

Chaudhary Bansi Lal University

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



Scheme of Examination for Physics Subject in Undergraduate Programmes

As per NEP 2020

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

With effect from the session 2024-25 (in phased manner)

DEPARTMENT OF PHYSICS

**Chaudhary Bansi Lal University, Bhiwani
HARYANA, INDIA**

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Chaudhary Bansi Lal University Bhiwani

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Semester-I

Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs.) T+P
CC-1/ MCC-1	A,B&C	24UN-PHY-101	Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-2	C	24UN-PHY-102	Mathematical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M1	A,B&D	24UN-PHY-103	Elementary Mechanics	1	1	10	20	30	3
			Practicum	1	2	5	15	20	3
MDC1	A, B,C&D	From Available pool of Multidisciplinary Courses as per NEP							
AEC-1	A,B&C	From Available pool of Ability Enhancement Courses as per NEP							
SEC-1	A,B&C	From Available pool of Skill Enhancement Courses as per NEP							
VAC-1	A,B&C	From Available pool of Value Added Courses as per NEP							



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Semester-II

Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs.) T+P
CC-2/ MCC-3	A,B&C	24UN-PHY-201	Electricity , Magnetism & EM Theory	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M2	A,B&D	24UN-PHY-202	Elementary Electricity. Magnetism & EM Theory	1	1	10	20	30	3
			Practicum	1	2	5	15	20	3
DSEC-1	B&C	24UN-PHY-203	Computational Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MDC-2	A, B,C&D	From Available pool of Multidisciplinary Courses as per NEP							
AEC-2	A,B&C	From Available pool of Ability Enhancement Courses as per NEP							
SEC-2	A,B&C	From Available pool of Skill Enhancement Courses as per NEP							
VAC-2	A,B&C	From Available pool of Value Added Courses as per NEP							
Internship	A,B&C	24UN-PHY-204	Internship of 4 Credits of 4-6 weeks duration after 2 nd Semester (Mandatory in case of exit). Refer the programme Ordinance.						



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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
CC-3/ MCC-4	A,B&C	24UN-PHY-301	Thermodynamics & Statistical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-2	B	24UN-PHY -102	Mathematical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-5	B & C	24UN-PHY -302	Classical Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MDC-3	A,B & C	From Available pool of Multidisciplinary Courses as per NEP							
CC-M3	A & C	From Available CC-3/MCC-4 of 4 credits as per NEP							
CC-M3 (V)	B	From Available pool of Minor (Vocational) Courses VOC-1							
AEC-3	A,B&C	From Available pool of Ability Enhancement Courses as per NEP							
SEC-3	A,B&C	From Available pool of Skill Enhancement Courses as per NEP							
VAC-3	C	From Available pool of Value Added Courses as per NEP							



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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
CC-4/ MCC-6	A,B&C	24UN-PHY-401	Waves and Optics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-7	B & C	24UN-PHY-402	Introductory Quantum Mechanics	3	3	20	50	70	3
MCC-8	B & C	24UN-PHY-403	Practicum	1	2	10	20	30	3
			Atomic spectroscopy	3	3	20	50	70	3
DSE-1	B & C	24UN-PHY-404	Practicum	1	2	10	20	30	3
			Laser Physics & Fiber Optics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
OR									
		24UN-PHY-405	Physics of Nano Materials	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M4 (V)	A, B & C	From Available pool of Minor (Vocational) Courses VOC 2							
AEC-4	A,B&C	From Available pool of Ability Enhancement Courses as per NEP							

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VAC-3	A & B	From Available pool of Value Added Courses as per NEP	
VAC-4	C	From Available pool of Value Added Courses as per NEP	
Internship	A,B&C	24UN-PHY-406	Internship of 4 Credits of 4-6 weeks duration after 4 th Semester (Mandatory in case of exit). Refer the programme Ordinance.

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Semester-V

Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T+P
CC-5/ MCC-9	A, B & C	24UN-PHY-501	Modern Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-10	B & C	24UN-PHY-502	Nuclear Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
DSE-2	B & C	24UN-PHY-503	Environmental Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
OR									
DSE-3	B & C	24UN-PHY-504	Non-Linear Dynamics	4	4	30	70	100	3
		24UN-PHY-505	Instrumentation and Analytical Methods	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
OR									
		24UN-PHY-506	Renewable Energy and Energy Harvesting	4	4	30	70	100	3
		From Available pool of Minor (Vocational) Courses VOC 1							
CC-M5 (V)	A & C								
SEC	A, B & C	24UN-PHY-507	Internship of 4 Credits of 4-6 weeks #						
#Four credits of internship, earned by a student during summer internship after 2nd semester or 4th semester, will be taken into account in 5th semester of a student who pursue 3 year UG Programme without taking exit option.									

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Semester-VI

Semester- VI									
Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T+P
CC-6/ MCC-11	A,B&C	24UN-PHY-601	Introduction to Electronics and Nuclear Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-12	B & C	24UN-PHY-602	Solid State Physics-I	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
DSE-5	B & C	24UN-PHY-603	Radiation Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
OR									
		24UN-PHY-604	Thin Films and Characterization	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
DSE-6		24UN-PHY-605	Numerical Methods in Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
OR									
		24UN-PHY-606	Applied Nuclear Techniques	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
CC-M5	B	From Available pool of Minor (Vocational) Courses VOC 3							



CC-M6	A	From Available CC-6/MCC-11 of 4 credits as per NEP
CC-M7(V)/CC-M6(V)	A & C	From Available pool of Minor (Vocational) Courses VOC 3
SEC-4	C	From Available pool of Skill Enhancement Courses as per NEP

Note: Nearly 2% of the syllabus is devoted to IKS-related content (VAC courses). Faculty members shall incorporate relevant IKS concepts and material related to the topics covered in their respective theory lectures.

New experiments in the Laboratory Courses may be added from time to time.



Scheme of Examination for MDC

Semester	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
1	MDC-1	A, B, C & D	24UN-PHY-MDC101	Physics Fundamentals-I	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3
2	MDC-2	A, B, C & D	24UN-PHY-MDC-201	Physics Fundamentals-II	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3
3	MDC-3	A, B, C & D	24UN-PHY-MDC-301	Elements of Modern Physics	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3

Scheme of Examination for SEC

Semester	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
1	SEC-1	A, B, C & D	24UN-PHY-SEC-101	Computational Skills in Physics	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3
2	SEC-2	A, B, C	24UN-PHY-SEC-201	Basic Instrumentation Skills	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3
3	SEC-3	A, B, C	24UN-PHY-SEC-301	Radiation Safety	2	2	15	35	50	3
				Practicum	1	2	05	15	20	3
6	SEC-4	C	24UN-PHY-SEC-601	Introduction to Astrophysics	2	2	15	35	50	3

Scheme of Examination for VAC & VOC

Semester	Course Type	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T + P
3	VAC-3	24UN-PHY-VAC301	Indian Astronomy in the 18 th and 19 th Centuries	2	2	15	35	50	3
3	VAC-3	24UN-PHY-VAC302	Basics of Indian Astronomy	2	2	15	35	50	3
3	VAC-3	24UN-PHY-VAC303	Exploring the Journey of Indian Space Satellites	2	2	15	35	50	3
4	VAC-4	24UN-PHY-VAC401	Physics in Everyday Life	2	2	15	35	50	3
4	VAC-4	24UN-PHY-VAC402	Radiations and its Hazards in Daily Life	2	2	15	35	50	3
3/5	VOC-1	24UN-PHY-VOC301	Drone Technology & Applications	2	2	15	35	50	3
			Practicum	2	4	15	35	50	3
4	VOC-2	24UN-PHY-VOC401	Refrigeration and Air Conditioning	2	2	15	35	50	3
			Practicum	2	4	15	35	50	3
4	VOC-2	24UN-PHY-VOC402	Maintenance of Laboratory Instruments	2	2	15	35	50	3
			Practicum	2	4	15	35	50	3
6	VOC-3	24UN-PHY-VOC601	Installation and Maintenance of Solar Panels	2	2	15	35	50	3
			Practicum	2	4	15	35	50	3
6	VOC-3	24UN-PHY-VOC602	Introduction to AI and ML for Physical Sciences	4	4	30	70	100	3



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: CC-1/MCC-1

Session:2024-25

Part A-Introduction

Subject	Physics		
Semester	1 st		
Name of the Course	Mechanics		
Course Code	24UN-PHY-101		
Course Type: (CC/MCC/MDC/CC-M/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+2or 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. Differentiate between elastic and plastic body. Elastic constants, determination and their physical significance. Torque and its significance. 3. Familiar about the special theory of relativity and its applications. Michelson's Morley experiments and its finding. 4. Analyze the two body Central Force problem and its applications 5. 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



Max.Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs
Part B-Contents of the Course		
<u>Instructions for Paper-Setter</u> 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) calculators allowed.		
Unit	Topics	Contact Hours
I	Fundamentals of Dynamics: Rigid body, Moment of Inertia, Radius of Gyration, Theorems of perpendicular and parallel axis(with proof), Moment of Inertia of ring, Disc, Angular Disc, Solid cylinder, Solid sphere, Hollow sphere, Rectangular plate, Square plate, Solid cone, Triangular plate, Torque, Rotational Kinetic Energy, Angular momentum, Law of conservation of angular momentum, Rolling motion, condition for pure rolling, acceleration of body rolling down an inclined plane, Flywheel, Moment of Inertia of an irregular body.	11
II	Elasticity: Deforming force, Elastic limit, stress, strain and their types, Hooke's law, Modulus of rigidity, Relation between shear angle and angle of twist, elastic energy stored/volume in an elastic body, Elongation produced in heavy rod due to its own weight and elastic potential energy stored in it, Tension in rotating rod, Poisson's ratio and its limiting value, Elastic Constants and their relations. Torque required for twisting cylinder, Hollow shaft is stiffer than solid one. Bending of beam, bending moment and its magnitude, Flexural rigidity, Geometrical moment of inertia for beam of rectangular cross-section and circular cross-section. Bending of cantilever (loaded by a weight W at its free end), weight of cantilever uniformly distributed over its entire length. Dispersion of acentrally loaded beam supported at its ends, determination of elastic constants for material Of wire by Searle's method.	12

III	Special Theory of Relativity: Michelson's Morley experiment and its outcomes, Postulates of special theory of relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, relativistic addition of velocities, variation of mass-energy equivalence, relativistic Doppler effect, relativistic kinematics, transformation of energy and momentum, transformation of force, Problems of relativistic dynamics.	11
IV	Gravitation and central force motion: Law of gravitation, Potential and field due to spherical shell and solid sphere. Motion of a particle under central force field, Two body problem and its reduction to one body problem and its solution, compound pendulum or physical pendulum in form of elliptical lamina and expression of time period, determination of g 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(m) joined together with spring of spring constant(k).	11
	<u>Practicum</u> 1. Measurement of length (or diameter) using Vernier Caliper, screw gauge and travelling microscope. 2. To study the random error in observations. 3. To determine the area of window using extant. 4. Moment of Inertia of a Fly Wheel 5. Moment of Inertia of irregular body using a Torsion Pendulum. 6. Young's Modulus by Bending of Beam. 7. Modulus of rigidity of material of wire by Maxwell's Needle. 8. Elastic constants by Searle's method. 9. To determine the value of 'g' by using Bar pendulum. 10. To find the Poisson ratio of rubber by Rubber tube method. 11. To compare Moment of Inertia of a solid Sphere, Hollow Sphere and solid Disc of same mass with the help of Torsion Pendulum. 12. To determine the bending moment of a cantilever beam with uniformly distributed load, uniformly varying load and point load. Note: Student will perform at least 08 experiments. The examiner will allot one Practicum at the time of end term examination.	30

