PG BOS
Annexure-III

Chaudhary Bansi Lal University

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

Scheme of Examination
for
Physics Subject
in
5-year Integrated B.Sc. (Hons./Hons. with research) (Physics)-M.Sc. (Physics)

as per NEP 2020
Curriculum and Credit Framework for 5-year Integrated 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

Programme Learning Outcomes (PLOs) for UG-PG Integrated Programme as per NEP-2020

PLOs		Bachelor's Degree in Physics
		After the completion of Bachelor's degree in Physics the student will be able to:
PLO-1	Knowledge and Understanding	Demonstrate comprehensive knowledge and understanding of fundamental and advanced concepts of physics, supported by appropriate mathematical, computational, and experimental techniques to explain physical phenomena and solve scientific problems.
PLO-2	Research, Innovation and Multidisciplinary Learning	Develop research aptitude through scientific inquiry, literature review, project work, data interpretation, and innovation while integrating knowledge from physics, chemistry, mathematics, electronics, computer science, artificial intelligence, materials science, and other interdisciplinary domains.
PLO-3	Experimental, Computational and Technical Skills	Design and perform experiments, analyze scientific data, and utilize modern laboratory instruments, programming, computational methods, simulation tools, and emerging technologies for scientific investigations and technological applications.
PLO-4	Professional Skills and Lifelong Learning	Develop communication, leadership, teamwork, entrepreneurship, digital literacy, and self-learning abilities to adapt to emerging technologies, professional challenges, and lifelong learning opportunities.
PLO-5	Ethics, Environment and Social Responsibility	Demonstrate professional ethics, scientific integrity, laboratory safety, environmental consciousness, sustainable practices, constitutional values, and social responsibility while applying scientific knowledge for the welfare of society.
PLO-6	Critical thinking and Problem solving	Apply scientific reasoning, mathematical methods, computational tools, and analytical skills to identify, formulate, analyze, and solve theoretical, experimental, and interdisciplinary problems in physics and allied sciences.
PLO-7	Employability and Career Readiness	Acquire the theoretical knowledge, practical skills, research competence, and multidisciplinary capabilities required for higher education, scientific research, teaching, entrepreneurship, public services, and careers in academia, research laboratories, industries, and technology-driven organizations.
PLO-8	Holistic Development and Global Citizenship	Develop intellectual curiosity, creativity, innovation, cultural awareness, global outlook, and holistic personality through multidisciplinary learning, Skill Enhancement Courses (SEC), Value Added Courses (VAC), Ability Enhancement Courses (AEC), internships, community engagement, and research experiences.

Chaudhary Bansi Lal University Bhiwani

Scheme of Examination for the Physics Subject in 5-year Integrated Programmes (Multiple Entry-Exit, Internships and Choice Based Credit System LOCF) with effect from the session 25-26 (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
MCC-1	C	25IMS-PH-101	Classical Mechanics-I	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-2	C	25IMS-PH-102	Optics& optical technology	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M1	C	From available CC/MCC/CC-M of 4 credits as per NEP							
MDC1	C	From Available pool of Multidisciplinary Courses as per NEP/SWAYAM/MOOCs							
AEC-1	C	From Available pool of Ability Enhancement Courses as per NEP/SWAYAM/MOOCs							
SEC-1	C	From Available pool of Skill Enhancement Courses as per NEP/SWAYAM/MOOCs							
VAC-1	C	From Available pool of Value Added Courses as per NEP/SWAYAM/MOOCs							

Semester-II

Course Type	Applicable Scheme	CourseCode	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T+P
MCC-3	C	25IMS-PH-201	Electricity and magnetism-I	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-4	C	25IMS-PH-202	Classical Mechanics & Waves	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M2	C	From available CC/MCC/CC-M of 4 credits as per NEP							
MDC-2	C	From Available pool of Multidisciplinary Courses as per NEP/SWAYAM/MOOCs							
AEC-2	C	From Available pool of Ability Enhancement Courses as per NEP/SWAYAM/MOOCs							
SEC-2	C	From Available pool of Skill Enhancement Courses as per NEP/SWAYAM/MOOCs							
VAC-2	C	From Available pool of Value Added Courses as per NEP/SWAYAM/MOOCs							
Internship	C	25IMS-PH-204	Internship of 4 Credits of 4-6 weeks duration after 2nd Semester (Mandatory in case of exit). Refer the programme Ordinance.						

Refer the courses listed below i.e. remedial/bridge course:

- The above courses are remedial/bridge courses to be completed in addition to the regular curriculum of the 5-Year Integrated B.Sc.–M.Sc. Physics Programme by students who have studied Physics but not Mathematics at the 10+2 level.
- Students shall be required to successfully complete and pass these remedial/bridge courses to be eligible for the award of the relevant Certificate, Diploma, Degree, or any exit qualification under the Programme.
- This scheme shall be read in conjunction with the approved Scheme and Syllabi of the 5-Year Integrated B.Sc.–M.Sc. Physics Programme as approved by the University.

Semester-III

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
MCC-5	C	25IMS-PH-301	Electricity and magnetism-II	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-6	C	25IMS-PH-302	Basic of Electronics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-7	C	25IMS-PH-303	Introductory of Quantum Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M3	C	From available CC/MCC/CC-M of 4 credits as per NEP							
MDC3	C	From Available pool of Multidisciplinary Courses as per NEP/SWAYAM/MOOCs							
AEC-3	C	From Available pool of Ability Enhancement Courses as per NEP/SWAYAM/MOOCs							
SEC-3	C	From Available pool of Skill Enhancement Courses as per NEP/SWAYAM/MOOCs							

Semester-IV

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
MCC-8	C	25IMS-PH-401	Mathematical Physics-I	4	4	30	70	100	3
MCC-9	C	25IMS-PH-402	Thermodynamics & Statistical Mechanics-I	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-10	C	25IMS-PH-403	Introduction to Computation Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-11	C	25IMS-PH-404	Nuclear & Particle Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M4	C	From available CC/MCC/CC-M of 4 credits as per NEP							
AEC-4	C	From Available pool of Ability Enhancement Courses as per NEP/SWAYAM/MOOCs							
VAC-4	C	From Available pool of Value Added Courses as per NEP/SWAYAM/MOOCs							
Internship	C	25IMS-PH-405	Internship of 4 Credits of 4-6 weeks duration after 2nd Semester (Mandatory in case of exit). Refer the programme Ordinance.						

25IMS-PH-403 is related to Computational Techniques/Computer Language, hence same may be offered through Classroom Lectures, Online Video Lectures, and MOOCs-based Content.

Scheme of Examination for MDC

Semester	Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	Endterm Marks	Total Marks	Duration of exam (Hrs.) T+P
1	MDC-1	C	24UN-PHY-MDC101	Physics Fundamentals-I	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3
2	MDC-2	C	24UN-PHY-MDC201	Physics Fundamentals-II	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3

Chaudhary Bansi Lal University Bhiwani Integrated. : Programs
Course:CC-1/MCC-1

Max. Marks:100 **InternalAssessmentMarks:30** **End Term Exam Marks: 70**	**Time:3 Hrs.**

Session:2025-26			
Part A-Introduction			
Subject	Physics		
Semester	1st		
Nameof the Course	Classical Mechanics-I		
CourseCode	25IMS-PH-101		
Course Type: (CC/MCC/MDC/CCM/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics as main subject at level 4 (i.e. 10+2 or equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the dynamics of system of particles, conservation of energy and momentum application of both translational and rotational dynamics motions simultaneously in analyzing rolling with slipping. 2. Explain and apply Kepler's Laws and Newton's Law of Universal Gravitation to describe planetary motion and orbital dynamics. 3. Evaluate the dynamics of satellites in circular orbits, including geosynchronous satellites, and apply concepts to practical systems like GPS. 4. Learn to present observations, results, analysis and different concepts related to experiments of Mechanics.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5

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 beset. 5. Use of scientific (non-programmable) calculator is allowed.		
Unit	**Topics**	**Contact Hours**
I	**Fundamentals of Dynamics:** Review of vector algebra and differential calculus of vectors: gradient, divergence and curl. Reference frames. Inertial frames, Review of Newton's Laws of Motion. Concept of inertia (vega) and cause-effect in motion. Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Momentum of variable-mass system: motion of rocket. Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames.	12
II	**Work and Energy:** Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Force as the gradient of potential energy. Work & Potential energy. Elastic potential energy. Law of Conservation of Energy. Spring-mass system without and with friction (Damped oscillations).Energy diagram. Stable and unstable equilibrium. Torque on a dipole.	10
III	**Rotational Dynamics:** Angular momentum of a particle and system of particles, Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Theorems of perpendicular and parallel axis (with proof Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation. Rolling motion, condition for pure rolling.	12
IV	**Gravitation (Central Force):** Kepler's Laws. Law of gravitation. Planetary motion from Surya Siddhanta. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). Physiological effects on astronauts.	11

	Practicum 1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope. 2. To study the random error in observations. 3. To determine the height of a building using a Sextant. 4. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity. 5. To determine the Moment of Inertia of a Flywheel. 6. To determine g and velocity for a freely falling body using Digital timing Technique. 7. To explore elliptical orbits and verify Kepler's laws (software or an online simulation). 8. To track positions, calculate distances, and discuss triangulation (Use smart phones or handheld GPS devices). 9. To Study motion of a sphere, cylinder, and hoop rolling down a ramp (Simulation). 10. Distinguish between pure rolling, slipping, and combined motion (simulations). 11. Simulate a physical pendulum and determine its period and moment of inertia. 12. To determine the moment of inertia of an irregular-shaped body using the concept of a physical pendulum. **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30

Suggested Evaluation Methods

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

PartC- Learning Resources

Recommended Books/e-resources/LMS:

1.Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
2. Fundamentals-of-Physics-I-Mechanics, R. Shankar, 2014, Yale University Press
3. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
4. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
5. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
6. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
7. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
8. University Physics. F. W Sears, M. W Zemansky, H. D Young 13/e, 1986, Addison Wesley
9. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.
10. Analytical Mechanics, G. R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
11. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
12. Physics for scientists and Engineers with Modern Phys., J. W. Jewett, R.A. Serway, 2010, Cengage Learning.

