theorems, AC circuits: complex Reactance and Impedance, Analysis for RL, RC and LC and Series LCR Circuit.	10
	Practicum **Practicum** 1. Use of Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses. 2. Low resistance by Carey Foster's bridge with calibration. 3. Frequency of A.C. mains using an electromagnet. 4. Frequency of A.C. mains Electrical vibrator. 5. High resistance by substitution method. 6. To compare capacitances using De'Sauty bridge. 7. R-C Circuit: To study the Charge & Discharge of a capacitor and determine time constant. 8. To study a series LCR circuit and determine its (a) Resonant frequency, (b) Quality factor. 9. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor. 10. To verify the Thevenin and Norton theorems. 11. To verify the Superposition and Maximum Power Transfer Theorems. 12. Self-inductance by Anderson's bridge. 13. Verification of laws of electromagnetic induction. 14. To determine the ferromagnetic constants retentivity, permeability and susceptibility by tracing I-H Hysteresis curve using C.R.O. 15. Determination of magnetic field along the axis of a current carrying coil. **Note: Student will perform at least six experiments. The examiner will allot one Practicum at the time of end term examination**	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory(20Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10Marks** • Mid-Term Exam: **Nil**	**End Term Examination :50Marks** **20 Marks**

Part C-Learning Resources

References

1. Introduction to Electrodynamics, D. J. Griffiths, 4th Edition, Pearson India (2017).
2. Electricity and Magnetism (Berkley, Phys. Course 2), Edward M. Purcell, 1986 McGrawHill Education
3. Electricity and Magnetism, A.S. Mahajan & A.A. Rangwala (Tata- McGraw Hill), 1988
4. Foundations of Electromagnetic Theory, J. Reitz, F. J. Milford and R. W. Christie, 4th Edition,

Addison Wesley (2008).
5. Classical Electrodynamics, J.D. Jackson, John wiley& Sons.

Course Title:	**Classical, and Nuclear Physics**
Course Code:	**25UN-PHYSC-202**
Course type:	**CC/MCC**

Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**	**Time:3hrs**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Unit-I: Fundamentals of Dynamics:** Reference frames, Inertial and non-inertial frames of references, Conservative and non-conservative forces, fictitious forces, Concept of potential energy, Energy diagram. Stable and unstable equilibrium, Elastic potential energy, Force as gradient of potential energy, Work & Potential energy, Impulse, Centre of Mass for a system of particles, Motion of centre of mass (discrete and continuous), Expression for kinetic energy, Linear momentum and angular momentum for a system of particles in terms of centre of mass values. Collisions: Elastic and inelastic collisions between particles Centre of Mass and Laboratory frames.	12
II	**Unit-II: Rotational Dynamics:** 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, Torque, Principle of conservation of angular momentum, Moment of Inertia (discrete and continuous), Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation, elementary Gyroscope.	12

III	**Unit-III: Basic Properties of Nuclei:** Nuclear composition (p-e and p-n hypotheses), Nuclear properties; Nuclear mass, size, spin, parity, magnetic dipole moment, quadruple moment (shape concept) and binding energy, Systematic of nuclear binding energy per nucleon curve. Radioactivity: Law of Radioactive Decay, Half-life and mean lifetime, Radioactive Series, α-decay: Range of α-particles, Geiger-Nuttal law and α-particle Spectra, Gamow Theory of Alpha Decay, βdecay, Energy Spectra and Neutrino Hypothesis, γ-decay, Origin of γ-rays, Nuclear Isomerism and Internal Conversion.	11
IV	**Unit-IV: Radiation Interaction:** Interaction of energetic heavy charged particles (proton, Alpha particles etc.); Energy loss of heavy charged particle (Bethe formula, no derivation), Range of alpha particles, Interaction of light charged particle (Beta-particle), Interaction of Gamma Ray. **Nuclear Radiation Detectors:** Gas filled counters; Ionization chamber, proportional counter, G.M. Counter, Scintillation detector, semiconductor Detector.	8
	Practicum 1. To determine the value of Planck's constant by using a Photoelectric Cell. 2. To determine the value of Planck's constant by using LEDs of at least 4 different wavelengths. 3. To understand atomic systems with discrete energy levels by Franck-Hertz experiment. 4. To study characteristics of G.M. Counting System. 5. To determine absorption coefficient of metal sheet by G.M Counting System. 6. To determine Young's modulus of a wire by optical lever method. 7. To determine the modulus of rigidity of a wire by Maxwell's needle. 8. To determine the elastic constants of a wire by Searle's method. 9. Moment of Inertia of a Fly Wheel 10. Moment of Inertia of irregular body using a Torsion Pendulum. 11. To compare Moment of Inertia of a solid Sphere, Hollow Sphere and solid Disc of same mass with the help of Torsion Pendulum. 12. To determine the bending moment of a cantilever beam with uniformly distributed load, uniformly varying load and point load.. **Note: Student will perform at least six experiments. The examiner will allot one Practicum at the time of end term examination**	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory(20Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10Marks**	**End Term Examination :50Marks** **20 Marks**

• Mid-Term Exam: **Nil**	

Part C-Learning Resources

References

1. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
2. Physics, Resnick, Halliday & Walker, Wiley
3. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
4. Kenneth S. Krane, Introductory Nuclear Physics, Wiley, New York, 1988
5 Radiation detection and measurement: G.F. Knoll (Wiley, New York) (2000)