Suggested Evaluation Methods	
1. <i>Self-report</i>	2. <i>Interview</i>
3. <i>Focus group</i>	4. <i>Observation</i>
5. <i>Document analysis</i>	6. <i>Case study</i>
7. <i>Survey</i>	8. <i>Experimental</i>
9. <i>Qualitative</i>	10. <i>Quantitative</i>
11. <i>Mixed methods</i>	12. <i>Triangulation</i>
13. <i>Content analysis</i>	14. <i>Discourse analysis</i>
15. <i>Grounded theory</i>	16. <i>Phenomenology</i>
17. <i>Ethnography</i>	18. <i>Historical research</i>
19. <i>Comparative research</i>	20. <i>Meta-analysis</i>
21. <i>Systematic review</i>	22. <i>Randomized controlled trial</i>
23. <i>Cohort study</i>	24. <i>Cross-sectional study</i>
25. <i>Case-control study</i>	26. <i>Case series</i>
27. <i>Qualitative research</i>	28. <i>Quantitative research</i>
29. <i>Mixed methods research</i>	30. <i>Triangulation</i>
31. <i>Content analysis</i>	32. <i>Discourse analysis</i>
33. <i>Grounded theory</i>	34. <i>Phenomenology</i>
35. <i>Ethnography</i>	36. <i>Historical research</i>
37. <i>Comparative research</i>	38. <i>Meta-analysis</i>
39. <i>Systematic review</i>	40. <i>Randomized controlled trial</i>
41. <i>Cohort study</i>	42. <i>Cross-sectional study</i>
43. <i>Case-control study</i>	44. <i>Case series</i>
45. <i>Qualitative research</i>	46. <i>Quantitative research</i>
47. <i>Mixed methods research</i>	48. <i>Triangulation</i>
49. <i>Content analysis</i>	50. <i>Discourse analysis</i>
51. <i>Grounded theory</i>	52. <i>Phenomenology</i>
53. <i>Ethnography</i>	54. <i>Historical research</i>
55. <i>Comparative research</i>	56. <i>Meta-analysis</i>
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59. <i>Cohort study</i>	60. <i>Cross-sectional study</i>
61. <i>Case-control study</i>	62. <i>Case series</i>
63. <i>Qualitative research</i>	64. <i>Quantitative research</i>
65. <i>Mixed methods research</i>	66. <i>Triangulation</i>
67. <i>Content analysis</i>	68. <i>Discourse analysis</i>
69. <i>Grounded theory</i>	70. <i>Phenomenology</i>
71. <i>Ethnography</i>	72. <i>Historical research</i>
73. <i>Comparative research</i>	74. <i>Meta-analysis</i>
75. <i>Systematic review</i>	76. <i>Randomized controlled trial</i>
77. <i>Cohort study</i>	78. <i>Cross-sectional study</i>
79. <i>Case-control study</i>	80. <i>Case series</i>
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83. <i>Mixed methods research</i>	84. <i>Triangulation</i>
85. <i>Content analysis</i>	86. <i>Discourse analysis</i>
87. <i>Grounded theory</i>	88. <i>Phenomenology</i>
89. <i>Ethnography</i>	90. <i>Historical research</i>
91. <i>Comparative research</i>	92. <i>Meta-analysis</i>
93. <i>Systematic review</i>	94. <i>Randomized controlled trial</i>
95. <i>Cohort study</i>	96. <i>Cross-sectional study</i>
97. <i>Case-control study</i>	98. <i>Case series</i>
99. <i>Qualitative research</i>	100. <i>Quantitative research</i>
101. <i>Mixed methods research</i>	102. <i>Triangulation</i>
103. <i>Content analysis</i>	104. <i>Discourse analysis</i>
105. <i>Grounded theory</i>	106. <i>Phenomenology</i>
107. <i>Ethnography</i>	108. <i>Historical research</i>
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113. <i>Cohort study</i>	114. <i>Cross-sectional study</i>
115. <i>Case-control study</i>	116. <i>Case series</i>
117. <i>Qualitative research</i>	118. <i>Quantitative research</i>
119. <i>Mixed methods research</i>	120. <i>Triangulation</i>
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149. <i>Cohort study</i>	150. <i>Cross-sectional study</i>
151. <i>Case-control study</i>	152. <i>Case series</i>
153. <i>Qualitative research</i>	154. <i>Quantitative research</i>
155. <i>Mixed methods research</i>	156. <i>Triangulation</i>
157. <i>Content analysis</i>	158. <i>Discourse analysis</i>
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177. <i>Grounded theory</i>	178. <i>Phenomenology</i>
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187. <i>Case-control study</i>	188. <i>Case series</i>
189. <i>Qualitative research</i>	190. <i>Quantitative research</i>
191. <i>Mixed methods research</i>	192. <i>Triangulation</i>
193. <i>Content analysis</i>	194. <i>Discourse analysis</i>
195. <i>Grounded theory</i>	

Internal Assessment:

- **Theory (20Marks)**
 - ┆ Class Participation: **05 Marks**
 - ┆ Seminar/presentation/assignment/quiz/class test etc.: **05 Marks**
 - ┆ Mid-Term Exam: **10Marks**

- **Practicum(10Marks)**
 - ┆ Class Participation: **Nil**
 - ┆ Seminar/Demonstration/Viva-voccc/Labrecordsetc.: **10 Marks**
 - ┆ Mid-Term Exam: **Nil**

Internal Assessment:

- **Theory (20Marks)**
 - ┆ Class Participation: **05 Marks**
 - ┆ Seminar/presentation/assignment/quiz/class test etc.: **05 Marks**
 - ┆ Mid-Term Exam: **10Marks**

- **Practicum(10Marks)**
 - ┆ Class Participation: **Nil**
 - ┆ Seminar/Demonstration/Viva-voccc/Labrecordsetc.: **10 Marks**
 - ┆ Mid-Term Exam: **Nil**

- Internal Assessment:**
- **Theory (20Marks)**
 - ┆ Class Participation: **05 Marks**
 - ┆ Seminar/presentation/assignment/quiz/class test etc.: **05 Marks**
 - ┆ Mid-Term Exam: **10Marks**

 - **Practicum(10Marks)**
 - ┆ Class Participation: **Nil**
 - ┆ Seminar/Demonstration/Viva-voccc/Labrecordsetc.: **10 Marks**
 - ┆ Mid-Term Exam: **Nil**

Internal Assessment:

- **Theory (20Marks)**
 - ┆ Class Participation: **05 Marks**
 - ┆ Seminar/presentation/assignment/quiz/class test etc.: **05 Marks**
 - ┆ Mid-Term Exam: **10Marks**

- **Practicum(10Marks)**
 - ┆ Class Participation: **Nil**
 - ┆ Seminar/Demonstration/Viva-voccc/Labrecordsetc.: **10 Marks**
 - ┆ Mid-Term Exam: **Nil**

- Internal Assessment:**
- **Theory (20Marks)**
 - ┆ Class Participation: **05 Marks**
 - ┆ Seminar/presentation/assignment/quiz/class test etc.: **05 Marks**
 - ┆ Mid-Term Exam: **10Marks**

 - **Practicum(10Marks)**
 - ┆ Class Participation: **Nil**
 - ┆ Seminar/Demonstration/Viva-voccc/Labrecordsetc.: **10 Marks**
 - ┆ Mid-Term Exam: **Nil**

End Term Examination
:50Marks

:20Marks

End Term Examination
:50Marks

:20Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Mechanics “Berkeley Physics Course Vol. I, Charles Kittel, Tata Mc Graw-Hill
2. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
3. Elements of Properties of Matter, D.S. Mathur, S. Chand & Com. Pt. Ltd., New Delhi
4. Physics, Resnick, Halliday & Walker, Wiley
5. Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R. A. Serway, 2010, Cengage Learning
6. An introduction to mechanics, D. Kleppner, R. J. Kolenkow, 1973, Mc Graw-Hill.
7. Properties of Matter, R. Murgeshan, S. Chand & Com. Pt. Ltd., New Delhi
8. Classical Mechanics, J.C. Upadhyaya, Himalaya Publishing House.
9. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
10. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
11. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
12. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
13. Modern Approach to Practical Physics, R. K. Singla, Modern Publishers, Jalandhar
14. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, Asia Publishing House.

- Recommended Books/e-resources/LMS:**
1. Mechanics “Berkeley Physics Course Vol. I, Charles Kittel, Tata Mc Graw-Hill
 2. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
 3. Elements of Properties of Matter, D.S. Mathur, S. Chand & Com. Pt. Ltd., New Delhi
 4. Physics, Resnick, Halliday & Walker, Wiley
 5. Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R. A. Serway, 2010, Cengage Learning
 6. An introduction to mechanics, D. Kleppner, R. J. Kolenkow, 1973, Mc Graw-Hill.
 7. Properties of Matter, R. Murgeshan, S. Chand & Com. Pt. Ltd., New Delhi
 8. Classical Mechanics, J.C. Upadhyaya, Himalaya Publishing House.
 9. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
 10. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
 11. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
 12. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
 13. Modern Approach to Practical Physics, R. K. Singla, Modern Publishers, Jalandhar
 14. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, Asia Publishing House.

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Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MCC-2

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Mathematical Physics		
Course Code	24UN-PHY-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+2orequivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn the Fourier analysis of periodic functions and their application in physical problems. Learn the beta, gamma, the error functions, and their applications in doing integrations. 2. Acquire knowledge of methods to solve partial differential equations with the examples of important partial differential equations in Physics. 3. Write given function in terms of sine and cosine terms in Fourier series and also to get knowledge in Fourier transforms 4. Learn about beta gamma function, their properties, solve Legendre equations find generating function for Legendre Polynomial, Hermite equation, study orthogonal properties of Hermite Polynomials, recurrence relations of complex numbers and their properties such as analyticity, poles and residues. 5. Learn about the methods to solve the mathematical problem using Fortran		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5

Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs.
Part B-Contents of the Course		
<u>Instructions for Paper-Setter</u> 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. 1. Use of scientific(non-programmable) calculators allowed.		
Unit	Topics	Contact Hours
I	Theory of Errors: Systematic and Random errors, Propagation of errors, Normal law of errors, Standard and Probable error, Least square fit, error on slope and intercept of fitted line. Matrices: Normal Matrices, Orthogonal Matrices, Hermitian Matrices, Unitary Matrices, Symmetric and Anti-symmetric Matrices, Conjugate of a Matrix, Anti- Hermitian Matrices, Trace of Matrix, Eigen values and Eigen vectors of Matrices, Diagonalization of Matrices.	11
II	Method of expansion of a function: Taylor's expansion, Power series, Laurent's theorem. Partial and ordinary differential equations, Partial Differential equations, First order differential equations, Method of separation of variables, Singular points, Vibrations of an elastic string, One dimensional Heat Flow, Heat conduction equation for a 3- dimensional rectangular configuration and apply it to the cooling of a brick (assuming constant initial temperature distribution), vibrations of rectangular and circular membrane, Method of Frobenius, Diffusion equation, Laplace's equation in problems of rectangular, cylindrical and spherical symmetry, Inhomogeneous partial differential equation-Green's function.	12
III	Fourier series and Integrals: Introduction, Evaluation of coefficients of Fourier series, cosine series, sine series, Dirichlet's theorem; representation of Even and odd functions, Extension of interval, complex form of Fourier series, Properties of Fourier series: Convergence, Integration, Differentiation, Parseval's theorem, Physical applications of Fourier series analysis: square wave, Half wave rectifier, Full wave rectifier, saw tooth wave, triangular wave; Fourier Integrals, deduction of expressions for the Fourier Transform and its inverse.	11

IV	Beta and Gamma Functions: Definition of gamma function, beta function, other forms of beta function, Relationship between beta and gamma function, Legendre's equation, Legendre's Polynomial, Legendre's function of second kind, General solution of Legendre's equation, Generating function of Legendre's polynomial, orthogonality of Legendre's polynomials, Deduction of Rodrigues's formula for the Legendre's Polynomials, Hermite Polynomial, Hermite differential equation, Generating function of Hermite Polynomial, deduction of recursion relation for H_n of 1st kind and 2nd.	11
	Practicum Review of FORTRAN Programming fundamentals: FORTRAN Preliminaries: Integer and floating-point arithmetic expression, built in functions, executable and non-executable statements, input and output statements, Formats, IF, DO, FOR and GO TO statements, Dimension arrays, statement function and function subprogram. To print out all natural (even/odd) numbers between given limits using computer. 1. Compute the product of two matrices of different dimension using DO loop 2. Numerical integration by Simpson 1/3 rule 3. Fitting of a straight line using Least-Square method 4. Using array variable, find out the average and standard deviation 5. Write a program to evaluate the function $Y = 1/[C(1 + e \cos \theta)]$ and $V = \sqrt{[C M G (e^2 + e \cos \theta + 1)]}$ $e = 1.1$, $C = 3.0(E+08)$, $M = 5.893(E+24)$, $G = 6.67(E-11)$ for varying value of θ from 0 to π. 6. To find maximum, minimum and range of a given set of numbers using computer. 7. To evaluate sum of finite series. 8. Find the roots of a quadratic equation. 9. To find integration of a definite integral by trapezoidal rule. 10. To find the area of a triangle, sphere and cylinder. 11. Given values for a, b, c and d and a set of values for the variable x evaluate the function defined by: $f(x) = ax^2 + bx + c \text{ if } x < d$ $f(x) = 0 \text{ if } x = d$ $f(x) = ax^2 + bx - c \text{ if } x > d$ For each value of x and print the value of x and f(x). Write a program for an arbitrary number of x values. Note: Teachers will discuss the fundamentals of FORTRAN Programming to the students. There after student will perform atleast 08 experiments. The examiner will allot one Practicum at the time of end term examination.	30
Suggested Evaluation Methods		

Internal Assessment: > Theory(20Marks) ☐ Class Participation:05 Marks ☐ Seminar/presentation/assignment/quiz/classstestetc.:05 Marks ☐ Mid-Term Exam:10Marks > Practicum(10Marks) ☐ Class Participation : Nil ☐ Seminar/Demonstration/Viva-voce/Labrecordsetc.:10Marks ☐ Mid-Term Exam: Nil	End Term Examination :50Marks 20 Marks
PartC-Learning Resources	
Recommended Books/e-resources/LMS: 1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier 2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill. 3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole. 4. An Introduction to Ordinary Differential Equations, Earl A Coddington, 1961, PHI Learning. 5. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill. 6. Essential Mathematical Methods, K.F. Riley and M.P. Hobson, 2011, Cambridge University Press 7. Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications. 8. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Books. 9. Advanced Practicum Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House 10. Advanced level Physics Practicum's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers 11. A Text Book of Practicum Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal 12. Engineering Practicum Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd. 13. Practicum Physics, G. L. Squires, 2015, 4th Edition, Cambridge University Press. 14. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub. 15. Introduction to Numerical Analysis, S. S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd. 16. Schaum's Outline of Programming with C++. J. Hubbard, 2000, Mc Graw-Hill Pub. 17. Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et.al, 3rd Edn., 2007, Cambridge University Press. 18. A first course in Numerical Methods, U. M. Ascher & C. Greif, 2012, PHI Learning. 19. Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition. 20. Numerical Methods for Scientists & Engineers, R. W. Hamming, 1973, Courier Dover Pub. 21. An Introduction to Computational Physics, T. Pang, 2nd Edn., 2006, Cambridge Univ. Press 22. Computational Physics, Darren Walker, 1st Edn., 2015, Scientific International Pvt. Ltd.	