Chaudhary Bansi Lal University Bhiwani

Integrated. **Programs**

Course:CC-2/MCC-2

Session:2025-26			
Part A-Introduction			
Subject	Physics		
Semester	1st		
Name of the Course	Optics & Optical Technology		
Course Code	25IMS-PH-102		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics as main subject at level 4 (i.e. 10+2 or equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Have understanding of Interference by Division of Wave front, by Division of Amplitude and Interference due to transmitted light & reflected light 2. Understand and explain the diffraction, dispersive power of grating, Rayleigh's criterion and resolving power of telescope & a grating 3. Understand the theories and laws of polarization 4. Understand and appreciate the applications of Lasers in developing LED, Holography, in materials processing, in Medicine, Industry and Military. Have the idea of optical fibers, their properties and principle of propagation of electromagnetic waves through optical fibers.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 **InternalAssessmentMarks:30** **End Term Exam Marks: 70**		**Time: 03 Hrs.**	
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	**Interference by Division of Wave front:** Young's double slit experiment, Coherence, Conditions of interference, Fresnel's bi-prism and its applications to determine the wavelength of sodium light and thickness of a mica sheet, phase change on reflection. **Interference by Division of Amplitude:** Plane parallel thin film, production of colors in thin films, Interference due to transmitted light and reflected light, wedge shaped film (Basic idea), Newton's rings.	11
II	**Fraunhofer diffraction:** Diffraction: a Single Slit, Double Slit and N-slit (Transmission Grating). Rayleigh's criterion of resolution, Resolving Power and Dispersive Power of a Plane Diffraction Grating. Introduction to **Fresnel diffraction** with examples.	10
III	**Polarization:** Double refraction: Nicol prism, polaroids and their uses. Production and analysis of plane, circularly and elliptically polarized light, Half-wave and quarter-wave plate, optical activity, Fresnel's explanation of optical activity: Biquartz and half shade polarimeter.	10
IV	**Lasers:** Coherence (Spatial & Temporal coherence) Stimulated emission, and spontaneous emission, Einstein's 'A' and 'B' coefficients and their relationship amplification. Factor for lasing action: population inversion, active Medium, Pumping and Optical Resonator; Main Properties of laser beam, Gas laser (He-Ne) and Solid state laser (Ruby). **Optical fiber:** Critical angle of propagation, Acceptance angle Numerical aperture, Mode of Propagation (V-number), Types of optics fiber, Normalized frequency, Attenuation, Applications, Fiber-optic Communication.	14

	Practicum 1. To determine Refractive index of the material of a prism using sodium source. 2. Determination of wavelength of sodium light using Newton'sRings. 3. To determine the dispersive power and Cauchy constants of the material of a prism using Mercury discharge source. 4. Determination of wavelength of sodium light by using a diffraction grating. 5. Resolving power of a telescope. 6. Resolving power of a grating. 7. Comparison of Illuminating Powers by a Photometer. 8. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter. 9. Ordinary and extraordinary refractive indices for calcite or quartz. 10. To determine the Numerical Aperture and acceptance angle of an Optical Fibre. 11. To determine wavelength, coherent length, and coherent time of laser using He-Ne Laser. 12. Explore acceptance angle andNA by varying core and cladding indices (simulations). 13. Simulate a simple digital communication link using laser and photodiode. **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30

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**

PartC-Learning Resources

Recommended Books/e-resources/LMS:

1. The Physics of Vibrations and Waves,H.J.Pain,2013,John Wiley and Sons.
2. The Physics of Waves and Oscillations, N.K.Bajaj,1998,Tata McGraw Hill.
3. Fundamentals and Applications of Ultrasonic Waves, J. David N.Cheeke, CRC(2002).
4. Optics, Ajoy Ghatak,2008, Tata McGraw Hill.
5. An Introduction to Interferometery, John Wiley & Sons, New Delhi.
6. Fundamentals of Photonics, SPIE, Open Source.

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Integrated- **Programs**

Course:MDC-1

Session:2025-26			
PartA-Introduction			
Subject	Physics		
Semester	1st		
NameoftheCourse	Physics Fundamentals-I		
CourseCode	24UN-PHY-MDC101		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)	Not studied Physics subject at level 4 (i.e.10+2orequivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Have knowledge about the nature, scope and impact of physics on technological development of the society. 2. Understand and describe motion of an object in one dimension. 3. Understand and describe the laws of motion and their applications in daily life. 4. Understand and appreciate the importance of laws of conservation of energy and momentum in daily life. 5. Learn to present observations, results, analysis and different concepts related to experiments of Physics Fundamentals-I.		
Credits	Theory	Practicum	Total
	2	1	3
Contact Hours	2	2	4
Max. Marks:70 **InternalAssessmentMarks:20 End Term Exam Marks: 50**		**Time:3 Hrs**	
PartB – ContentsoftheCourse			

InstructionsforPaper-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 beset.
5. Use of scientific(non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	Physics-Nature, scope & excitement, Major discoveries in physics, major contribution by Indian Physicists, Fundamental physical constants, Physics in relation to other sciences, impact of physics on society and on latest development in science & technology. System of Measuring Units-Need for measurement, measuring process, concept of mass, length, time; Fundamental and derive units, system of units, concepts of error, types of error (only definition), Accuracy and precision in measurement, least count and applications of measuring instruments -Vernier caliper, Screw Gauge.	08
II	Motion of objects in one dimension- position of the object, origin/reference point, frame of reference, definitions and examples of motion in one, two and three dimension, Scalar and Vector quantities, description of motion along a straight line distance and displacement, uniform motion and non-uniform motion, average and instantaneous speed, average and instantaneous velocity, acceleration; graphical analysis of straight line motion distance time graph, velocity-time graph, equation of motions and their applications.	08
III	Causes of motion concept of force, Newton's1stlaw of motion, inertia and mass; Newton's 2nd law of motion, momentum and force; 3rd law of motion, daily life applications of Newton's laws of motion. Universal law of gravitation and its importance, acceleration due to gravity and free fall of a body; mass and weight of an object on earth and moon, concept of thrust and pressure and importance in daily life, buoyancy and Archimedes principle-the physics behind floating of objects on water.	07
IV	Work, energy, types of energy-Kinetic energy and Potential energy, P.E. of an object at a height; law of conservation of energy and its applications. Conservation of linear and angular momentum, collision (elastic and inelastic) and conservation laws in collisions- importance in daily life; concepts of center of mass-Physics behind cycling, rock climbing and skating.	07

	Practicum 1. To measure the diameter of a small spherical/cylindrical body. 2. To measure the length, width and height of the given rectangular block. 3. To measure the internal diameter and depth of a given beaker/calorimeter and hence find its volume. 4. Use of screw gauge:(i) to measure diameter of a given wire and (ii) to measure thickness of a given sheet 5. To determine radius of curvature of a given spherical surface by a spherometer. 6. To find the down ward force, along an inclined plane, acting on a roller due to gravitational pull of the earth and study its relationship with the angle of inclination by plotting graph between force and sin θ. 7. To find the weight of a given body using parallelogram law of vectors. 8. Verification of Archimedes principle. 9. Verification of Work-energytheorem. 10. Acceleration due to gravity(g) by bar pendulum. 11. To determine the moment of Inertia of a fly-wheel. 12. Study of law of conservation of linear momentum and Kinetic Energy. 13. **Note: Student will perform at-least six experiments. The examiner will allot one Practicum at the time of end term examination.**	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory(15Marks)** • Class Participation: **04 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**04 Marks** • Mid-Term Exam: 07 **Marks** ➢ **Practicum(05Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.:**05Marks** • Mid-Term Exam: **Nil**	**End Term Examination :35Marks** **:15Marks**

Part C – Learning Resources

Recommended Books/e-resources/LMS:

1. Essential University Physics, Vol.- 1 & 2 by Richard Wolfson, Pearson Education, Patparganj, Delhi, India.
2. Concept of Physics by H.C. Verma, Bharti Bhawan, Ansari Road, Daryaganj, NewDelhi, India.
3. Modern Physics (2nd edition),by S.L.Kakani and Shubhra Kakani,VivaBooks,NewDelhi.
4. Physics for Scientists and Engineers with Modern Physics, 7th edition, by Raymond A. Serway and JohnW. Jewett, Jr., Thomson Higher Education10DavisDriveBelmont, CA 94002-3098 USA.
5. Physics For You, Fifth Edition, by Keith Johnson, OUP Oxford;5th edition (23June 2016).
6. B.Sc. Practicum Physics, C.L. Arora, R Chand &Co.New Delhi.
7. B.Sc. Practicum Physics, Harnam Singh and Dr. P. S. Hemne, S Chand & Company Ltd.

Chaudhary Bansi Lal University
Bhiwani Integrated Programs
Course:CC-3/MCC-3

Session:2025-26	
PartA-Introduction	
Subject	Physics
Semester	2nd
Name of the Course	**Electricity and Magnetism-I**
CourseCode	25IMS-PH-201
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC
Level of the course(Asper Annexure-I	100-199
Pre-requisite for the course (if any)	Appeared or passed the 1st sem (5-year Integrated B.Sc. (Hons./Hons. with research)-M.Sc. (Physics)/ equivalent)
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Explain and differentiate the vector and scalar formalisms of electrostatics. Also be able to apply Gauss's Divergence & Stokes theorem to solve various problems in electrostatics 2. Describe the magnetic materials & important properties of magnetic field. Understand the properties and theories of dia-, para- & ferromagnetic materials. 3. Derive Maxwell equations and their physical significance and familiar about the propagation of electromagnetic waves i.e. boundary conditions at the interface between different media. The students will also be able to have basic idea about the propagation of electromagnetic waves in free space and in medium. 4. Understand D.C. and A.C. circuits, able to apply and analyze using networks. Analyze DC/AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe thegraphical relationship of resistance, capacitor and inductor. 5. Learn to present observations, results, analysis and different concepts related to experiments of Electricity and Magnetism.

Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 **InternalAssessmentMarks:30 End** **Term Exam Marks: 70**		**Time: 03 Hrs.**	

Par tB-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%numericalproblemsareto beset.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Vector background and electric field:** Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss's divergence theorem, Stoke's theorem.	11
II	**Electrostatics:** Superposition principle for continuous charge distribution, Gauss's law in integral and differential form, electric potential, energy of electrostatic field, Poisson's and Laplace's equations (introduction only), properties of conductors, method of images (with simple example Dielectric medium, Polarization, Bound charges in a polarized dielectric and their physical interpretation.	12
III	**Magnetostatics:** Lorentz force, Ampere's and Biot-Savart's law, divergence and curl of **B**, vector potential, charged particle in electromagnetic field (with example); Magnetism in matter: volume and surface currents (introduction only), magnetization vector **M** and vector **H**. **Magnetic properties** Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Para-, Dia- and Ferromagnetism, B-H curve and hysteresis.	12
IV	**D.C.and A.C.circuits:** D.C. Network theorems: Thevenin's theorem, Norton theorem, Superposition theorem; AC Circuits: Kirchhoff's laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width, Parallel LCR Circuit.	10

	Practicum 1. Use of multi-meter 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. Determination of Impedance of an A.C. circuit and its verification. 4. Frequency of A.C. mains using an electromagnet. 5. Frequency of A.C. mains Electrical vibrator. 6. High resistance by substitution method. 7. To compare capacitances using De'Sautybridge. 8. To study the Characteristics of a Series RC Circuit. 9. To study a series LCR circuit and determine its (a) Resonant frequency, (b) Quality factor. 10. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor. 11. To verify the Thevenin and Norton theorems. 12. To verify the Superposition and Maximum Power Transfer Theorems. 13. Self-inductance by Anderson's bridge. 14. Verification of laws of electromagnetic induction. 15. Study of B-H curves of various materials using C.R.O and determination of various parameters. **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory(20Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/class test etc.:**05Marks** • Mid-TermExam:**10 Marks** ➢ **Practicums (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. Electricity and Magnetism by EdwardM.Purcell
2. Electricity and Magnetism by A.S. Mahajan&A.A.Rangwala
3. Introduction to Electrodynamics by D.J.Griffiths
4. Classical Electrodynamics by J.D. Jackson.
5. FeynmanLecturesVol.2 by R.P.Feynman,R.B.Leighton,M.Sands
6. Elements of Electromagnetics by M.N.O.Sadiku.
7. Electricity and Magnetism by J.H.Fewkes&J.Yarwood.Vol. I,1991, OxfordUniv. Press.
8. B.Sc. Practicum Physics by C.L. Arora
9. Advanced Level Practicum Physics by M.Nelkon and Ogborn Heneman
10. Practicum Physics by S.S. Srivastava and M.K.Gupta.
11. Practicum Physics by S.L.Gupta and V.Kumar.
12. Modern Approach to Practicum Physics by R.K. Singla
13. Advanced Practicum Physics for students by B.L.Flint and H.T.Worsnop

Chaudhary Bansi Lal University Bhiwani

Integrated **Programs**

Course:CC-4/MCC-4

Session:2025-26	
Part A-Introduction	
Subject	Physics
Semester	2nd
Name of the Course	**Classical Mechanics & Waves**
Course Code	25IMS-PH-202
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC
Level of the course(As per Annexure-I	100-199
Pre-requisite for the course (if any)	Appeared or passed the 1st sem (5-year Integrated B.Sc. (Hons./Hons. with research)-M.Sc. (Physics)/ equivalent)
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to 1. Explain and differentiate the vector and scalar formalisms of electrostatics. Also be able to apply Gauss's Divergence & Stokes theorem to solve various problems in electrostatics 2. Describe the magnetic materials & important propertiesof magnetic field. Understand the properties and theories of dia-, para- & ferromagnetic materials 3. Derive Maxwell equations and their physical significance and familiar boundary conditions at the interface between different media. The students will also be able to have basic idea about the propagation of electromagnetic waves 4. Analyze DC/AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor 5. Learn to present observations, results, analysis and different concepts related to experiments of Electricity and Magnetism 5. Differentiate between elastic and plastic body. Elastic constants, determination and their physical significance. Torque and its significance.

Credits	Theory	Practicum	Total
	1	1	2
Contact Hours	1	2	3

Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**	**Time: 03 Hrs.**

PartB-ContentsoftheCourse

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1will be compulsoryand 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%numericalproblemsareto beset.
5. Use of scientific(non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Central Force**: Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram., compound pendulum or physical pendulum in formofelliptical lamina and expression oftime period, determination ofg by means of bar pendulum, Normal coordinates and normal modes, Normal modes of vibration for given spring mass system, possible angular frequencies of oscillation of two identical simple pendulums of length (l) and small bob of mass (m0joined together with spring of spring constant (k).	10
II	**Simple Harmonic Oscillations SHM:** Differential equation of SHM and its solution, Simple pendulum and compound pendulum, Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle, Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies Beats (Introduction only); Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures **Damped Harmonic Oscillations:** Damped motion of mechanical and electrical oscillators, critical damping, amplitude decay, energy decay, logarithmic decrement, relaxation time, Q-value.**Forced Harmonic Oscillations:** Transient and steady state behavior of a forced oscillator, Q-Value- as a measure of power absorption band width, Coupled Oscillation (basic concept only).	15
III	**Non-Inertial Systems:** Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems. **Special Theory of Relativity:** Michelson's Morley experiment and its outcomes, Postulates of special theory of relativity, Lorentz	10

	Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, relativistic addition of velocities, variation of mass-energy equivalence.	
IV	**Wave Motion:** Wave Equation, Solution of wave equation, Plane and Spherical Waves, Longitudinal and Transverse Waves, Particle and Wave Velocities, The string as a force oscillator, Velocity of Transverse vibrations of Stretched Strings, Reflections and transmission of waves on a string at a boundary, Velocity of Longitudinal Waves in a Fluid in a Pipe, Newton's Formula for Velocity of Sound, Reflections and transmission of sound waves at a boundary, Energy distribution in sound waves, Phase and Group Velocities.	10
	Practicum 1. To determine the value of g using Bar Pendulum. 2. To determine the value of g using Kater's Pendulum. 3.To obtain and analyze Lissajous figures by applying two perpendicular SHMs. 4.To study damped oscillations in an LCR circuit. 5.Visualize beats patterns from two waves of slightly different frequencies (simulation). 6.To observe and measure the velocity of transverse waves on a stretched string. 7.To determine the velocity of sound in air using a resonance tube. 8.To determine the velocity of longitudinal waves in a metal rod. 9.To differentiate and estimate phase and group velocities (simulation/Instrument). 10. Plot $A(t)=A_0e^{-\gamma t}$, vary damping constant and initial amplitude, plot decay curves (simulations). 11. Observe transverse wave propagation on a string and study the wave equation (Simulation: adjust tension, mass, frequency): $\partial^2y/\partial t^2=v^2\partial^2y\partial x^2$ 12. Explore how sound propagates in open/closed pipes. Simulate different pipe lengths and note resonant frequencies. 13. To determine the wavelength of sodium light by Michelson Interferometer 14. To study (i) Length contraction (ii) Time dilation (iii) Velocity addition by using simulations (any two) **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30
SuggestedEvaluationMethods		

InternalAssessment: ➢ **Theory(20Marks)** • ClassParticipation: **05 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05** • Mid-TermExam:**10 Marks** ➢ **Practicum (10 Marks)** • ClassParticipation:**Nil** • Seminar/Demonstration/Viva-voce/Labrecordsetc.: 10**Marks** • Mid-TermExam: **Nil**	**End Term Examination :50Marks** **:20Marks**

PartC-LearningResources

Recommended Books/e-resources/LMS:

1. **Classical Mechanics** by H. Goldstein, Charles P. Poole and John L. Safko.
2. **Classical Mechanics** by N. C. Rana and P. S. Joag.
3. **Mechanics** by D. S. Mathur.
4. **Waves and Oscillations** by N. K. Bajaj.
5. **Waves and Oscillations** by A. P. French.
6. **Classical Mechanics** by J. C. Upadhyaya.
7. **Mechanics** by Berkeley Physics Course, Vol. 1, by Charles Kittel, Walter D. Knight and Malvin A. Ruderman.
8. **Fundamentals of Physics** by David Halliday, Robert Resnick and Jearl Walker.
9. **University Physics with Modern Physics** by Hugh D. Young and Roger A. Freedman.
10. **The Feynman Lectures on Physics, Vol. I** by Richard P. Feynman, Robert B. Leighton and Matthew Sands.
11. **Introduction to Special Relativity** by Robert Resnick.
12. **Waves** by Frank S. Crawford Jr.
13. **Oscillations and Waves** by Satya Prakash and Vinay Dua.
14. **Introduction to Electrodynamics** (for wave propagation concepts) by David J. Griffiths.
15. **Physics for Degree Students (B.Sc.) Vol. I** by C. L. Arora.