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:CC-M1

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Elementary Mechanics		
Course Code	24UN-PHY-103		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC-M		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics as main subject at level 4 (i.e.10+2orequivalent) and Physics not as major subject in 1 st sem		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the dynamics of system of particles, Determination of moment of inertia using Theorems of parallel and perpendicular axis. Application of both translational and rotational dynamics motions simultaneously in analyzing rolling with slipping 2. Differentiate between elastic and plastic bodies. Elastic constants, determination and their physical significance. Torque and its significance in rotatory motion 3. Familiar about the special theory of relativity and its applications. Michelson's Morley experiment and its findings. 4. Analyze the two body Central Force problem and its applications 5. Learn to present observations, results, analysis and different concepts related to experiments of Mechanics		
Credits	Theory	Practicum	Total
	1	1	2
Contact Hours	1	2	3

Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs
Part B- Contents of the Course		
<u>Instructions for Paper-Setter</u> 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. 1. Use of scientific (non-programmable) calculators allowed.		
Unit	Topics	Contact Hours
I	Fundamentals of Dynamics: Rigid body, Moment of Inertia, Radius of Gyration, Theorems of perpendicular and parallel axis (with proof), Moment of Inertia of ring, Disc, Angular Disc, Solid cylinder.	3
II	Elasticity: Deforming force, Elastic limit, stress, strain and their types, Hooks law, Module of elasticity Relation between shear angle and angle of twist, Poisson's ratio and its limiting value. Torque required for twisting cylinder.	4
III	Special Theory of Relativity: Michelson's Morley experiment and its outcomes, Postulates of special theory of relativity, Lorentz Transformations, Lorentz contraction, Time dilation, Relativistic transformation of velocity, relativistic addition of velocities, variation of mass-energy equivalence	4
IV	Gravitation and central force motion: Law of gravitation, Potential and field due to spherical shell and solid sphere. Motion of a particle under central force field, 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 (m_0) joined together with spring of spring constant (k).	4
	<u>Practicum</u> 1. Measurement of length(ordiameter) using vernier caliper, screw gauge and travelling microscope. 2. To study the random error in observations. 3. To determine the area of window using a sextant. 4. Moment of Inertia of a FlyWheel 5. Moment of Inertia of irregular body using a Torsion Pendulum. 6. Young's Modulus by Bending of Beam. 7. Young's modulus by Koenig's method. 8. Modulus of rigidity of material of wire by Maxwell's Needle.	15

	9. Elastic constant by Searle's method. 10. To determine the value of 'g' by using Bar pendulum. Note: Student will perform at least 06 experiments. The examiner will allot one Practicum at the time of end term examination.	
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(10Marks) ❑ Class Participation: 04Marks ❑ Seminar/presentation/assignment/quiz/class test etc.: Nil ❑ Mid-Term Exam: 6Marks ➤ Practicum(5 Marks) ❑ Class Participation: Nil ❑ Seminar/Demonstration/Viva-voce/Labrecordsetc.: 5 Marks ❑ Mid-Term Exam: Nil	End Term Examination :20Marks 15 Marks	
PartC-Learning Resources		
Recommended Books/e-resources/LMS: 1. Mechanics“BerkeleyPhysicsCourseVol.I”,CharlesKittel,TataMcGraw-Hill 2. Mechanics,D.S.Mathur,S.ChandandCompanyLimited,2000 3. Elements of Properties of Matter, D.S. Mathur, S.Chand & Com.Pt.Ltd.,New Delhi 4. Physics, Resnick, Halliday &Walker, Wiley 5. PhysicsforscientistsandEngineerswithModernPhys.,J.W.Jewett,R.A.Serway,2010, Cengage Learning 6. An introduction to mechanics,D.Kleppner,R.J.Kolenkow,1973,McGraw-Hill. 7. Properties of Matter, R.Murgeshan,S.Chand &Com. Pt. Ltd., New Delhi 8. Classical Mechanics, J.C. Upadhyaya, Himalaya Publishing House 9. B.Sc. Practicum Physics, C.L.A rora,S.Chand Publisher,NewDelhi 10. AdvancedLevelPracticumPhysics,M.NelkonandOgborn,HenemannEducationBooks Ltd., New Delhi 11. Practicum Physics, S.S. Srivastava and M.K. Gupta, Atma Ram& Sons, Delhi 12. Practicum Physics,S.L.Gupta and V.Kumar,Pragati Prakashan Meerut 13. Modern Approach to Practicum Physics,R.K.Singla, Modern Publishers, Jalandhar 14. Advanced Practicum Physics for students,B.L.Flintand H.T.Worsnop,Asia Publishing House.		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MDC-1

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Physics Fundamentals–I		
Course Code	24UN-PHY-MDC101		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course	100-199		
Pre-requisite for the course (if any)	NotstudiedPhysicssubjectatlevel4(i.e.10+2orequivalent)		
Course Learning Out comes(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 Internal Assessment Marks:20 End Term Exam Marks: 50		Time:3hrs	
Part B-Contents of the Course			



Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no.1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
1. Use of scientific (non-programmable) calculators 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	8
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.	8
III	Causes of motion-concept of force, Newton's 1st law of motion, inertia and mass; Newton's 2 nd law of motion, momentum and force; 3 rd 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.	7
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.	7

<u>Practicum</u> 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 downward 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 $\sin \theta$ 7. To find the weight of a given body using parallelogram law of vectors. 8. Verification of Archimedes principle. 9. Verification of Work-energy theorem. 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. Note: Student will perform atleast 08 experiments. The examiner will allot one Practicum at the time of end term examination.	30
Suggested Evaluation Methods	
Internal Assessment: ➤ Theory(15 Marks) [] Class Participation:04Marks [] Seminar/presentation/assignment/quiz/classtestetc.:04Marks [] Mid-Term Exam:7Marks ➤ Practicum(5 Marks) [] Class Participation: Nil [] Seminar/Demonstration/Viva-vocce/Labrecordsetc.:05 Marks [] Mid-Term Exam: Nil	End Term Examinationn : :35 Marks :15 Marks
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, Viva Books, NewDelhi. 4. Physics for Scientists and Engineers with Modern Physics, 7th edition, by Raymond A. Serway and John W. Jewett Jr., Thomson Higher Education 10 Davis Drive Belmont, CA 94002-3098 USA. 5. Physics For You, Fifth Edition, by Keith Johnson, OUP Oxford; 5th edition (23 June 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 Undergraduate Programs

Course: CC-2/MCC-3

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	2 nd		
Name of the Course	Electricity, Magnetism and EM Theory		
Course Code	24UN-PHY-201		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC		
Level of the course	100-199		
Pre-requisite for the course (if any)	Appeared or passed the 1 st sem (B.Sc. Physical Science/ 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 electro magnetic waves in free space and in medium. 4. Understand D.C. and A.C. circuits, able to apply and analyses using networks. 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.		
Credits	Theory	Practicum	Total

	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs	
Part B-Contents of the Course			
<u>Instructions for Paper-Setter</u>			
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%numericalproblems are to be set.			
1. 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 vectorandtheirphysicalsignificance,Gauss'sdivergencetheorem,Stoke's theorem.ConservativenatureofElectrostaticField,ElectrostaticPotential, Potential as line integral of field, potential difference Derivation of electric field E from potential as gradient. Derivation of Laplace and Poisson equations.Electricflux,Gauss'sLaw,DifferentialformofGauss'slawand applications of Gauss's law. Mechanical force of charged surface, Energy Per unit volume.		11
II	MagneticField: Biot-Savartlawanditssimpleapplications:straightwireand circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment, Ampere's Circuital Law and its applications to (1) Solenoid and (2) Toroid, properties of B: curl and divergence, Magnetic Properties of Matter: Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H and M, Electronic theory of dia and para magnetism, Domain theory of ferromagnetism (Langevin's theory), Cycle of Magnetization- B-H curve and hysteresis loop: Energy dissipation, Hysteresis loss and importance of Hysteresis Curve		12
III	Time varying electromagnetic fields: Electromagnetic induction,		11

	Faraday's laws of induction and Lenz's Law, Self-inductance, Mutual inductance, Energy stored in a Magnetic field, Derivation of Maxwell's equations, Displacement current, Maxwell's equations in differential and integral form and their physical significance. Electromagnetic Waves: Electromagnetic waves, Transverse nature of electromagnetic wave, energy transported by electromagnetic waves, Poynting vector, Poynting's theorem. Propagation of Plane electromagnetic waves in free space & Dielectrics	
IV	DC current Circuits: Electric current and current density, Electrical conductivity and Ohm's law (Review), Kirchhoff's laws for D.C. networks, Network theorems: Thevenin's theorem, Norton theorem, Superposition theorem. Alternating Current Circuits: A resonance circuit, Phasor, Complex Reactance and Impedance, Analysis for RL, RC and LC Circuits, Series LCR Circuit: (1) Resonance, (2) Power Dissipation (3) Quality Factor and (4) Band Width, Parallel LCR Circuit.	11
	Practicum 1. Use of Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses. 2. Low resistance by Carey Foster's bridge with calibration. 3. 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 capacitance using De' Sauty bridge. 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 at least 08 experiments. The examiner will allot one Practicum at the time of end term examination.	30
Suggested Evaluation Methods		

Internal Assessment: ➤ Theory (20 Marks) ☐ Class Participation: 05 Marks ☐ Seminar/presentation/assignment/quiz/class test etc.: 05 Marks ☐ Mid-Term Exam: 10 Marks ➤ Practicum (10 Marks) ☐ Class Participation: Nil ☐ Seminar/Demonstration/Viva-voce/Lab record etc.: 10 Marks ☐ Mid-Term Exam: Nil	End Term Examination :50 Marks 20 Marks
Part C-Learning Resources	
Recommended Books/e-resources/LMS: 1. Electricity and Magnetism (Berkley, Phys.Course2), Edward M. Purcell, 1986 McGraw-Hill Education 2. Electricity and Magnetism: A. S. Mahajan & A. A. Rangwala (Tata-Mc Graw Hill), 1988. 3. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw 4. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings. 5. Feynman Lectures Vol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education 6. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press. 7. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press. 8. Field and Wave Electromagnetics (2nd Edn.), David K. Cheng, Addison-Wesley Publishing Company. 9. B. Sc. Practicum Physics, C.L. Arora, S. Chand Publisher, New Delhi 10. Advanced Level Practicum Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi 11. Practicum Physics, S. S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi 12. Practicum Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut 13. Modern Approach to Practicum Physics, R. K. Singla, Modern Publishers, Jalandhar 14. Advanced Practicum Physics for students, B. L. Flint and H. T. Worsnop, Asia Publishing House	

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:CC-M2

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	2 nd		
Name of the Course	Elementary Electricity, Magnetism & EM Theory		
Course Code	24UN-PHY-202		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC-M		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics not as major subject in 2 nd sem		
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 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		
Credits	Theory	Practicum	Total
	1	1	2
Contact Hours	1	2	3
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	



Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no.1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculators 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.	4
II	Magnetic field and magnetic properties : Magnetic induction, Magnetic flux, Solenoidal nature of vector field of induction, properties of $\nabla \cdot \mathbf{B} = 0$ (ii) $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$, Magnetic Materials, types, Hysteresis curve and Importance of Hysteresis Curve.	3
III	Time varying electromagnetic fields and electromagnetic waves: Electromagnetic induction, Faraday's laws of induction and Lenz's Law, Derivation of Maxwell's equations and their physical significance. Boundary conditions at interface between two different media, Propagation of electromagnetic wave (Basic idea, no derivation), Poynting vector and Poynting theorem.	4
IV	D.C. and A.C. circuits: D.C. Network theorems: Thevenin's theorem, Norton theorem, Superposition theorem; Analysis of LCR Series and parallel resonant circuits.	4
	<u>Practicum</u> 1. Use of Multimeter for measuring Resistance, A.C and D.C Voltage and Current, checking of electrical fuses. 2. Low resistance by Carey Foster's bridge with calibration. 3. 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.	30



	6. High resistance by substitution method. 7. To compare capacitances using De' Sauty bridge. 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. Note: Student will perform at least 06 experiments. The examiner will allot one Practicum at the time of end term examination.	
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(10Marks) ❑ Class Participation:04Marks ❑ Seminar/presentation/assignment/quiz/class test etc.:Nil ❑ Mid-Term Exam:6Marks ➤ Practicum(5 Marks) ❑ Class Participation: Nil ❑ Seminar/Demonstration/Viva-voce/Labrecordsetc.:05 Marks ❑ Mid-Term Exam: Nil	End Term Examination :20Marks :15 Marks	
Part C-Learning Resources		
Recommended Books/e-resources/LMS: 1. Electricity and Magnetism (Berkley, Phys.Course2), Edward M. Purcell, 1986McGraw-Hill Education 2. Electricity and Magnetism: A.S. Mahajan& A. A. Rangwala (Tata-Mc Graw Hill),1988. 3. Electricity, Magnetism& Electromagnetic Theory, S.Mahajanand Choudhury, 2012, Tata McGraw 4. Introduction to Electrodynamics, D.J. Griffiths,3rdEdn., 1998, Benjamin Cummings. 5. FeynmanLecturesVol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education 6. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press. 7. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol. I, 1991, Oxford Univ. Press. 8. Field and Wave Electromagnetics(2ndEdn.), David K. Cheng, Addison- Wesley Publishing Company.		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: DSEC-1

Session:2024-25			
Part A -Introduction			
Subject	Physics		
Semester	2 nd		
Name of the Course	Computational Physics		
Course Code	24UN-PHY-203		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	DSEC		
Level of the course	100-199		
Pre-requisite for the course (if any)	Appeared or passed the 1 st sem (B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the programming language and their use in various applications 2. Develop Python programs to solve computational problems 3. Select a suitable programming to solve differential equations 4. Find the integral value of a function using appropriate method. 5. Understand how to develop a programme for a particular problem and it will improve logical thinking that helps to solve scientific problems using Python language.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs	
Part B-Contents of the Course			

Instructions for Paper-Setter

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

Unit	Topics	Contact Hours
I	Introduction to Programming using Python: Structure of a Python Program, Functions, Interpreter shell, Indentation. Identifiers and keywords, Literals, Strings, Basic operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment Operator, Bit wise operator). Standard libraries in Python, notion of class, object and method.	11
II	Creating Python Programs: Identifiers and keywords; Literals, numbers, and strings; Operators; Expressions; Input/output statements; Defining functions; Control structures (conditional statements, loop control statements, break, continue and pass, exit function), default arguments. Mutable and immutable objects. Testing and debugging a program	12
III	Differentiation: Taylor series method, Newton's forward and backward difference formula, Stirling's formula. Numerical solutions of partial differential equations using Taylors's series method	11
IV	Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Gaussian Quadrature, Legendre–Gauss Quadrature, Numerical double integration.	11
	<u>Practicum</u> 1. Write a Python program to illustrate the various functions of the "Math" module. 2. Write a function that takes the lengths of three sides: side1, side2 and side3 of the triangle as the input from the user using input function and return the area of the triangle as the output. Also, assert that sum of the length of any two sides is greater than the third side. 3. Write a Python function that takes a number as an input from the user and computes its factorial. 4. Write a function that takes a number with two or more digits as an input and finds its reverse and computes the sum of its digits. 5. Write a function that takes two numbers as input parameters and returns their least common multiple and highest common factor. 6. Write a Python function to calculate the sum and product of two compatible matrices. 7. Write a function that takes a list of numbers as input from the user and produces the corresponding cumulative list where each element in the	30

	List present at index is the sum of elements at index $j \leq i$. 8. Write a function that takes n as an input and creates a list of n lists such that i^{th} list contains first five multiples of i. 9. Solution of differential equations using Taylor's series method. 10. Numerical integration using(a) Simpson 1/3 and 3/8 rule 11. Gauss quadrature methods for one and two dimensional integrals Note: Student will perform at least 08 experiments. The examiner will allot one Practicum at the time of end term examination.	
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(20Marks) ☐ Class Participation: 05 Marks ☐ Seminar/presentation/assignment/quiz/class test etc.: 05 Marks ☐ Mid-Term Exam: 10Marks ➤ Practicum(10Marks) ☐ Class Participation: Nil ☐ Seminar/Demonstration/Viva-voce/Lab record setc.: 10Marks ☐ Mid-Term Exam: Nil	End Term Examination :50Marks :20Marks	
Part C-Learning Resources		
Recommended Books/e-resources/LMS: 1. Sheetal Taneja, Naveen Kumar, Python Programming "A Modular Approach" Pearson India. 2. E. Balaguru swamy, Introduction to Computing and Problem Solving using Python, 2nd edition, McGraw Hill Education, 2018 3. RC Desai, Fortran Programming and Numerical methods, Tata Mc Graw Hill, New Delhi. 4. Suresh Chandra, Computer Applications in Physics, Narosa Publishing House 5. M L De Jong, Introduction to Computation Physics, Addison-Wesley publishing company. 6. RC Verma, PK Ahluwalia and KC Sharma, Computational Physic san Introduction, New Age International Publisher. 7. SS Sastry Introductory methods of numerical Analysis, Prentice Hall of India Pvt. Ltd. 8. V Rajaraman, Computer Oriented Numerical Method, Prentice Hall of India Pvt. Ltd. 9. C Balachandra Rao and CK Santha, Numerical Methdods, University Press 10. KE Atkinson, An introduction to numerical analysis, John Wileyand Sons.		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course : MDC-2

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	2 nd		
Name of the Course	Physics Fundamentals-II		
Course Code	24UN-PHY-MDC201		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course	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 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. Gras pan introductory idea about the generation of X-rays, α-, β-and γ-rays through an understanding of composition of atom & nucleus 5. Understand the observations, results, analysis and different concepts related to experiments of light &optics.		
Credits	Theory	Practicum	Total
	2	1	3
Contact Hours	2	2	4
Max.Marks:70 Internal Assessment Marks:20 End Term Exam Marks: 50		Time:3hrs	



Part B-Contents of the Course

Instructions for Paper-Setter

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

Unit	Topics	Contact Hours
I	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 of stars, advance Sunrise and delayed Sunset; Scattering of light and blue colour of the sky; apparent depth, total internal reflection and its important applications	7
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	8
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, magnetic field and direction of field due to a current-through	8
	Straight conductor and through a circular loop; solenoid, electromagnet	

Rf

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	7
	<u>Practicum</u> - To find the focal length of a convex mirror using a convex lens. - To find the value of v for different values of u in the case of a concave mirror and to find the focal length - To find the focal length of a concave lens using a convex lens. - To determine the refractive index of a glass slab - To find the refractive index of a liquid using a convex lens and plane mirror - To determine the resistivity of different wires by plotting a graph for potential difference versus current. - To verify Ohm's law for metallic conductor and to determine its resistance. - To find the frequency of AC mains with a sonometer. - Use of Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses. - Use of Multimeter to check the working condition of diode, an LED, a resistor and a capacitor. Note: Student will perform at least 06 experiments. The examiner will allot one Practicum at the time of end term examination.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(15 Marks) □ Class Participation:04Marks □ Seminar/presentation/assignment/quiz/classstestetc.:04Marks □ Mid-Term Exam: 7Marks ➤ Practicum(05 Marks) □ Class Participation: Nil □ Seminar/Demonstration/Viva-voce/Labrecordsetc.:05 Marks □		End Term Examination :35 Marks 15 Marks
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, Darya ganj, New Delhi, India.
3. Modern Physics(2ndedition), by S.L. Kakani and Shubhra Kakani, Viva Books, New Delhi.
4. Physics for Scientists and Engineers with Modern Physics, 7thedition, by Raymond A. Serway and John W. Jewett, Jr., Thomson Higher Education 10 Davis Drive Belmont, CA 94002-3098 USA.
5. Physics For You (Fifth Edition) by Keith Johnson.
6. B. Sc Practical Physics, C. L. Arora, R Chand & Co. New Delhi
7. B. Sc Practical Physics, Harnam Singh and Dr. P.S. Hemne, S Chand & Company Ltd.



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: SEC-1

Session:2024-25

Part A-Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Computational Skills in Physics		
Course Code	24UN-PHY-SEC101		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC/SEC)	SEC		
Level of the course	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. This course will give an insight to computer hardware. 2. This course will give an insight to computer applications. 3. Students will familiarize with use of computer to solve physics problems. 4. Students will familiarize to prepare algorithms and flowcharts for solving a problem. 5. Students will familiarize with programming language for solving a problem 6. Operation and interpretation of computer programming. 7. Learn to present observations, results, analysis and different concepts related to experiments of Computational Skills on Physics.		
Credits	Theory	Practicum	Total
	2	1	3
Contact Hours	2	2	4
Max.Marks:70 Internal Assessment Marks:20 End Term Exam Marks: 50		Time:3hrs	
Part B-Contents of the Course			



Instructions for Paper-Setter

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

Unit	Topics	Contact Hours
I	Introduction: What is computational physics? Why do we need it? Computer hardware: basic computer architecture, hierarchical memory, RAM, ROM, cache, latency and bandwidth.	06
II	Machine representation, precision and errors Representation on a computer: Integer representation; floating-point representation; Machine precision; Errors: round-off; approximation errors; random errors; errors of the third kind;	07
III	Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of $\sin(x)$ as a series, algorithm for plotting (1) trajectory of a projectile Thrown at an angle with the horizontal.	10
IV	Scientific Programming: Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment Operators.	07



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:SEC-2

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	2 nd		
Name of the Course	Basic Instrumentation Skills		
Course Code	24UN-PHY-SEC201		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC/SEC)	SEC		
Level of the course	100-199		
Pre-requisite for the course (if any)	Appeared or passed the 1 st sem. (B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understanding of instruments' accuracy, precision, sensitivity, resolution range, and errors in measurements. 2. Proficiency in using a multimeter for measuring DC voltage, DC current, AC voltage, AC current, and resistance. 3. Understanding the block diagram of a basic CRO and the construction of its components like CRT, electron gun, electrostatic focusing, and acceleration. 4. Knowledge of specifications of electronic voltmeters/multimeters and their significance. 5. Introduction to digital oscilloscopes, including their block diagrams and principles of operation. 6. Learn to present observations, results, analysis and different concepts related to experiments of Basic Instrumentation Skills		
Credits	Theory	Practicum	Total
	2	1	3
Contact Hours	2	2	4
Max.Marks:70 Internal Assessment Marks:20 End Term Exam Marks: 50		Time:3hrs	
Part B-Contents of the Course			



Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.	04
II	Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier-amplifier. Block diagram ac millivoltmeter, specifications and their significance.	04
III	Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion fact or meter, wave analysis.	13
IV	Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges. Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period	09

	measurement using universal counter/frequency counter, time-base stability, accuracy and resolution.	
	Practicum 1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance. 2. To observe the limitations of a multimeter for measuring high frequency voltage and currents. 3. To measure Q of a coil and its dependence on frequency, using a Q-meter. 4. Measurement of voltage, frequency, time period and phase angle using CRO. 5. Measurement of time period, frequency, average period using universal counter/ frequency counter. 6. Measurement of rise, fall and delay times using a CRO. 7. Measurement of distortion of a R F signal generator using distortion factor meter. 8. Measurement of R, L and C using a L C R bridge/universal bridge. Note: Student will perform at least 06 experiments. The examiner will allot one Practicum at the time of end term examination.	30
	Suggested Evaluation Methods	
	Internal Assessment: ➤ Theory (15 Marks) □ Class Participation: 04 Marks □ Seminar/presentation/assignment/quiz/class test etc.: 04 Marks □ Mid-Term Exam: 07 Marks. ➤ Practicum (5 Marks) □ Class Participation: Nil □ Seminar/Demonstration/Viva-voce/Lab records etc.: 05 Marks □ Mid-Term Exam: Nil	End Term Examination :35 Marks :15 Marks
	Part C-Learning Resources	
	Recommended Books/e-resources/LMS: 1. A text book in Electrical Technology- BL Theraja – S Chand and Co.. 2. Performance and design of AC machines-M G Say E L B S E dn.. 3. Digital Circuits and systems, Venugopal, 2011, Tata Mc Graw Hill.. 4. Logic circuit design, Shimon P. Vingron, 2012, Springer.. 5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning. 6. Electronic Devices and circuits, S. Salivahan an & N.S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill. 7. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India	

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: VOC-1

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	3 rd /5 th		
Name of the Course	Drone Technology & Applications		
Course Code	24UN-PHY-VOC301		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Explain the basic principles, components, and types of drone systems. 2. Demonstrate knowledge of drone operation, maintenance, and flight planning. 3. Understand the use of onboard sensors and data acquisition techniques for mapping and monitoring application. 4. Identify diverse applications of drone technology and demonstrate awareness of safety practices, regulations, and ethical considerations.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6
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. 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.