Chaudhary Bansi Lal University Bhiwani
Integrated. **Programs**
Course:MDC-2

Session:2025-26			
Part A-Introduction			
Subject	Physics		
Semester	2nd		
NameoftheCourse	**Physics Fundamentals-II**		
CourseCode	24UN-PHY-204		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course(As per Annexure-I	100-199		
Pre-requisite for the course (if any)	Not studied Physics subject at level 4 (i.e.10+2orequivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner willbeableto: 1. Have basic knowledge about nature of light, the associated phenomena and their importance in daily life 2. Understand and describe the working of important optical instruments through the learning of image formation by mirrors and lenses 3. Have basic knowledge about electric current, electric circuit, electric components, and Practicum utility of heating and magnetic effects of electric current 4. Grasp an introductory idea about the generation of X-rays, α-, β- and γ-rays through an understanding of composition of atom & nucleus 5. Understand theobservations, results, analysis and different concepts related to experiments of light &optics.		
Credits	Theory	Practicum	Total
	2	1	3
ContactHours	2	2	4

Max. Marks:70 Internal Assessment Marks:20 End Term Exam Marks: 50	Time: 03 Hrs.

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	Light and optics-Nature and properties of light, its speed, frequency and wavelength; Reflection of light-types of reflection and their importance in daily life, laws of reflection, multiple reflection by mirrors and their applications. Refraction of light- laws of refraction, refractive index, refraction of light through prism(dispersion of light), formation Rainbow, twinkling ofstars, advance Sunrise and delayed Sunset; Scattering of light and blue colour of the sky; apparent depth, total internal reflection and its important applications	07
II	Image formation through reflection-images formed by plane mirrors, multiple images formed by two flat mirrors and optical illusions; images formed by parabolic mirrors and spherical mirrors- Concave and convex mirrors, ray diagrams, mirror equation and magnification; applications of plane and curved mirrors in daily life. Image formation through refraction-images by convex and concave lenses, ray diagrams and lens equation. Optical instruments-Camera, eye, telescope and microscope	08
III	Electricity- electric charge, types of charges, unit of charge, frictional electricity, electricity by conduction and electric current, units of electric current, measurement of current, conductors and insulators; resistance, resistivity and Ohm's law, electric potential and potential difference, emf; Electric circuit- resistor, capacitor, battery, ammeter and voltmeter; Series and parallel combinations of resistors, electrical wiring in houses and electrical safety (fuse, hot wire, neutral, ground and short circuit), electric power and electric power transmission; Heating effect of current and its Practicum applications. Magnetic effect of electric current- Magnetic field and field lines, bar magnet,magneticfieldanddirectionoffieldduetoacurrent-throughstraight conductor and through a circular loop;solenoid, electromagnet.	08

IV	Structure of an atom- Rutherford's model of an atom, Bohr's model of an atom and composition of the atom-electron, proton and neutron, orbits or shells (energy levels in an atom), distribution of electrons indifferent shells of the atom, atomic number and atomic mass of an atom, core shell and outer shell, valency of an atom, excitation and ionization of the atom, meaning of atomic transitions; Discovery of X-rays, Generation of X-rays, their characteristics, applications and harmful effects; Composition of nucleus, meaning of nuclear transitions and properties of α-, β- and γ-rays	07
	Practicum 1. To find the focal length of a convex mirror using a convex lens. 2. To find the value of v for different values of u in the case of a concave mirror and to find the focal length. 3. To find the focal length of a concave lens using a convex lens. 4. To determine the refractive index of a glass slab 5. To find the refractive index of a liquid using a convex lens and plane mirror 6. To determine the resistivity of different wires by plotting graph for potential difference versus current. 7. To verify Ohm's law for metallic conductor and to determine its resistance. 8. To find the frequency of AC mains with a sonometer. 9. Use of Multimeter for measuring Resistance, A.C. and D.C.Voltage and Current, checking of electrical fuses. 10. Use of Multimeter to check the working condition of diode, an LED, a resistor and a capacitor. **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory(15Marks)** • Class Participation: **04Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**04Marks** • Mid-Term Exam: 07 **Marks** ➢ **Practicum(05Marks)** • Class Participation:**Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **05Marks** • Mid-Term Exam: **Nil**		**End Term Examination :35Marks** **15Marks**
PartC-LearningResources		

Recommended Books/e-resources/LMS:

1. **Essential University Physics, Vol. 1 & 2** by Richard Wolfson.
2. **Concepts of Physics** by H. C. Verma.
3. **Modern Physics (2nd Edition)** by S. L. Kakani and Shubhra Kakani.
4. **Physics for Scientists and Engineers with Modern Physics (7th Edition)** by Raymond A. Serway and John W. Jewett, Jr.
5. **Physics for You (5th Edition)** by Keith Johnson.
6. **B.Sc. Practical Physics** by C. L. Arora.
7. **B.Sc. Practical Physics** by Harnam Singh and P. S. Hemne.

Chaudhary Bansi Lal University
Bhiwani Integrated - Programs
Course:CC-5/MCC-5

Session:2025-26	
PartA-Introduction	
Subject	Physics
Semester	3rd
Name of the Course	**Electricity and Magnetism-II**
CourseCode	25IMS-PH-301
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC
Level of the course(Asper Annexure-I	200-299
Pre-requisite for the course (if any)	Appeared or passed the2nd sem (5-year Integrated B.Sc. (Hons./Hons. with research) -M.Sc. (Physics)/ equivalent)
Course L earning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Analyze the behaviour of electric fields in dielectric media, evaluate capacitance of practical capacitor configurations, and explain energy storage in electrostatic systems. 2. Explain the principles of electromagnetic induction, self and mutual inductance, transformers, and magnetic circuits, and solve related numerical problems. 3. Describe the magnetic behaviour of materials, explain the operating principles of electrical measuring instruments and magnetic sensors, and relate their applications to modern technology. 4. Interpret Maxwell's equations in integral and differential forms, explain the concept of displacement current, and describe the generation and propagation of electromagnetic waves and their technological applications. 5. Perform laboratory experiments on electrical measurements, inductance, transformers, magnetic materials, and modern electrical instruments; analyze

	experimental data and prepare scientific reports.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 **InternalAssessmentMarks:30 End** **Term Exam Marks: 70**		**Time: 03 Hrs.**	

Par tB-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%numericalproblemsareto beset.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Electric dipole and dipole field**, Torque and potential energy of an electric dipole, Electric quadrupole (qualitative treatment), Capacitors with dielectrics, Energy stored, Ferroelectric materials and applications. **Faraday's laws of electromagnetic induction**, Motional emf, Self and mutual inductance, Energy stored in magnetic field, Eddy currents and applications, Transformer: construction, working, efficiency and losses.	12
II	**Magnetic domains**, Domain theory of ferromagnetism, Soft and hard magnetic materials, Ferrites, Permanent magnets, Magnetostriction, Hall effect and its applications, Magnetoresistance (qualitative), Electromagnets, Solenoids, Toroids, Applications of magnetic materials in electrical devices.	10
III	**Displacement current** and the need for Maxwell's correction to Ampere's law, Maxwell's equations in integral and differential forms, Physical significance of Maxwell's equations, Electromagnetic waves (qualitative introduction), **Wave propagation in free space**, Electromagnetic spectrum, Energy density of electric and magnetic fields, Poynting vector and its physical significance (statement only), Applications of electromagnetic waves in communication systems, radar, microwave ovens, optical fibre communication, wireless technologies and medical imaging.	13
IV	**Moving-coil galvanometer**, Ballistic galvanometer (principle and applications), Conversion of galvanometer into ammeter and voltmeter, Potentiometer and its applications, Digital multimeter, Cathode Ray Oscilloscope (CRO), Digital Storage Oscilloscope (DSO), Function generator, Introduction to electrical sensors: LDR, Thermistor, Hall sensor and Piezoelectric sensor.	10