Unit	Topics	Contact Hours
I	Introduction to drones and Unmanned Aerial Vehicles (UAVs), History and evolution of drone technology, Classification of drones, Types of UAVs (fixed-wing, multirotor, hybrid), Components of a drone, Flight controller, Propellers, Electronic Speed Controller (ESC), Motors, Battery systems, Ground control station, Basic principles of drone flight	8
II	Drone communication systems, Radio transmitter and receiver, Global Positioning System (GPS), Inertial Measurement Unit (IMU), Flight modes, Mission planning, Pre-flight inspection.	7
III	Drone assembly and calibration, Take-off and landing procedures, Battery management, Basic maintenance and troubleshooting. Drone-mounted sensors, RGB cameras, Thermal cameras, Multispectral cameras, LiDAR (basic concept).	8
IV	Image and video acquisition, Aerial photography, Mapping and surveying, Remote sensing basics, Data collection techniques, Introduction to Geographic Information System (GIS). Applications in agriculture, Infrastructure inspection, Environmental monitoring, Disaster management, Surveying and mapping etc.	7
	<u>Practicum</u> 1. Study and identification of different types of Drones. 2. To study Drone assembly and basic component. 3. To study the transmission and reception of signals using a radio transmitter and receiver (Bluetooth). 4. To study the variation of received signal strength with distance. 5. To study the effect of distance on image size and clarity. 6. To study the effect of height on the area covered in an aerial photograph. 7. To study about drone mounted sensor. 8. To study basic drone flight operations such as safe take off, hovering, directional movement and controlled landing using manual and stabilized flight modes. 9. To identify and resolve common drone faults. 10. To study Pre-flight inspection and safety procedure of a drone. Note: Student will perform at least eight experiments. The examiner will allot one practical at the time of end term examination	

Suggested Evaluation Methods

Internal Assessment:

➤ Theory (15 Marks)

- Class Participation: **4 Marks**
- Seminar/presentation/assignment/quiz/class test etc.: **4Marks**
- Mid-Term Exam: **7 Marks**

➤ Practicum (15 Marks)

- Class Participation: **5**
- Seminar/Demonstration/Viva-voce/Lab records etc.: **10Marks**
- Mid-Term Exam: **Nil**

**End Term
Examination
: 35 Marks**

:35 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Introduction to UAV Systems by Paul G. Fahlstrom and Thomas J. Gleason.
2. Small Unmanned Aircraft: Theory and Practice by Randy Beard and Timothy McLain.
3. Introduction to Drone Technology by R. K. Rajput.
4. Drone Technology by S. K. Singh.
5. Fundamentals of Remote Sensing by George Joseph.

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:CC-3/MCC-4

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Thermodynamics & Statistical Physics		
Course Code	24UN-PHY-301		
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 2 nd sem(B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand and describe the basic concepts and laws of thermodynamics 2. Apply the laws of thermodynamics to develop Maxwell's thermodynamic relations be able to understand their physical interpretations 3. Appreciate cellular nature of phase space and Have better knowledge of classical statistics which would result in greater insight into solutions of various complex problems 4. Have better understanding of quantum statistics and are in a position to extend the treatment to the analysis of complex problems 5. Learn to present observations, results, analysis and different concepts of experiments related to Thermodynamics & Statistical Physics		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5



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

Time:3hrs

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

Unit	Topics	Contact Hours
I	THERMODYNAMICS-I Thermodynamic-systems, variables and equation of state, thermal equilibrium, Zeroth law of thermodynamics; Concept of heat andwork, First law of thermodynamics- its significance and limitations, internal energy as a state function, different types of process-isochoric process, isobaric process, adiabatic process, isothermal process, cyclic process, Reversible and irreversible process, First law and cyclic process; Second law of thermodynamics and its significance, Carnot theorem; Joule's free expansion, Joule Thomson effect, Joule-Thomson (Porous plug) experiment : conclusions and explanation, Entropy, calculations of entropy of reversible and irreversible process, T-S diagram, entropy of a perfect gas, Nernst heat law (third law of thermodynamics); Liquefaction of gases (qualitative idea).	11
II	THERMODYNAMICS-II Derivation of Clausius-ClapeyronandClausiuslatentheatequationsandtheirsignificance, phase diagram and triple point of a substance, development of Maxwell thermodynamical relations, Thermodynamical functions: Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them, derivation of Maxwell thermodynamical relations from thermodynamical functions, Application of Maxwell relations: relations between two specific heats of gas, derivation of Stefan's law, adiabatic compression and expansion of gas & deduction of theory of Joule Thomson effect.	10
III	Statistical Physics-I	12

	Distribution of N (for N= 2, 3, 4) distinguishable and indistinguishable particles in two boxes of equal size, microstates and macrostates, thermodynamical probability, constraints and accessible states, statistical fluctuations, general distribution of distinguishable particles in compartments of different sizes, β -parameter, entropy and probability; Concept of phase space, division of phase space into cells, postulates of statistical mechanics; Classical and quantum statistics, basic approach to these statistics, Maxwell-Boltzmann statistics applied to an ideal gas in equilibrium-energy distribution law, Maxwell's distribution of speed & velocity (derivation required), most probable speed, average and r.m.s. speed, mean energy for Maxwellian distribution.	
IV	Statistical Physics-II Dulong and Petit Law, derivation of Dulong and Petit law from classical physics; Need of Quantum statistics- classical versus quantum statistics, Bose-Einstein energy distribution Law, Application of B. E. Statistics to Planck's radiation law, degeneracy and B. E. condensation; Fermi-Dirac energy distribution Law, F.D. gas and degeneracy, Fermi energy and Fermi temperature; F. D. energy distribution Law for electron gas in metals, zero point energy, average speed (at 0 K) of electron gas	11
	Practicum 1. To determine Mechanical Equivalent of Heat, by Callender and Barne's constant flow method. 2. Measurement of Planck's constant using black body radiation. 3. To determine Stefan's Constant. 4. To determine the coefficient of thermal conductivity of copper by Scarle's Apparatus. 5. To determine the Coefficient of Thermal Conductivity of Cuby Angstrom's Method. 6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method. 7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer. 8. To study the variation of thermo emf across two junctions of a thermocouple with temperature. 9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system 10. To calibrate Resistance Temperature Device(RTD) using Null Method/Off-Balance Bridge 11. To prove the law of probability by using one coin, two coins and 10 or more coins. 12. To determine the coefficient of increase of volume of air at constant pressure. 13. To determine the coefficient of increase of pressure of air at constant volume. 14. Computer simulation of Maxwell-Boltzmann distribution, Fermi-	30

	Dirac & Bose-Einstein 15. Study of statistical distribution from the given data and to find most probable, average, and rms value 16. Mechanical Equivalent of heat(J) by Joule's calorimeter. 17. Heating efficiency of electrical kettle with varying voltage.	
Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.		
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(20Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/classstestetc.: 05 Marks • Mid-Term Exam: 10 Marks ➤ Practicum(10Marks) • Class Participation :Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil		End Term Examination :50 Marks 20 Marks
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
1. Thermal Physics and Statistical Mechanics, S.K. Roy, New Age International Publishers, New Delhi 2. Thermodynamics and Statistical Physics, J.K. Sharma and K.K. Sarkar,Himalaya Publishing House, Bombay 3. Introduction to Thermodynamics and its Applications, Stowe Keith, University Press (India) Pvt. Ltd, Hyderabad 4. Introductory Thermodynamics, Pierre Infelta, Brown Walker Press, Boca Ratan,Florida 5. Fundamentals of Thermodynamics, J.K.Johnson, University of Pittsburgh 2009 6. Thermodynamics and Its Applications, Jefferson Tester,MichaelModell,3rdEdition 7. Thermodynamics, Statistical Thermodynamics & Kinetics, Thomas Engel, PhilipReid,2ndEdition 8. Advanced Practical Physics for students, B.L.Flint &H.T.Worsnop,1971, Asia Publishing House. 9. Advanced level Physics Practicals, Michael Nelson and Jon M.Ogborn,4thEdition, reprinted 1985, Heinemann Educational Publishers 10. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11thEdition, 2011,Kitab Mahal, New Delhi. 11. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985,Vani Publication.		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MCC-2

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Mathematical Physics		
Course Code	24UN-PHY-102		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course(As per Annexure-I)	100-199		
Pre-requisite for the course(if any)	Appeared or passed the 2 nd sem (B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn the Fourier analysis of periodic functions and their applications in physical problems. Learn the beta, gamma and the error functions and their applications in doing integrations. 2. Acquire knowledge of methods to solve partial differential equations with the examples of important partial differential equations in Physics. 3. Write given function in terms of sine and cosine terms in Fourier series and also to get knowledge in Fourier transforms 4. Learn about beta gamma function, their properties, solve Legendre equations find generating function for Legendre Polynomial, Hermite equation, study orthogonal properties of Hermite Polynomials, recurrence relations of complex numbers and their properties such as analyticity, poles and residues. 5. Learn about the methods to solve the mathematical problem using Fortran		
Credits	Theory	Practical	Total
	3	1	4



Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70	Time:3hrs		

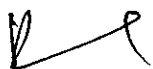
PartB-Contents of the Course

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	Theory of Errors: Systematic and Random errors, Propagation of errors, Normal law of errors, Standard and Probable error, Least square fit, error on slope and intercept of fitted line. Matrices: Normal Matrices, Orthogonal Matrices, Hermitian Matrices, Unitary Matrices, Symmetric and Anti-symmetric Matrices, Conjugate of a Matrix, Anti-hermitian Matrices, Trace of Matrix, Eigen values and eigen vectors of Matrices, Diagonalization of Matrices.	11
II	Method of expansion of a function: Taylor's expansion, Power series, Laurent's theorem. Partial and ordinary differential equations, Partial Differential equations, First order differential equations, Method of separation of variables, Singular points, Vibrations of an elastic string, One dimensional Heat Flow, Heat conduction equation for a 3-dimensional rectangular configuration and apply it to the cooling of a brick (assuming constant initial temperature distribution), vibrations of rectangular and circular membrane, Method of Frobenius, Diffusion equation, Laplace's equation in problems of rectangular, cylindrical and spherical symmetry, Inhomogeneous partial differential equation-Green's function.	12
III	Fourier series and Integrals: Introduction, Evaluation of coefficients of Fourier series, cosine series, sine series, Dirichlet's theorem, representation of Even and odd functions, Extension of interval, complex form of Fourier series, Properties of Fourier series: Convergence, Integration, Differentiation, Parseval's theorem, Physical applications of Fourier series analysis: square wave, Half wave rectifier, Full wave rectifier, saw tooth wave, triangular wave, Fourier Integrals, deduction of expressions for the Fourier Transform and its inverse.	11
IV	Beta and Gamma Functions: Definition of gamma function, beta function, other forms of beta function,	11

	Relationship between beta and gamma function, Legendre's equation, Legendre's Polynomial, Legendre's function of second kind, General solution of Legendre's equation, Generating function of Legendre's polynomial, orthogonality of Legendre's polynomials, Deduction of Rodrigue's formula for the Legendre's Polynomials, Hermite Polynomial, Hermite differential equation, Generating function of Hermite Polynomial, deduction of recursion relation for H_n of 1 st kind and 2 nd	
	Practicum Review of FORTRAN Programming fundamentals: FORTRAN Preliminaries: Integer and floating point arithmetic expression, built in functions, executable and non-executable statements, input and output statements, Formats, IF, DO and GO TO statements, Dimension arrays, statement function and function subprogram. - To print out all natural (even/odd) numbers between given limits using computer. - Compute the product of two matrices of different dimension using DO loop - Numerical integration by Simpson 1/3 rule - Fitting of a straight line using Least-Square method - Using array variable, find out the average and standard deviation - Write a program to evaluate the function $Y=1/[C(1+e\cos\theta)]$ and $V=\sqrt{[CMG(e^2 + e\cos\theta + 1)]}$, $e = 1.1$, $C = 3.0(E+08)$, $M=5.893(E+24)$, $G=6.67(E-11)$ for varying value of θ from 0 to π. - To find maximum, minimum and range of a given set of numbers using computer. - To evaluate sum of finite series. - Find the roots of a quadratic equation. - To find integration of a definite integral by trapezoidal rule. - To find the area of a triangle, sphere and cylinder. - Given values for a, b, c and d and a set of values for the variable x evaluate the function defined by. $f(x) = ax^2 + bx + c \text{ if } x < d$ $= 0 \text{ if } x = d$ $f(x) = ax^2 + bx - c \text{ if } x > d$ For each value of x and print the value of x and f(x). Write a program for an arbitrary number of x values. Note: Teachers will discuss the fundamentals of FORTRAN Programming to the students. There after student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		



Internal Assessment: > Theory(20Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 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
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Part C-Learning Resources

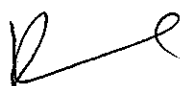
Recommended Books/e-resources/LMS:

1. Mathematical Methods for Physicists: Arfken, Weber, Harris, Elsevier (2005)
2. Fourier Analysis by M.R. Spiegel, Tata McGraw-Hill (2004)
3. Mathematics for Physicists, Susan M. Lea, Thomson Brooks/Cole (2004)
4. An Introduction to Ordinary Differential Equations, Earl A Coddington, PHI Learning (1961)
5. Differential Equations, George F. Simmons, Tata McGraw-Hill (2006)
6. Essential Mathematical Methods, K.F. Riley and M.P. Hobson, Cambridge University Press (2011)
7. Partial Differential Equations for Scientists and Engineers, S .J. Farlow, Dover Publications (1993)
8. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, VivaBooks (2003)
9. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House (1971)
10. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, Heinemann Educational Publishers (1985)
11. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal (2011)
12. Engineering Practical Physics, S. Panigrahi & B. Mallick, Cengage Learning India Pvt. Ltd (2015)
13. Practical Physics, G.L. Squires, 4th Edition, Cambridge University Press (2015)
14. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, Vani Publication (1985)
15. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., PHI Learning Pvt. Ltd (2012)
16. Schaum's Outline of Programming with C++, J. Hubbard, 2000, McGraw-Hill Pub (2000)
17. Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al, 3rd Edn., 2007, Cambridge University Press (2007)
18. A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning (2012)
19. Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn, Wiley India Edition (2007).
20. Numerical Methods for Scientists & Engineers, R.W. Hamming, Courier Dover Publications (1973)
21. An Introduction to Computational Physics, T. Pang, 2nd Edn., Cambridge Univ. Press (2006)
22. Computational Physics, Darren Walker, 1st Edn., 2015, Scientific International Pvt. Ltd (2015)

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MCC-5

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Classical Mechanics		
Course Code	24UN-PHY-302		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course(if any)	Appeared or passed the 2 nd sem (B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes(CLO):	After completing this course ,the learner will be able to: 1. Learn the concept of conservation of energy, momentum, angular momentum and apply them to understand the basic problems in physics. 2. Understand the importance of Lagrangian & Hamiltonian dynamics and to find the Lagrangian and Hamiltonian for various simple mechanical systems such as Linear Harmonic oscillator, Simple pendulum, Atwood's machine 3. Describe and understand the concepts of central force motion, Kepler's laws of planetary motion and scattering in central force field 4. Differentiate between inertial and Non-inertial frame of references and describe how fictitious forces arise in a non-inertial frame and to understand the importance of these forces. 5. Learn to present observations, results, analysis and different concepts related to experiments of Classical Mechanics.		
Credits	Theory	Practical	Total
	3	1	4



Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs	
Part B-Contents of the Course			
<u>Instructions for Paper-Setter</u>			
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. 1. Use of scientific (non-programmable) calculator is allowed.			
Unit	Topics		Contact Hours
I	INTRODUCTORY IDEAS OF CLASSICAL MECHANICS: Newton’s Laws of Motion, Limitation of Newton’s programme; Space-time reference system; Introduction to different coordinate systems-Cartesian, cylindrical and spherical coordinate systems. Mechanics of single particle- Conservation Laws of linear momentum, Angular momentum and mechanical energy, First integrals of motion; Mechanics of a system of particles- Concept of external and internal forces, concept of centre of mass and centre of mass frame of reference, Conservation laws of linear momentum, Angular momentum and mechanical energy, relation between angular momentum and angular momentum about the Centre of Mass.		11
II	LAGRANGIAN AND HAMILTONIAN DYNAMICS: Degrees of freedom; Constraints - Their classification, properties and examples; Generalized coordinates, Transformation equations, Generalized Displacement, Velocity, Acceleration, Momentum, Force and Potential; Principle of Virtual Work & D’Alembert’s Principle, Lagrange’s equations of motion from D’Alembert’s Principle; Cyclic or ignorable coordinates; Integrals of motion; Concept of symmetry-Homogeneity and isotropy. Hamilton’s Function and Hamilton’s equations of motion, Properties of Hamiltonian and Hamilton’s equations of motion; Formation of (i) Lagrangian and Lagrange’s equations of motion (ii) Hamiltonian and Hamilton’s equation of motion-for-Linear Harmonic oscillator, Atwood’s machine, simple pendulum & compound pendulum.		12
III	MOTION UNDER CENTRAL FORCE: Definition and properties of the central force, two body central force problem- reduction to equivalent one body problem (Lagrangian and Lagrange’s equations of motion); differential equation for an orbit, general features of the orbit, stability of the orbits under central force and conditions		11

	for closure. Inverse square law- Kepler's law of planetary motion and their derivation; Scattering in central force field- Scattering cross-section, scattering angle, impact parameter and derivation of Rutherford scattering cross-section	
IV	ROTATING FRAMES AND RELATIVE COORDINATE SYSTEMS: Inertial and non-inertial frame of references; inertial forces in rotating frame (rotating coordinate systems) – Coriolis force and derivation of Coriolis force from Lagrangian formulation, electromagnetic analogy of the inertial forces; effect of Coriolis force- on projectile motion (a) the projectile dropped from a height (h) with initial velocity zero (b) the projectile is sent vertically up with velocity v_0 to reach a height h above the ground and if returns to the ground, river flow on the surface of earth, formation of cyclones, trade and tropical winds, Coriolis force effect in atomic nuclei, Coriolis phenomenon in the planetary atmospheres; Foucault pendulum, Precession of charged particles in a magnetic field, methods of handling the situations with two rotations separated by a time varying translation.	11
	Practicum 1. To study the Motion of spring and calculate spring constant & value of Acceleration due to Gravity. 2. To determine the value of 'g' by using Kater's pendulum. 3. To study (i) the law of conservation of linear momentum (ii) the law of conservation of kinetic energy and (iii) to calculate the restitution using one dimensional collision apparatus of two hanging spheres. 4. To investigate the motion of coupled oscillators. 5. Surface tension by Quinke's method 6. Young's modulus by Koenig's method. 7. To determine "Y" by optical lever. 8. Viscosity of liquid using Stokes method. 9. To determine the surface tension of a liquid by jaeger's method. 10. To determine the coefficient of Viscosity by Poiseuille's method 11. Verification of parallel & perpendicular axis theorem– using Moment of Inertia. 12. Determination of Log decrement & viscosity. 13. Verification of vibrating string Melde's experiment Note: Student will perform atleast six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		



Internal Assessment: ➤ Theory(20Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/classstestetc.:05 Marks • Mid-Term Exam:10 Marks ➤ Practicum(10Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Labrecordsetc.: 10 Marks • Mid-Term Exam: Nil	End Term Examination :50 Marks 20 Marks
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Classical Mechanics, H.Goldstein(2nd Edition)
2. Mechanics, D.S.Mathur, S.Chand & Co. Pvt. Ltd., NewDelhi
3. Classical Mechanics, J. C.Upadhyaya, HimalyaPublishingHouse,Mumbai.
4. Classical Mechanics, S.L.Gupta, V.Kumar & H.V.Sharma, Pragati Prakashan,Meerut.
5. Classical Mechanics, N. C. Rana & P. S. Joag, Tata McGraw-Hill Publishing company Limited, New Delhi
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, NewDelhi
7. Advanced Level Practical Physics, M.Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
8. Practical Physics, S.S.Srivastava and M.K.Gupta, Atma Ram & Sons,Delhi
9. Practical Physics, S.L.Gupta and V.Kumar, Pragati Prakashan Meerut
10. Modern Approach to Practical Physics, R.K. Singla, ModernPublishers,Jalandhar
11. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, Asia Publishing House.



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:MDC-3

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Elements of modern Physics		
Course Code	24UN-PHY-MDC301		
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 level4 (i.e. 10+2or equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Have introductory idea about the importance of semiconductors and basic semiconductor devices 2. Have the knowledge about the lasers and optical fibers and their importance in scientific and technological fields 3. Understand importance of radio isotopes, Nuclear fission and fusion reactions and their hazardous aspects 4. Have the knowledge about the importance of some scientifically and technologically advanced materials. 5. Learn to present observations, results, analysis and different concepts related to experiments of Elements of modern Physics.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4
Max. Marks:70 Internal Assessment Marks:20 End Term Exam Marks: 50		Time:3hrs	
Part B-Contents of the Course			



Instructions for Paper-Setter

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

Unit	Topics	Contact Hours
I	Basics of semiconductor and semiconductor devices-Atomic structure and energy levels, energy bands (basic idea), definition of conductor, semiconductor and insulators (on the basis of energy gap), Intrinsic semiconductors, extrinsic semiconductors-p-type and n-type semiconductor), P-N junction diode-depletion layer, forward biasing and reverse biasing, V-I characteristics; Principle, working and applications of Zener diode, Photodiode, Solar cell and Light emitting diode (LED).	8
II	Basics of Laser systems - introduction to LASER, important properties of laser light, Principle of laser- Light amplification, population inversion and pumping; Working of laser- schematic diagram for functioning of laser, three level and four level Laser systems; applications of Lasers in different fields of science and technology.	5
III	Basics of fiber optics- introduction to optical fibers, total internal reflection and the optical fibers, structure and types of optical fiber (basic idea), advantages and disadvantages of optical fibers, optical fiber communication system (basic idea), applications of optical fibers.	5
IV	Magnetic Materials- Introduction, classification and applications of magnetic materials; Piezoelectricity and applications of Piezoelectric materials; Superconductors and their applications; Nanomaterials - Introduction to nanomaterials, extraordinary properties of nanomaterials, applications and limitations of nanotechnology	6
	<u>Practicum</u> 1. V-I characteristics of p-n junction diode.	30

	2. V-I characteristics of Zener diode. 3. Characteristics of Solar Cell 4. To verify the inverse square law of light using a photo-voltaic cell. 5. To determine value of Boltzmann constant using V-I characteristic of PN diode. 6. To study the effect of intensity of light (by varying distance of the source) on an LDR 7. To verify the characteristics of LASER 8. To measure the numerical aperture of an optical fibre using He-Ne laser source. 9. Study double slit interference by He-Ne laser 10. Determine the diameter of a wire using (He-Ne Laser) diffraction method	
Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.		
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(15 Marks) • Class Participation: 4Marks • Seminar/presentation/assignment/quiz/classstestetc.:4 Marks • Mid-Term Exam:7 Marks ➤ Practicum(5 Marks) • Class Participation:nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 Marks • Mid-Term Exam: Nil	End Term Examination :Marks : 35 Marks :15 Marks	
Part C- Learning Resources		
Recommended Books/e-resources/LMS: 1. Concept of Modern Physics, Arthur Beiser, McGraw Hill Education. 2. Modern Physics (2ndedition), S.L.Kakani and Shubhra Kakani,Viva Books, NewDelhi. 3. Semiconductor Devices-Physics and Technology, S.M.Sze ,Wiley (1985) 4. Laser andNon-linear optics, B.B. Laud,Wiley Eastern Limited (1985) 5. Semiconductor Electronics, A.K.Sharma, New Age International Publisher (1996) 6. Introductory Nuclear Physics, KennethS.Krane , Wiley,NewYork (1988) 7. Radiation detection and measurement, G.F. Knoll, Wiley,NewYork (2000) 8. Crystallography for Solid State Physics, Verma and Srivastava, Wiley,NewYork (1982) 9. Solid State Physics, Rajnikant,Wiley India (2011). 10. Materials Science, J.C. Anderson, KD. Leaver, R.D. Rawlings andJ.M. Alexander,4th Edition, Chapman Hall, London (1990). 11. Materials Science and Engineering, V.Raghavan,3rdEd., Prentice-Hall India,NewDelhi (1993). 12. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, Asia Publishing House (1971) 13. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4Edition,		



Heinemann Educational Publishers (1985)

14. B.Sc. Practical Physics, C.L. Arora, RChand & Co.New Delhi

15. B.Sc. Practical Physics,Harnam Singh and Dr.P.S.Hemne,S Chand &Company Ltd.

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Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:CC-4/MCC-6

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Waves and Optics		
Course Code	24UN-PHY-401		
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 3rd sem (B.Sc. Physical Science/ 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. Learn about Huygens-Fresnel's theory, diffraction at a straight edge and at a circular aperture, diffraction due to a narrow slit and due to a narrow wire. Understand and explain the Fraunhofer diffraction, dispersive power of grating, Rayleigh's criterion and resolving power of telescope & a grating 3. Understand the theories and laws of polarization along with understanding of the production and detection of (i) Plane polarized light (ii)Circularly polarized light and (iii)Elliptically polarized light 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 fibres, their properties and principle of propagation of electromagnetic waves through optical fibres		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5

Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs
PartB-Contents of the Course		
<u>Instructions for Paper-Setter</u> 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. 1. Use of scientific (non-programmable) calculator is allowed.		
Unit	Topics	Contact Hours
I	INTERFERENCE 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	10
II	DIFFRACTION Fresnel's diffraction: Huygens-Fresnel's theory, Fresnel's assumptions, rectilinear propagation of light, diffraction at a straight edge, rectangular slit and diffraction at a circular aperture (Basic idea). Fraunhofer diffraction: Single slit diffraction, double slit diffraction, plane transmission grating spectrum, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of a grating	10
III	POLARIZATION Polarization: Polarisation by reflection, refraction and scattering, Malus Law, Phenomenon of double refraction, Huygens's wave theory of double refraction (Normal and oblique incidence), Analysis of polarized Light. Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light. Optical activity, Polarimeters (Basic idea)	10

IV	Lasers: Basic concept of absorption and emission of radiations, amplification and population inversion; Main components of lasers: (i) Active Medium (ii) Pumping (iii) Optical Resonator; Properties of laser beam, Metastable state, Types of Lasers (He-Ne Laser & Ruby Laser), Applications of Lasers Fibre optics: Optical fibres and their properties, Principal of light propagation through a optical fibre, Acceptance angle and numerical aperture, Types of optical fibres: Single mode and multimode fibres, Advantages and Disadvantages of optical fibers.	10
	Practicum - To determine Refractive index of the material of a prism using sodium source. - Determination of wavelength of sodium light using Newton's Rings. - To determine the dispersive power and Cauchy constants of the material of a prism using Mercury discharge source. - To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source. - Determination of wavelength of sodium light by using a diffraction grating. - Resolving power of a telescope. - Resolving power of a prism. - Resolving power of a grating. - Comparison of Illuminating Powers by a Photometer. - Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter. - Ordinary and extraordinary refractive indices for calcite or quartz. - To find the equivalent focal length of a lens system by nodal slide assembly. Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(20Marks) - Class Participation: 05 Marks - Seminar/presentation/assignment/quiz/classstestetc.: 05 Marks - Mid-Term Exam: 10 Marks ➤ Practicum(10Marks) - Class Participation: Nil - Seminar/Demonstration/Viva-vocce/Lab records etc.: 10Marks - Mid-Term Exam: Nil		End Term Examination :50Marks 20 Marks
Part C- Learning Resources		