	Practicum 1. To convert a moving-coil galvanometer into an ammeter and calibrate it. 2. To convert a moving-coil galvanometer into a voltmeter and calibrate it. 3. To determine the self-inductance of a coil using Anderson's bridge (or Maxwell's bridge). 4. To determine the mutual inductance between two coupled coils. 5. To study the characteristics of a transformer and determine its efficiency under different loads. 6. To study the charging and discharging characteristics of a capacitor and with/without different dielectric materials. 7. To study the hysteresis curve (B–H curve) of a ferromagnetic material using a CRO/digital interface and determine coercivity and retentivity. 8. To study the characteristics of an LDR and determine its resistance as a function of light intensity. 9. To study the characteristics of a thermistor and determine its temperature coefficient of resistance. 10. To study the Hall effect and determine the Hall coefficient of a semiconductor (or perform computer-based data analysis where the experimental setup is unavailable). 11. To study the characteristics of a piezoelectric sensor and its applications. 12. To determine the magnetic field along the axis of a solenoid and compare it with the theoretical value. 13. Simulation of electric field due to an electric dipole and visualization of equipotential surfaces using open-source software. 14. Simulation of electromagnetic wave propagation and visualization of electric and magnetic field vectors using open-source simulation. **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30
Suggested Evaluation Methods		
InternalAssessment: ➢ **Theory(20Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/class test etc.:**05Marks** • Mid-TermExam:**10 Marks** ➢ **Practicums (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. **Introduction to Electrodynamics** by David J. Griffiths, 4th Edition, Cambridge University Press, 2017.
2. **Electricity and Magnetism** by Edward M. Purcell and David J. Morin, 3rd Edition, Cambridge University Press, 2013.
3. **Electricity and Magnetism** by A. S. Mahajan and A. A. Rangwala, Tata McGraw-Hill Education.
4. **Electricity and Magnetism** by N. N. Ghosh, Books & Allied (P) Ltd.
5. **Electricity and Magnetism** by R. Murugeshan and K. Sivaprasath, S. Chand Publishing.
6. **Electromagnetics with Applications** by John D. Kraus and Daniel A. Fleisch, 5th Edition, McGraw-Hill Education.
7. **Basic Electrical Engineering** by D. P. Kothari and I. J. Nagrath, McGraw-Hill Education.
8. **Electromagnetics** by B. B. Laud, New Age International Publishers.
9. **Classical Electrodynamics** – John D. Jackson, 3rd Edition, Wiley India. (For advanced reference only.)
10. **B.Sc. Practical Physics** by C. L. Arora, S. Chand & Company.
11. **Practical Physics** by S. L. Gupta and V. Kumar, Pragati Prakashan.
12. **Advanced Practical Physics** byB. L. Worsnop and H. T. Flint, Asia Publishing House.

Chaudhary Bansi Lal University
Bhiwani Integrated Programs
Course:CC-6/MCC-6

Session:2025-26			
PartA-Introduction			
Subject	Physics		
Semester	3rd		
Name of the Course	**Basics of Electronics**		
CourseCode	25IMS-PH-302		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC		
Level of the course(Asper Annexure-I	200-299		
Pre-requisite for the course (if any)	Appeared or passed the 2nd sem (5-year Integrated B.Sc. (Hons./Hons. with research) -M.Sc. (Physics)/ equivalent)		
Course L earning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Explain semiconductor physics, PN junctions, diodes, rectifiers, and optoelectronic devices. 2. Analyze the characteristics, biasing, and applications of BJTs and FETs. 3. Design and analyze amplifier circuits, feedback circuits, oscillators, and Op-Amp applications. 4. Apply Boolean algebra and design combinational and sequential digital circuits. 5. Construct, simulate, test, and troubleshoot analog and digital electronic circuits using laboratory instruments and simulation software.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 InternalAssessmentMarks:30 End Term Exam Marks: 70		**Time: 03 Hrs.**	
Par tB-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%numericalproblemsareto beset.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Semiconductor Diodes and Their Applications:** Introduction to conductors, semiconductors and insulators; intrinsic and extrinsic semiconductors; energy band concept; electrons and holes as charge carriers; formation of PN junction; forward and reverse bias characteristics of PN junction diode; Zener diode and its applications; Light Emitting Diode (LED), photodiode and solar cell; half-wave, full-wave and bridge rectifiers; capacitor filter; clipping and clamping circuits and their applications.	11
II	**Transistors and Basic Amplifiers:** Construction, working and characteristics of Bipolar Junction Transistor (BJT); transistor configurations (CB, CE and CC); current gain (α and β); transistor as a switch and as an amplifier; DC load line and operating point; basic transistor biasing; Junction Field Effect Transistor (JFET): construction, working and characteristics; comparison of BJT and JFET; single-stage RC coupled amplifier and its applications.	11
III	**Operational Amplifiers and Oscillators:** Introduction to integrated circuits; operational amplifier and its ideal characteristics; inverting and non-inverting amplifiers; voltage follower; summing amplifier; integrator and differentiator; comparator; basic concepts of positive and negative feedback; RC phase-shift oscillator; Wien bridge oscillator; applications of operational amplifiers and oscillators.	11
IV	**Introduction to digital electronics** and comparison between analog and digital systems; number systems (decimal, binary, octal and hexadecimal) and interconversion; binary arithmetic (addition and subtraction); binary-coded decimal (BCD) and ASCII codes; logic gates (AND, OR, NOT, NAND, NOR, XOR and XNOR), truth tables and logic symbols; universal gates and their implementation; Boolean algebra and De Morgan's theorems; simplification of simple Boolean expressions; combinational logic circuits including half adder and full adder; introduction to sequential logic circuits, latches and flip-flops (SR, JK and D); basic applications of digital electronics in computers, communication systems, instrumentation and consumer electronic devices.	12

	Practicum 1. To study the V-I characteristics of a PN junction diode under forward and reverse bias conditions. 2. To study the characteristics of a Zener diode and its application as a voltage regulator. 3. To construct and study half-wave and full-wave rectifier circuits with capacitor filter. 4. To study the input and output characteristics of a Bipolar Junction Transistor (BJT) in Common Emitter (CE) configuration. 5. To study a transistor as a switch and as a simple amplifier. 6. To construct and study the characteristics of an RC coupled amplifier and determine its voltage gain. 7. To study the characteristics and applications of an operational amplifier (IC 741) as an inverting and non-inverting amplifier. 8. To verify the truth tables of basic logic gates (AND, OR, NOT, NAND, NOR, XOR and XNOR) using digital ICs. 9. To study SR and JK flip-flops and verify their truth tables. 10. To familiarize with the use of a Digital Multimeter (DMM), Cathode Ray Oscilloscope (CRO), Function Generator and Regulated DC Power Supply for measurement and testing of basic electronic circuits. **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30
Suggested Evaluation Methods		
InternalAssessment: ➢ **Theory(20Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05Marks** • Mid-TermExam:**10 Marks** ➢ **Practicums (10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Labrecordsetc.: **10Marks** • Mid-Term Exam:**Nil**		**End Term Examination :50Marks** **20 Marks**
Part C–Learning Resources		

Recommended Books/e-resources/LMS:

1. **Electronic Principles** by A. P. Malvino and David J. Bates.
2. **Electronic Devices and Circuit Theory** by Robert L. Boylestad and Louis Nashelsky.
3. **Electronic Devices** by Thomas L. Floyd.
4. **Principles of Electronics** by V. K. Mehta and Rohit Mehta.
5. **Microelectronic Circuits** by Adel S. Sedra and Kenneth C. Smith.
6. **Integrated Electronics** by Jacob Millman and Christos C. Halkias.
7. **Modern Digital Electronics** by R. P. Jain.
8. **Digital Design** by M. Morris Mano and Michael D. Ciletti.
9. **Electronic Devices and Circuits** by S. Salivahanan, N. Suresh Kumar and A. Vallavaraj.
10. **Electronic Devices and Circuits** by Sanjeev Gupta.

Chaudhary Bansi Lal University
Bhiwani Integrated Programs
Course:CC-7/MCC-7

Session:2025-26	
Part A-Introduction	
Subject	Physics
Semester	3rd
Name of the Course	**Introduction to Quantum Mechanics**
CourseCode	25IMS-PH-303
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC
Level of the course(Asper Annexure-I	200-299
Pre-requisite for the course (if any)	Appeared or passed the2nd sem (5-year Integrated B.Sc. (Hons./Hons. with research) -M.Sc. (Physics)/ equivalent)

Course L earning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Analyze the behaviour of electric fields in dielectric media, evaluate capacitance of practical capacitor configurations, and explain energy storage in electrostatic systems. 2. Explain the principles of electromagnetic induction, self and mutual inductance, transformers, and magnetic circuits, and solve related numerical problems. 3. Describe the magnetic behaviour of materials, explain the operating principles of electrical measuring instruments and magnetic sensors, and relate their applications to modern technology. 4. Interpret Maxwell's equations in integral and differential forms, explain the concept of displacement current, and describe the generation and propagation of electromagnetic waves and their technological applications. 5. Perform laboratory experiments on electrical measurements, inductance, transformers, magnetic materials, and modern electrical instruments; analyze experimental data and prepare scientific reports.

Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5

Max. Marks:100 **InternalAssessmentMarks:30 End** **Term Exam Marks: 70**	**Time: 03 Hrs.**

Par tB-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%numericalproblemsareto beset.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Foundations of Quantum Mechanics:** Failure of classical physics, Blackbody radiation, Photoelectric effect, Compton effect, de Broglie hypothesis, Davisson–Germer experiment, Wave packet and group velocity, Heisenberg uncertainty principle and its applications, Bohr correspondence principle, Probability interpretation of the wave function (Born interpretation).	11

II	**Schrödinger Wave Mechanics:** Postulates of quantum mechanics (elementary treatment), Time-dependent and time-independent Schrödinger equations, Properties of the wave function, Normalization and probability density, Expectation values, Operators and observables, Eigenvalues and eigenfunctions, Commutation relations (introductory treatment).	11
III	**One-Dimensional Quantum Systems:** Particle in a one-dimensional infinite potential well, Finite potential well (qualitative treatment), Potential barrier and quantum tunnelling (qualitative), Linear harmonic oscillator (introductory treatment), Zero-point energy, Applications of tunnelling: Scanning Tunnelling Microscope (STM), Alpha decay (qualitative).	12
IV	**Quantum Mechanics of Simple Atomic Systems:** Hydrogen atom: Schrödinger equation (outline only), Quantum numbers and their physical significance, Atomic orbitals and probability distribution, Electron spin, Spin angular momentum, Pauli exclusion principle, Aufbau principle, Stern–Gerlach experiment, Introduction to identical particles and applications of quantum mechanics in lasers, semiconductors and nanotechnology.	11
	Practicum 1. **Verification of Planck's constant using the photoelectric effect (experimental or virtual laboratory).** 2. **Determination of Planck's constant using LEDs of different wavelengths.** 3. **Simulation of the Davisson–Germer experiment.** 4. **Simulation of quantum tunnelling through a potential barrier.** 5. **Simulation of wave packet propagation and group velocity.** 6. **Numerical study of the harmonic oscillator wave functions.** 7. **Visualization of hydrogen atomic orbitals using open-source software.** 8. **Study of electron probability distributions for different quantum numbers.** 9. **Simulation of the Stern–Gerlach experiment.** 10. **Computational determination of energy eigenvalues for simple quantum systems.** 11. **Mini-project on applications of quantum mechanics in modern technology.** 12. **Computational presentation on a Nobel Prize-winning quantum experiment.** **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30

Suggested Evaluation Methods	
InternalAssessment: ➢ **Theory(20Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05Marks** • Mid-TermExam:**10 Marks** ➢ **Practicums (10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Labrecordsetc.: **10Marks** • Mid-Term Exam:**Nil**	**End Term Examination :50Marks** **20 Marks**

Part C–Learning Resources

Recommended Books/e-resources/LMS:

1. **Concepts of Modern Physics** – Arthur Beiser, McGraw-Hill Education.
2. **Introduction to Quantum Mechanics** – David J. Griffiths and Darrell F. Schroeter, 3rd Edition, Cambridge University Press (Selected Chapters).
3. **Quantum Mechanics** – Satya Prakash, Kedar Nath Ram Nath.
4. **Quantum Mechanics** – G. Aruldhas, PHI Learning.
5. **Modern Physics** – R. Murugeshan and Kiruthiga Sivaprasath, S. Chand Publishing.
6. **Quantum Mechanics** – Leonard I. Schiff, McGraw-Hill Education.
7. **Quantum Mechanics** – Eugen Merzbacher, Wiley.
8. **A Textbook of Quantum Mechanics** – P. M. Mathews and K. Venkatesan, McGraw-Hill Education.
9. **Quantum Mechanics** – V. K. Thankappan, New Age International.
10. **Introduction to Quantum Mechanics** – Richard L. Liboff, Addison-Wesley.

Chaudhary Bansi Lal University Bhiwani

Integrated **Programs**

Course:CC-8/MCC-8

Session:2025-26			
Part A-Introduction			
Subject	Physics		
Semester	4th		
Name of the Course	**Mathematical Physics-I**		
Course Code	25IMS-PH-401		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course	200-299		
Pre-requisite for the course (if any)	Appeared or passed the 3rdsem (5-year Integrated B.Sc. (Hons./Hons. with research)-M.Sc. (Physics)/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Apply infinite series, power series, and special functions to solve mathematical problems encountered in physics. 2. Solve first-order and elementary second-order partial differential equations arising in physical systems. 3. Apply matrix algebra and elementary group theory to describe symmetry and linear transformations in physics. 4. Apply probability theory and statistical methods for data analysis and modelling of physical phenomena.		
Credits	Theory	Practicum	Total
	4	0	4
Contact Hours	4	0	4
Max. Marks:100 **InternalAssessmentMarks:30** **End Term Exam Marks: 70**		**Time: 03 Hrs.**	
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	**Infinite Series and Special Functions:** Infinite series, Convergence and divergence of series, Tests of convergence (comparison, ratio and root tests), Power series, Taylor and Maclaurin series, Fourier series (periodic functions and simple applications), Gamma and Beta functions and their properties, Legendre polynomials: generating function, recurrence relations, orthogonality and simple applications in physics.	15
II	**Partial Differential Equations and Integral Transforms:** Formation of partial differential equations, First-order partial differential equations, Solution by separation of variables, Classification of second-order partial differential equations, One-dimensional wave equation, Heat conduction equation and Laplace equation (elementary solutions), Fourier transform and inverse Fourier transform, Introduction to Laplace transform and applications to physical problems.	15
III	**Matrices and Elementary Group Theory:** Matrices and matrix algebra, Determinants and inverse matrices, Eigenvalues and eigenvectors, Diagonalization of matrices, Orthogonal and unitary matrices, Linear vector spaces (introductory treatment), Groups: definition and examples, Finite groups, Cyclic groups, Permutation groups, Matrix representations of groups, Symmetry operations in molecules and crystals, Applications of group theory in physics.	15
IV	**Unit IV: Probability and Statistics for Physicists:** Random variables, Probability distributions, Mean, median, mode, Variance and standard deviation, Moments, Binomial, Poisson and Gaussian distributions, Correlation and regression, Least squares fitting, Error analysis and propagation of errors, Chi-square test (introductory treatment), Monte Carlo method (basic concept).	15

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**

PartC-Learning Resources

Recommended Books/e-resources/LMS:

1. **Mathematical Methods for Physicists** by George B. Arfken, Hans J. Weber and Frank E. Harris, Academic Press.
2. **Mathematical Physics** by B. D. Gupta, Vikas Publishing House.
3. **Mathematical Physics** by H. K. Dass, S. Chand Publishing.
4. **Mathematical Methods in the Physical Sciences** by Mary L. Boas, Wiley.
5. **Mathematical Physics** by Satya Prakash, Sultan Chand & Sons.
6. **Advanced Engineering Mathematics** by Erwin Kreyszig, Wiley.
7. **Mathematical Methods for Scientists and Engineers** by Donald A. McQuarrie, University Science Books.
8. **Mathematical Methods for Physics and Engineering** by K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press.
9. **Introduction to Probability and Statistics** by Seymour Lipschutz and John J. Schiller (Schaum's Outline), McGraw-Hill Education.
10. **Group Theory and Quantum Mechanics** by Michael Tinkham, Dover Publications.

Integrated **Programs**

Course:CC-9/MCC-9

Session:2025-26			
Part A-Introduction			
Subject	Physics		
Semester	4th		
Name of the Course	**Thermodynamics and Statistical Mechanics-I**		
Course Code	25IMS-PH-402		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course	200-299		
Pre-requisite for the course (if any)	Appeared or passed the 3rdsem (5-year Integrated B.Sc. (Hons./Hons. with research) (Physics)-M.Sc. (Physics)/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Explain the fundamental laws of thermodynamics and apply them to thermodynamic systems and processes. 2. Analyze the thermodynamic properties of pure substances, heat engines, refrigerators, and entropy changes in physical processes. 3. Apply thermodynamic potentials and Maxwell's relations to solve problems involving equilibrium thermodynamic systems. 4. Explain the basic concepts of kinetic theory and statistical mechanics, including microscopic interpretation of macroscopic thermodynamic properties and classical distribution laws.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 **InternalAssessmentMarks:30** **End Term Exam Marks: 70**		**Time: 03 Hrs.**	
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	**Fundamentals of Thermodynamics:** Thermodynamic systems and surroundings, Thermodynamic equilibrium, State variables, Equation of state, Zeroth law of thermodynamics and temperature, Work, heat and internal energy, First law of thermodynamics, Heat capacities, Reversible and irreversible processes, Isothermal and adiabatic processes, Applications of the first law to ideal gases, Joule's law, Joule–Thomson effect (qualitative).	11
II	**Second Law of Thermodynamics and Entropy:** Limitations of the first law, Heat engines, Carnot cycle and Carnot theorem, Thermodynamic temperature scale, Clausius inequality, Kelvin–Planck and Clausius statements, Entropy and its physical significance, Entropy change in reversible and irreversible processes, Entropy of an ideal gas, Principle of increase of entropy, Refrigerators and heat pumps, Third law of thermodynamics and its applications.	11
III	**Thermodynamic Potentials and Applications**: Thermodynamic potentials: Internal energy, Enthalpy, Helmholtz free energy and Gibbs free energy, Maxwell's thermodynamic relations, Clausius–Clapeyron equation, Phase equilibrium and phase transitions (qualitative), Gibbs phase rule, Van der Waals equation of state, Critical constants, Law of corresponding states (qualitative), Introduction to blackbody radiation and Stefan–Boltzmann law.	12
IV	**Introduction to Statistical Mechanics:** Microscopic and macroscopic states, Concept of phase space, Microstate and macrostate, Statistical interpretation of entropy, Probability and thermodynamic probability, Boltzmann's entropy relation, Maxwell–Boltzmann distribution (qualitative derivation), Distribution of molecular speeds, Most probable, average and root-mean-square speeds, Degrees of freedom, Equipartition theorem and applications, Specific heat of gases (classical theory), Limitations of classical statistics and introduction to quantum statistics.	11
	Practicum 1. To determine the mechanical equivalent of heat by Joule's method (or virtual experiment). 2. To determine the thermal conductivity of a good conductor by Searle's method. 3. To determine the coefficient of thermal expansion using Newton's ring apparatus (or equivalent setup).	30