Recommended Books/e-resources/LMS:

1. Principles of Optics, M.B. Born and E. Wolf, Pergamon Press
2. Optics, Ajoy Ghatak, Tata McGraw Hill (2008)
3. Fundamentals of Optics, Jenkins and White, McGraw Hill Book Co. Ltd., New Delhi
4. Optics, K.D. Muller, University Science Books, Mill Valley California
5. An Introduction to Interferometry, Tolansky, John Wiley & Sons, New Delhi
6. Polarized Light, Production and Use, Shureliff, Harvard University Press, Cambridge, MA (USA)
7. Lasers and Non-Linear Optics, B.B. Laud, New Age International (P) Ltd., Publishers, New Delhi
8. Lasers, Principles, Types and Applications, K.R. Nambiar, New Age International (P) Ltd., Publishers, New Delhi
9. Laser, Theory & Applications, K. Thyagarajan and A.K. Ghatak, Macmillan India limited
10. A text book of optics, N. Subrahmanyam and Brijlal, S. Chand & Company
11. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
12. Advanced Level Practical Physics, M. Nelkon and Ogborn, Heinemann Education Books Ltd., New Delhi
13. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
14. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
15. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
16. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MCC-7

Session:2024-25	
Part A-Introduction	
Subject	Physics
Semester	4 th
Name of the Course	Introductory Quantum Mechanics
Course Code	24UN-PHY-402
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC
Level of the course(As per Annexure-I)	100-199
Pre-requisite for the course(if any)	Appeared or passed the 3 rd sem(B.Sc. Physical Science(H)/ equivalent)
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and understand the theory of quantum measurements, wave packets and uncertainty principle. 2. Understand the central concepts of quantum mechanics: wave functions, Interpretation of Wave Function, momentum and energy operator, expectation values, the Schrodinger equation, time dependent and time independent cases, probability density, the normalization techniques, Eigen functions, Eigen values and their significance. 3. Understanding the behavior of quantum particle encountering the (i) barrier & ii) potential. 4. Solve Schrodinger equation for ground state energy and wave functions of various simple quantum mechanical one dimensional and three dimensional potentials. 5. Learn to present observations, results, analysis and different concepts related to experiments of Elements of Quantum Mechanics.

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Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time: 3hrs	

Part B-Contents of the Course

Instructions for Paper-Setter

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

Unit	Topics	Contact Hours
I	THE ORIGIN QUANTUM PHYSICS Inadequacies in Classical Physics, Overview of quantum physics, boundary between classical and quantum phenomena, Blackbody Radiation, Planck's Quantum Theory, Photons, Photoelectric effect, Compton effect (theory and result), Frank-Hertz experiment, de-Broglie hypothesis, Davisson and Germer experiment, wave packet, phase velocity, group velocity and their relation, Heisenberg's uncertainty principle, Time energy and angular momentum, position uncertainty. Uncertainty principle from de Broglie wave. (Wave particle duality). Gamma Ray Microscope, Electron diffraction from slit	12
II	THE SCHRODINGER WAVE EQUATION-I Time dependent and time independent Schrodinger equation, dynamical evolution of a quantum state; properties of Wave Function, Interpretation of Wave Function, Condition for physical acceptability of Wave Functions. Eigenvalues and Eigen functions, Mathematical consideration of Schrodinger equation: Normalization, Orthogonality, Observables, Stationary states, Position, Linear momentum & Energy operators; commutator of position and linear momentum operators; Postulates of quantum mechanics, Probability current density, Expectation values of position and linear momentum, Ehrenfest's theorem	11
III	THE SCHRODINGER WAVE EQUATION-II Solution of time dependent Schrodinger equation, Proof of Uncertainty principle (1D wave packet), Gaussian wave packet, Spread of Gaussian wave packet, Fourier analysis and Parseval's formula (main results only),	12

	Fourier integral theorem from Parseval's formula, General forms of Fourier transform, Kronecker delta and Dirac delta functions, Coordinate and momentum representations, Schrodinger equation in momentum representation, Significance of momentum wave functions, Box and Dirac delta normalization, Momentum wave functions for a free particle	
IV	ONE-DIMENSIONAL PROBLEMS Eigen Functions and Eigen values for a Particle in a One Dimensional Box, Potential step: reflectance and transmittance, Penetration of a barrier: reflectance, transmittance and tunnel effect, Application of barrier penetration, Tunnel diode and alpha decay (Qualitative description), One Dimensional Simple Harmonic Oscillator: Energy Levels and Wave Functions. Zero Point Energy	10
	Practicum 1. To find the specific heat of a solid by a method of mixture. 2. To find the specific heat of a liquid (Turpentine oil) by law of cooling. 3. To find coefficient of apparent expansion of glycerin 4. Study of Electron spin resonance-determine magnetic field as a function of the resonance frequency 5. Study of Zeeman effect with external magnetic field; Hyperfine splitting 6. To study the quantum tunneling effect with solid state device, e.g. tunneling current in backward diode or tunnel diode. 7. Determination of Planck's constant using the Photoelectric Effect. 8. Determination of work function using the Photoelectric Effect. 9. To demonstrate the concept of quantization of the energy levels according to the Bohr's model of an atom. 10. Study of excitations of a given atom by Franck Hertz setup. 11. To determine the ionization potential of mercury 12. Study of Arc emission spectrum of given samples (Fe and Cu). 13. Determination of e/m of an electron by Helical method. 14. Determination of e/m of an electron by Thomson method Note: Student will perform atleast six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		



Internal Assessment: ➤ Theory(20Marks) - Class Participation: 05 Marks - Seminar/presentation/assignment/quizz/classtestetc.:05 Marks - Mid-Term Exam:10 Marks ➤ Practicum(10Marks) - Class Participation:Nil - Seminar/Demonstration/Viva-vocce/Labrecordsetc.: 10Marks - Mid-Term Exam: Nil	End Term Examination :50Marks 20 Marks
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Part C-Learning Resources

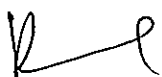
Recommended Books/e-resources/LMS:

1. Quantum Mechanics, Leonard I. Schiff, 3rd Edn 2010, Tata McGraw Hill.
2. A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, 2nd Edn, 2010, McGraw Hill.
3. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, 5th Edition, Macmillan India (2004)
4. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn, 2002, Wiley.
5. Quantum Mechanics, G. Aruldas, 2nd Edn 2002, PHI Learning of India.
6. Quantum Mechanics, B.H. Bransden and C.J. Joachain, Pearson Education, New Delhi.
7. Introductory Quantum Mechanics, David J. Griffiths, 2nd Ed. 2005, Pearson Education.
8. Quantum Physics of Atoms Molecules, Solids, Nuclei and Particles, R.M. Eisberg and R. Resnick, Wiley Eastern Ltd, New Delhi
9. Quantum Mechanics, GR Chatwal and SK Anand, Himalaya Publishing House, New Delhi
10. Quantum Physics (Berkeley Physics Course), E H Wichman, Tata McGraw Hill, Chennai
11. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
12. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
13. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
14. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:MCC-8

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Atomic spectroscopy		
Course Code	24UN-PHY-403		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course(if any)	Appearedorpassedthe3 rd sem(B.Sc.PhysicalScience(H)/ equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Acquire knowledge about the historical background and developments of atomic spectroscopy through the study of spectral series in Hydrogen atom, effect of nuclear motion on line spectra (correction of finite nuclear mass), short comings of Bohr's theory, Wilson sommerfeld quantization rule, Sommerfeld's extension of Bohr's model, Sommerfeld relativistic correction, Short comings of Bohr-Sommerfeld theory and finally Vector atom model 2. Understand and explain the vector atom model, various coupling schemes and atomic spectra of one and two electron atoms 3. Understand the LS & JJ coupling 4. Explain the influence on the spectra of atoms in the presence of external applied electric and magnetic field i.e. Zeeman effect, Paschen-Back effect, Stark effect 5. Learn to present observations, results, analysis and different concepts related to experiments of Elements of Atomic and Molecular Physics.		
Credits	Theory	Practical	Total
	3	1	4



Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70	Time:3hrs		

Part B-Contents of the Course

Instructions for Paper-Setter

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

Unit	Topics	Contact Hours
I	Historical background of atomic spectroscopy: Introduction of early observations, emission and absorption spectra, atomic spectra, wave number, Bohr atomic model (Bohr's postulates), spectra of Hydrogen atom, explanation of spectral series in Hydrogen atom, un-quantized states and continuous spectra, spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass), variation in Rydberg constant due to finite mass, shortcomings of Bohr's theory, Vector atom model; space quantization, electron spin, coupling of orbital and spin angular momentum, spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules.	11
II	Vector atom model (single valance electron): Orbital magnetic dipole moment (Bohr magneton), behavior of magnetic dipole in external magnetic field; Larmor's precession and Larmor's theorem. Penetrating and Non-penetrating orbits, Penetrating orbits on the classical model; Quantum defect, spin orbit interaction energy of the single valance electron. Hydrogen fine spectra, Main features of Alkali Spectra and their theoretical interpretation, term series and limits, Rydberg-Ritz combination principle, Absorption spectra of Alkali atoms, observed doublet fine structure in the spectra of alkali metals and its Interpretation, Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum	12
III	Vector atom model (two valance electron): Essential features of spectra of Alkaline-earth elements, Vector model for two valance electron atom: application of spectra. Coupling Schemes; LS or Russell – Saunders Coupling Scheme and JJ coupling scheme, Interaction energy in L-S coupling (sp, pd configuration), Lande interval rule, Pauli principle and	12

	periodic classification of the elements. Interaction energy in JJ Coupling(sp, pd configuration), equivalent and non-equivalent electrons, Twovalance electron system-spectral terms of non-equivalent and equivalent electrons, comparison of spectral terms in L-S And J-J coupling. Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin	
IV	Atom in external field: Zeeman Effect (normal and Anomalous), Experimental set-up for studying Zeeman effect, Explanation of normal Zeeman effect(classical and quantum mechanical), Explanation of anomalous Zeeman effect(Lande g-factor), Zeeman pattern of D1 and D2 lines of Na-atom, Paschen-Back effect of a single valence electron system. Weak field Stark effect of Hydrogen atom.	10
	<u>Practicum</u> 1. To determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode. 2. To determine the value of Planck's Constant by using four different LEDs. 3. To determine the value of e/m by (a) Magnetic Focussing or (b) Bar Magnet. 4. To determine the wavelengths of Hydrogen spectrum and hence to determine the value of Rydberg's Constant. 5. To determine the Wavelength of H-alpha Emission Line of Hydrogen Atom. 6. To determine the Wavelength and the Angular Spread of a He-Ne Laser. 7. To determine the value of Stefan's Constant. 8. To determine the Wavelength and the Velocity of Ultrasonic Waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the Diffraction of light through an Ultrasonic Grating. 9. To estimate the temperature of Sodium flame by studying the reversal of spectral lines (D lines). 10. To study the characteristics of LASER. Note: Student will perform atleast six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory(20Marks) - Class Participation: 05 Marks - Seminar/presentation/assignment/quiz/classstestetc.:05 Marks - Mid-Term Exam:10 Marks ➤ Practicum(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 (1987), A. Beiser, McGraw Hill Co Ltd. New Delhi
2. Atomic Physics (2007), J.B. Rajam, S Chand & Co, New Delhi
3. Atomic Physics Vol II (1991), J.H. Fewkes and J. Yarwood, Oxford University Press
4. Physics of Atoms and Molecules 2nd Ed (2009), B.H. Bransden and C.J. Joachain, Pearson Education, New Delhi
5. Fundamentals of Molecular Spectroscopy, Colin N. Banwell and Elaine M. McCash, McGraw Hill Co Ltd. New Delhi
6. Atomic and Nuclear Physics Vol I (1996), S.N. Ghoshal, S. Chand & Co., New Delhi
7. Atomic and Nuclear Physics (1982), K. Gopalkrishnan, Macmillan India, New Delhi
8. Elements of Spectroscopy, S.L. Gupta, V. Kumar and R.C. Sharma, Pragati Prakashan, Meerut.
9. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.
10. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
11. Indu Prakash and Ramakrishna, A Text Book of Practical Physics, Kitab Mahal, New Delhi.
12. D.P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
13. Nelson and Jon Ogborn, Practical Physics.