	4. To determine the specific heat of a solid using the calorimetric method. 5. To verify Newton's law of cooling and determine the cooling constant. 6. To determine the Stefan–Boltzmann constant using a filament lamp (or simulation-based method). 7. Computational study of Maxwell–Boltzmann speed distribution using Python/Spreadsheet software. 8. Computational determination of most probable, average and RMS speeds for different gases at various temperatures. 9. Simulation of Carnot, Otto and Diesel cycles and comparison of their efficiencies. 10. Mini project on thermodynamic processes or statistical distribution functions. **Note: Student will perform atleast 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**

PartC-Learning Resources

Recommended Books/e-resources/LMS:

1. **Heat and Thermodynamics** by Mark W. Zemansky and Richard H. Dittman, McGraw-Hill Education.
2. **Heat and Thermodynamics** by Brij Lal, N. Subrahmanyam and P. S. Hemne, S. Chand Publishing.
3. **Thermal Physics** by S. C. Garg, R. M. Bansal and C. K. Ghosh, Tata McGraw-Hill Education.
4. **An Introduction to Thermal Physics** by Daniel V. Schroeder, Oxford University Press.
5. **Fundamentals of Statistical and Thermal Physics** by Frederick Reif, Waveland Press.
6. **Statistical Physics** by F. Mandl, Wiley.
7. **Thermal Physics** by Charles Kittel and Herbert Kroemer, W. H. Freeman.
8. **Statistical Physics** by Berkeley Physics Course, Volume 5 – Frederick Reif, McGraw-Hill Education.
9. **Concepts in Thermal Physics** by Stephen J. Blundell and Katherine M. Blundell, Oxford University Press.

Integrated Programs
Course:CC-10/MCC-10

Session:2025-26			
Part A-Introduction			
Subject	Physics		
Semester	4th		
Name of the Course	**Basics of Computation Physics**		
Course Code	25IMS-PH-403		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course	200-299		
Pre-requisite for the course (if any)	Appeared or passed the 3rdsem (5-year Integrated B.Sc. (Hons./Hons. with research) (Physics)-M.Sc. (Physics)/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Develop Python programs to solve basic numerical problems in physics. 2. Apply numerical techniques for solving equations, integration and curve fitting. 3. Simulate selected physical systems and visualize numerical results. 4. Interpret computational results through graphs and scientific reports.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 **InternalAssessmentMarks:30** **End Term Exam Marks: 70**		**Time: 03 Hrs.**	
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	**Scientific Programming for Physics:** Introduction to scientific computing, Review of Python programming, Jupyter Notebook, NumPy arrays and mathematical operations, Basic matrix operations, User-defined functions, Plotting graphs using Matplotlib (line, scatter and multiple plots), Reading and writing simple data files.	11
II	**Numerical Methods in Physics:** Sources of numerical errors and error propagation, Floating-point arithmetic, Root-finding methods: Bisection and Newton–Raphson methods, Numerical differentiation, Numerical integration using Trapezoidal and Simpson's rules, Solution of simultaneous linear equations using Gaussian elimination and matrix inversion, Least-squares curve fitting and interpolation.	11
III	**Computational Physics Applications:** Projectile motion, Simple harmonic motion, Damped oscillation (qualitative simulation), Numerical solution of first-order differential equations using Euler's method, Charging and discharging of RC circuits, Electric field due to a system of point charges and visualization of equipotential lines.	11
IV	**Introduction to Computational Modelling:** Particle in a one-dimensional box (numerical visualization of wave functions), Maxwell–Boltzmann speed distribution, Random number generation, Random walk simulation, Monte Carlo estimation of π, Introduction to computational modelling in physics and scientific report writing.	12
	Practicum 1. Introduction to Jupyter Notebook, NumPy and Matplotlib. 2. Plotting mathematical functions and experimental data. 3. Numerical solution of equations using the Bisection method. 4. Numerical solution of equations using the Newton–Raphson method. 5. Numerical integration using Trapezoidal and Simpson's rules. 6. Least-squares fitting of experimental data. 7. Simulation of projectile motion. 8. Simulation of simple harmonic motion. 9. Simulation of charging and discharging of an RC circuit. 10. Plotting electric field and equipotential lines for simple charge configurations.	30

	11. Simulation of Maxwell–Boltzmann distribution or Random Walk. 12. Mini Project: Computational study of a simple physical system using Python **Note: Student will perform atleast 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**
PartC-Learning Resources		
Recommended Books/e-resources/LMS: 1. **Computational Physics** by Nicholas J. Giordano and Hisao Nakanishi. 2. **Introduction to Computational Physics** by Tao Pang. 3. **Programming in Python** by E. Balagurusamy. 4. **Numerical Methods for Scientific and Engineering Computation** by M. K. Jain, S. R. K. Iyengar and R. K. Jain. 5. **Computational Physics** by Jos Thijssen, Cambridge University Press.		

Integrated **Programs**

Course:CC-11/MCC-11

Session:2025-26			
Part A-Introduction			
Subject	Physics		
Semester	4th		
Name of the Course	**Nuclear & Particle Physics**		
Course Code	25IMS-PH-404		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course	200-299		
Pre-requisite for the course (if any)	Appeared or passed the 3rdsem (5-year Integrated B.Sc. (Hons./Hons. with research) (Physics)-M.Sc. (Physics)/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 5. Develop Python programs to solve basic numerical problems in physics. 6. Apply numerical techniques for solving equations, integration and curve fitting. 7. Simulate selected physical systems and visualize numerical results. 8. Interpret computational results through graphs and scientific reports.		
Credits	Theory	Practicum	Total
	3	1	4

Contact Hours	3	2	5
Max. Marks:100 **InternalAssessmentMarks:30** **End Term Exam Marks: 70**		**Time: 03 Hrs.**	

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	**Nuclear Structure and Nuclear Forces:** Introduction to the nucleus, Nuclear size, mass, density and charge, Mass defect and binding energy, Binding energy curve and nuclear stability, Nuclear forces and their characteristics, Liquid drop model (basic idea), Shell model (qualitative), Magic numbers and their significance.	11
II	**Radioactivity and Nuclear Reactions:** Radioactive decay law, Decay constant, Half-life and mean life, Alpha, beta and gamma decay, Radioactive series, Nuclear reactions, Q-value (simple numerical problems), Nuclear fission and fusion, Nuclear reactors (basic components and working), Applications of radioisotopes in medicine, agriculture and industry, Radiation hazards and safety.	11
III	**Radiation Detection and Applications:** Interaction of alpha, beta and gamma radiations with matter (qualitative), Ionization chamber, Geiger–Müller counter, Scintillation detector (basic principle only), Particle accelerators: Linear accelerator and Cyclotron (working principle), Radiation dosimetry (basic idea), Applications of nuclear radiation in medicine, industry and scientific research.	11
IV	**Introduction to Particle Physics:** Elementary particles: Leptons, Mesons and Baryons, Fermions and Bosons, Antiparticles, Four fundamental interactions, Conservation of charge, energy, momentum, baryon number and lepton number, Quark model (up, down and strange quarks), Formation of protons, neutrons and mesons from quarks, Introduction to the Standard Model (overview only), Applications of particle physics in medicine, space science and materials research.	12

	Practicum 1. Determination of the half-life of a radioactive isotope using supplied data. 2. Verification of the radioactive decay law using simulated or experimental data. 3. Study of counting statistics and verification of the Poisson distribution. 4. Determination of the binding energy per nucleon using nuclear mass tables and plotting the binding energy curve. 5. Study of the working principles of Geiger–Müller counter and scintillation detector using demonstration or virtual laboratory. 6. Simulation of alpha, beta and gamma radiation interactions with matter. 7. Study of particle classification and quark composition of common hadrons. 8. Mini Project: Applications of nuclear and particle physics (nuclear energy, PET imaging, radiotherapy, food irradiation, particle accelerators, or radiation safety). **Note: Student will perform atleast six experiments. The examiner will allot one Practicum at the time of end term examination.**	30

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**

PartC-Learning Resources

Recommended Books/e-resources/LMS:

1. **Atomic and Nuclear Physics** by N. Subrahmanyam, Brij Lal and P. S. Hemne, S. Chand Publishing.
2. **Concepts of Nuclear Physics** by Bernard L. Cohen, Tata McGraw-Hill Education.
3. **Nuclear Physics: An Introduction** by S. B. Patel, New Age International.
4. **Modern Physics** by R. Murugeshan and Kiruthiga Sivaprasath, S. Chand Publishing.
5. **Introductory Nuclear Physics** by Kenneth S. Krane, Wiley.
6. **Nuclear Physics: Principles and Applications** by John Lilley, Wiley.
7. **Introduction to Elementary Particles** by David J. Griffiths, Wiley.
8. **Nuclear and Particle Physics** by W. S. C. Williams, Oxford University Press.

9. **Atomic Physics** by J. B. Rajam, S. Chand Publishing

Chaudhary Bansi Lal University Bhiwani

Scheme of Examination for the Physics Subject in 5-year Integrated Programmes
(Multiple Entry-Exit, Internships and Choice Based Credit System LOCF) with effect from the session 25-26 (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
MCC-R1	C	25IMS-PH-104	Elementary Mathematics -I	4	4	30	70	100	3

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
MCC-R2	C	25IMS-PH-203	Elementary Mathematics -II	4	4	30	70	100	3

Note:

- The courses listed above are remedial/bridge courses to be undertaken in addition to the regular curriculum of the 5-Year Integrated B.Sc.–M.Sc. Programme in Physics. These courses are specifically designed for students who have completed 10+2 with Physics but have not studied Mathematics at the 10+2 level.
- This scheme should be interpreted in continuity with the approved Scheme and Syllabi of the 5-Year Integrated B.Sc.–M.Sc. in Physics Programme as sanctioned by the University.

5-year Integrated B.Sc.-M.Sc. in Physics

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs
Course:CC-R1/MCC-R1

Session:2025-26		
Part A-Introduction		
Subject	Physics	
Semester	1st	
Name of the Course	Elementary Mathematics -I	
Course Code	25IMS-PH-104	
Course Type: (CC/MCC/MDC/CCM/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC	
Level of the course	100-199	
Pre-requisite for the course (if any)	10+2 or equivalent	
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Demonstrate knowledge of trigonometric functions, equa radians and the unit circle approach. 2. Solve algebraic problems involving complex numbers, lir equations, permutations & combinations, and the binomia 3. Analyze and apply formulas related to sequences and series, including arithmetic and geometric progressions. 4. Understand the fundamental concepts of coordinate geometry, including straight lines, conic sections, and 3D geometry. 5. Understand the basics of calculus, including limits and derivatives, and use them for simple function analysis. Also, apply basic statistics and probability	
Credits	Theory	Total
	4	4
Contact Hours	4	4

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

PartB-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%numericalproblemsareto beset.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Sets and Functions** **Sets:** Sets and their representations, Empty set, Finite and Infinite sets, Equal sets, Subsets, Subsets of a set of real numbers especially intervals (with notations), Universal set, Venn diagrams, Union and Intersection of sets, Difference of sets, Complement of a set, Properties of Complement. **Relations and Functions** Introduction, Cartesian product of Sets, Relations, Functions **Trigonometric Functions:** Angles, Measuring angles in radians and in degrees, Definition of trigonometric functions with the help of unit circle, Trigonometric Functions of Sum and Difference of Two Angles, Trigonometric Equations	15
II	**Algebra** **Complex Numbers and Quadratic Equations:** Complex Numbers, Algebra of Complex Numbers, The Modulus and the Conjugate of a Complex Number, Argand Plane and Polar Representation, Quadratic Equations. **Linear Inequalities**: Introduction, Inequalities, Algebraic Solutions of Linear Inequalities in One Variable and their Graphical Representation, Graphical Solution of Linear Inequalities in Two Variables, Solution of System of Linear Inequalities in Two Variables. **Permutations and Combinations**: Fundamental principle of counting, Permutations and combinations. Binomial Theorem: Binomial Theorem for Positive Integral Indices **Sequence and Series:** Sequence and Series, Arithmetic Mean (A.M.),Geometric Progression(G.P.), general term of a G.P., sum of n terms of a G.P., geometric mean (G.M.), relation between A.M. and G.M..	15
III	**Coordinate Geometry** **Straight Lines:** Slope of a line and angle between two lines, various forms of equations of a line, General Equation of a line, Distance of a point from a line. **Conic Sections:** Sections of a cone: circles, ellipse, parabola, hyperbola, Standard equations and simple properties of parabola, ellipse and hyperbola, Standard equation of a circle	15

	Introduction to Three-dimensional Geometry: Coordinate axes and coordinate planes in three dimensions, Coordinates of a point in space. Distance between two points.	
IV	**Calculus** **Limits and Derivatives:** Intuitive idea of limit and derivative, trigonometric, exponential and logarithmic functions. Definition of derivative relate it to scope of tangent of the curve, derivative of sum, difference, product and quotient of functions of polynomial and trigonometric functions. **Statistics:** Measures of Dispersion: Range, Mean deviation, variance and standard deviation of ungrouped/grouped data. Probability: Events, occurrence of events, mutually exclusive events, Probability of an event, Conditional probability, multiplication theorem on probability, independent events, total probability.	15

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory (30Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**10Marks** • Mid-TermExam:**15 Marks**	**End Term Examination :70Marks**

Part C- Learning Resources

Recommended Books/e-resources/LMS:

1. NCERT Class 11, Mathematics Textbook (Parts 1 & 2)
2. Pearson Foundation Course – Mathematics Class 11
3. R.D. Sharma – Mathematics for Class 11

5-year Integrated B.Sc.-M.Sc. in Physics

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:CC-R2/MCC-R2

Session:2025-26	
Part A-Introduction	
Subject	Physics
Semester	2nd
Name of the Course	Elementary Mathematics -II
Course Code	25IMS-PH-203
Course Type: (CC/MCC/MDC/CCM/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC
Level of the course	100-199
Pre-requisite for the course (if any)	10+2 or equivalent
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. **Understand and analyze** different types of relations (reflexive, symmetric, transitive, and equivalence) and functions (one-to-one, onto, invertible, and composite). 2. **Demonstrate proficiency** in matrix operations (addition, multiplication, transpose and inverse) and use determinants to solve problems such as finding the area of a triangle and solving systems of equations. 3. **Explain and compute** the concepts of continuity, differentiability, and higher-order derivatives for algebraic, trigonometric, logarithmic, and exponential functions. 4. **Evaluate** integrals using various methods (substitution, partial fractions, by parts) and **apply** integration to find areas under simple curves. 5. **Represent and interpret** vectors in two- and three-dimensional space; perform vector operations such as addition, scalar multiplication, and finding components. 6. **Apply geometric and vector concepts** to analyze lines in 3D space — including direction cosines/ratios, vector and Cartesian equations, angles between lines, and shortest distances. 7. **Integrate concepts** from algebra, trigonometry, calculus, and geometry to model and solve real-life mathematical problems.

Credits	Theory	Total
	4	4
Contact Hours	4	4

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

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	**Relations and Functions** **Relations and Functions:** Types of relations: reflexive, symmetric, transitive and equivalence relations, one to one and onto functions, Composition of Functions and Invertible Function, Binary Operations. Inverse Trigonometric Functions: Definition, range, domain, principal value branch, Properties of Inverse Trigonometric Functions.	15
II	**Algebra** **Matrices:** Concept, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operations on matrices: Addition and multiplication and multiplication with a scalar, Transpose of a Matrix, Symmetric and Skew Symmetric Matrices, Elementary Operation (Transformation) of a Matrix, Invertible Matrices. **Determinants:** Determinant of a square matrix (up to 3x3 matrices), minors, co-factors and applications of determinants in finding the area of a triangle, Adjoint and inverse of a square matrix.	15
III	**Calculus** **Continuity and Differentiability:** Continuity and differentiability, chain rule, derivative of composite functions, derivatives of inverse trigonometric functions like $\sin^{-1}x$, $\cos^{-1}x$ and $\tan^{-1}x$, derivative of implicit functions, Concept of exponential and logarithmic functions, Derivatives of logarithmic and exponential functions, Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives. **Integrals:** Integration as inverse process of differentiation, Integration of a variety of functions by substitution, by partial fractions and by parts, Evaluation of simple integrals of the following types and problems based on them. **Application of the Integrals:** Applications in finding the area under simple curves, especially lines, circles/parabolas/ellipses (in standard form only).	15

IV	**Vectors and Three-dimensional Geometry** Three-dimensional Geometry: Direction cosines and direction ratios of a line joining two points, Cartesian equation and vector equation of a line, skew lines, shortest distance between two lines, Angle between two lines. **Vectors:** Vectors and scalars, magnitude and direction of a vector, Direction cosines and direction ratios of a vector, Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio.	15

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory (30Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/classtestetc.: **10Marks** • Mid-TermExam: **15 Marks**	**End Term Examination :70Marks**

Part C- Learning Resources
Recommended Books/e-resources/LMS: 1. NCERT Class 12 Mathematics Textbook (Parts 1 & 2) 2. R.D. Sharma – Mathematics for Class 12

List of Minor may be increased according to the availability of resources

Name of the Paper:	Semeter	Department
Calculus	I	Mathematics
Ordinary Differential Equations-I	II	Mathematics
Vector Calculus	III	Mathematics

The syllabi and paper codes of the aforementioned papers shall remain unchanged and shall be the same as those prescribed and approved under the Scheme and Syllabi of the Five-Year Integrated Programme in Mathematics.