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course:DSE-1

Session:2024-25			
PartA-Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Laser Physics & Fiber Optics		
Course Code	24UN-PHY-404		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course(As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Appeared or passed the 3 rd sem (B.Sc .Physical Science(I)/ equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the basic principle of laser, Einstein's coefficients and their physical significance. Line broadening and its reasons 2. Qualitative understanding of different lasing mechanism, variation of output laser power around threshold and basic idea of oscillating of modes in laser cavity and their roles in propagation 3. Understand about optical fibres and its classification, basic principle involved in propagation of light through optical fibre and its application in communication 4. Have the idea of Fibre materials, Fibre Cables and Fabrication Techniques 5. Understand how and why to use of laser source in performing experiments in laboratory and have the idea how the signal that carries information transmitted through the optical fibre.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5



Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs
Part B-Contents of the Course		
<u>Instructions for Paper-Setter</u> 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	Introduction to Laser: The Einstein Coefficients, Absorption and Emission cross-sections; Light amplification by an atomic system; Threshold condition; Origin of Line Shape function: Lorentzian and Gaussian shape functions; Line Broadening mechanisms - Homogeneous broadening; Natural Broadening, Collision broadening; Inhomogeneous broadening; Doppler Broadening	11
II	Laser Rate Equations: Two Level laser system, Three Level laser system, Four Level Laser Systems (Threshold Population, threshold pump rate, Laser power output with suitable examples), Variation of laser power around threshold; Optimum output coupling. Cavity modes: Number of modes in 1D, 2D and 3D cavities, Mode locking, Q switched lasers and methods of Q-switching	12
III	Optical fibres: Introduction; step index fibre, numerical aperture, pulse dispersion in step index fibre, graded index, material dispersion. Comparison of step and graded index fibres Propagation of light in optical Fibres : Basic structure and optical path of an optical fibre, Modes of propagation, meridional and skew rays, number of modes and cut off parameters of fibres, Single mode propagation. Disadvantage of monomode and graded index multimode fibre	11
IV	Fibre materials & Fabrication Techniques: Glass fibre, plastic fibre, losses of fibres; bending losses, intrinsic fibre losses, scattering losses and absorption losses. Fibre Cables: Fibre cable construction, Strength member, cable tensile loading, Minimum bend radius, Losses incurred during installation of cables or during subscriber service, testing of cables, cable selection criteria. Outside vapour phase oxidation, vapour phase axial deposition, modified chemical vapour deposition	11
	<u>Practicum</u> 1. . To determine wave length and angular divergence of LASER beam 2. Demonstration of Temporal coherence and measurement of	30

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

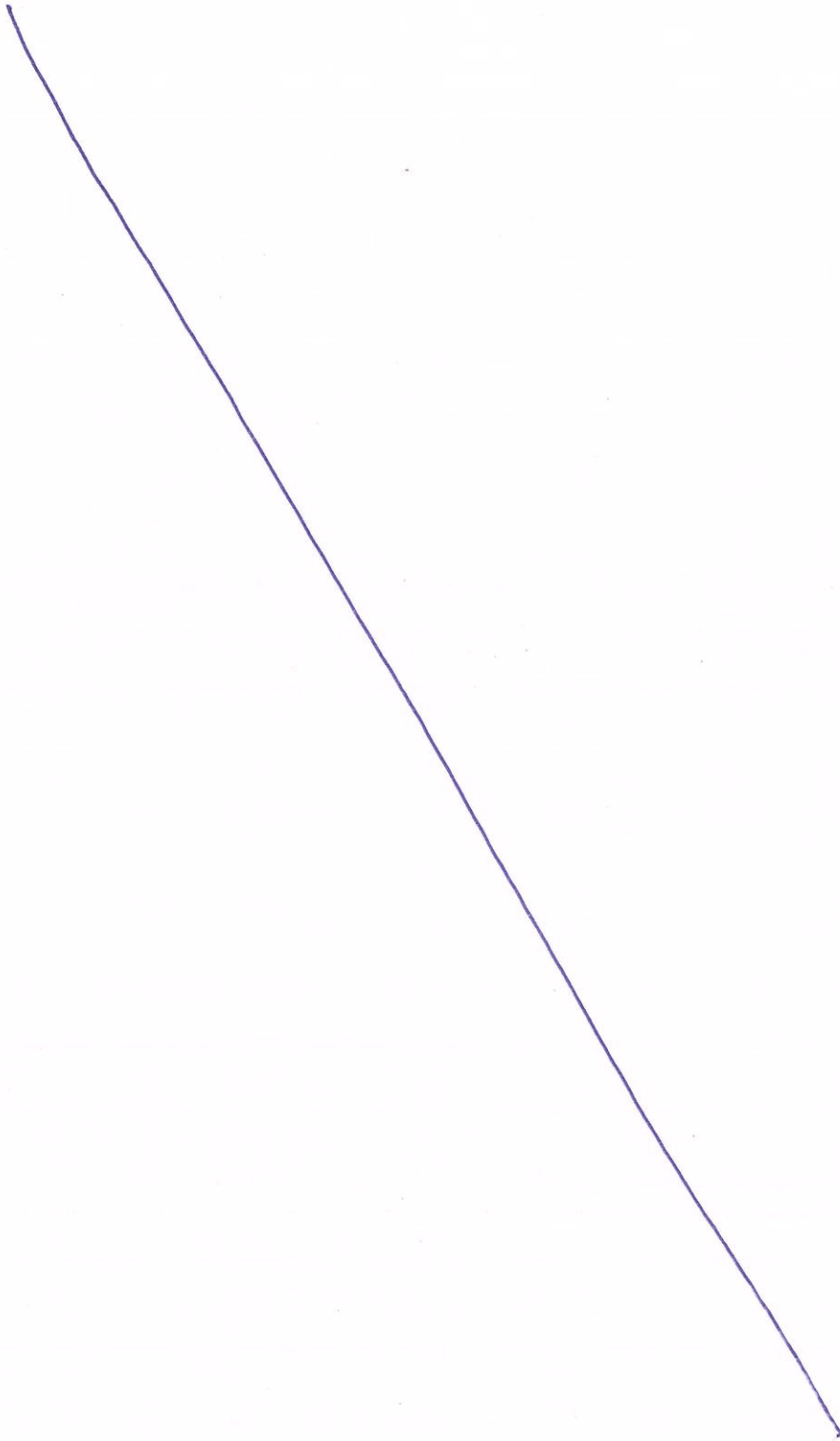
Course: DSE-1

Session:2024-25			
PartA-Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Physics of Nanomaterials		
Course Code	24UN-PHY-405		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	DSE		
	100-199		
Pre-requisite for the course(if any)	Appearedorpassedthe3 rd sem(B.Sc. Physical Science(II)/equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the properties of Nanomaterials/nanostructures 2. Understand the basic Physics of methods for preparation of Nanomaterials/nanostructures. 3. Understand the basic Physics of Characterization & Instrumentation Technique for Nanomaterials/nanostructures. 4. Understand the application and advantages of Nanomaterials 5. Understand the analysis and plotting ofexperimentaldata using various techniques.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs	
Part B-Contents of the Course			

Instructions for Paper-Setter

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

Unit	Topics	Contact Hours
I	Definition, Length scale, Historical background & developments, Richard Feynman Statement, Moore's law, Vision and objective of Nano-technology, Top down and Bottom up approach, Surface to Volume Ratio, Quantum confinement, Size effect in nano system, Quantum dots, Nanowires, Different Allotropes of carbon, Introduction to CNTs, Structure of CNTs, Types of CNTs- SWNTs, MWNTs, Bucky balls (C60), Graphene, Semiconductor Nano particles-types and properties.	10
II	Synthesis methods for Nanomaterials/Nanostructures: Bottom up and top down approaches for synthesis of nanomaterials, Synthesis of zero-dimensional nanostructures (Nanoparticles): Sol-Gel Process, Epitaxial core-shell nanoparticles, Ball milling, Synthesis of One-dimensional nanostructures (Nanowires, Nanorods, Nanotubes): Electrochemical deposition, Lithography, Synthesis of Two-dimensional nanostructures (Thin Films & Quantum wells): Molecular beam epitaxy (MBE), MOCVD, Cluster beam evaporation, Ion beam deposition.	12
III	Characterization & Instrumentation Technique for Nanomaterials/Nanostructures: X-ray Diffraction (XRD): Basic principle and idea of instrumentation, Determination of crystallite/particle size and strain in nanomaterials using Debye Scherer's formula and Williamson-Hall's plot, UV Visible spectroscopy: Basic principle and idea of instrumentation, optical energy band gap, Tauc plot, surface plasmon peaks Photoluminescence (PL) spectroscopy: Basic principle and idea of instrumentation, Shift in PL peaks with particle Size, Determination of alloy composition in thin films of compound semiconductors, Estimation for width of quantum wells, Raman spectroscopy: Basic principle and idea of instrumentation, Variations in Raman spectra of nanomaterials with particle size, Study of Raman spectra of carbon nanotubes and graphene.	13
IV	Applications of Nanomaterials: Importance of nano-scale and technology, Applications of Nanotechnology in different field: Automobiles, Electronics and Devices, Nano-biotechnology, Materials, Medicine, Food, Textiles and Fabrics, Sporting Equipment and Goods, Chemical and Bio sensor, Enhancing Water Quality, Space Science, Improving Air Quality, IT sector, Environmental Remediation, agriculture; Advantages of Nanomaterials	10



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Course: VAC-3

Session: 2023-24			
Part A - Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Indian Astronomy in the 18 th and 19 th Centuries		
Course Code	24UN-PHY-VAC301		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VAC		
Level of the course	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the Classical Astronomy in India and Early astronomical measurements. 2. Understand the Growth and Development of Space and Radio Astronomy in India 3. Understand the Growth of Optical Astronomy in India 4. Understand the Astronomy in ancient, medieval and early telescopic era of India.		
Credits	Theory	Practical	Total
	2	NA	2
Contact Hours	2	NA	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	
Part B- Contents of the Course			
Instructions for Paper- Setter			
1.Nine questions will be set in total. 2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No. 3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.			



Unit	Topics	Contact Hours
I	Classical Astronomy in India- Astronomy of the Vedas, Vedanga Jyotisa, Siddhantas- Famous Astronomers and Their Works, Aryabhata-I (b. 476 AD), Earth's Shape and Rotation, Post-Aryabhata Astronomy, Indian Astronomers and Eclipses, Early astronomical measurements: Measurement of Earth's radius by Eratosthenes; Lunar and solar motion studies by Hipparchus - equinoxes and solstices, lunar and solar eclipses;	8
II	Aryabhata-I and his seminal contributions to astronomy - relative motion, spinning Earth, eclipses, etc.; Varahamihira, Brahmagupta and other Siddhantic astronomers of India; symbiotic relation between mathematics and astronomy; evidence of the precession of equinox from Vedic literature; Jai Singh and his Jantar Mantar Developments of Space Astronomy in India -Satellite Experiments, Astrosat instruments,	7
III	Growth and Development of Radio Astronomy in India - Introduction, Radio Recombination Lines, The Gauribidanur T-array Radio Telescope, The Mauritius Radio Telescope, Pulsar Studies, Observations of Neutral Hydrogen Gas, Millimetre Wave Astronomy, Interplanetary Scintillations, Solar Wind and Solar Studies, Solar Radio Emission and Space Weather, Quasar and Pulsars	7
IV	Growth of Optical Astronomy in India - Birth of the Kodaikanal Observatory, Takhtasinghji Observatory and the Bhavnagar Telescope, Nizamiah Observatory, Post-war Development of Astronomy, Kodaikanal Observatory, The Vainu Bappu Observatory (VBO), Near-Infrared Astronomy, Udaipur Solar Observatory (USO)	8
Suggested Evaluation Methods		
Internal Assessment: > Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/class test etc.: 04 Marks • Mid-Term Exam: 7 Marks		End Term Examination : 35 Marks
Part C-Learning Resources		
Recommended Books/e-resources/LMS: 1. Astronomy in India: A Historical Perspective 2. The Story Of Astronomy In India by Chander Mohan 3. Indian Astronomy-An introduction by S Balachandra Rao Books		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: VAC-3

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Basics of Indian Astronomy		
Course Code	24UN-PHY-VAC302		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VAC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the Astronomy and Astronomical Scales 2. Learn about the Astronomical Instruments, Astronomy in the Internet Age and Citizen Science Initiatives 3. Understand Sun and the solar family & Physics of Galaxies 4. Learn about the Astronomy in ancient, medieval and early telescopic era of India,		
Credits	Theory	Practical	Total
	2	NA	2
Contact Hours	2	NA	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u> 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.

Unit	Topics	Contact Hours
I	Introduction to Astronomy and Astronomical Scales: History of astronomy, wonders of the Universe, overview of the night sky, diurnal and yearly motions of the Sun, size, mass, density and temperature of astronomical objects, basic concepts of positional astronomy: Celestial sphere, Astronomical coordinate systems, Horizon system and Equatorial system	7
II	Astronomical Instruments: Observing through the atmosphere (Scintillation, Seeing, Atmospheric Windows and Extinction). Basic optical definitions for telescopes: Magnification, Light Gathering Power, Limiting magnitude, Resolving Power, Diffraction Limit. Optical telescopes, radio telescopes, Hubble space telescope, James Web space telescope, Fermi Gamma ray space telescope. Astronomy in the Internet Age: Overview of Aladin Sky Atlas, Astrometrica, Sloan Digital Sky Survey, Stellarium, virtual telescope Citizen Science Initiatives: Galaxy Zoo, SETI@Home, RAD@Home India	8
III	Sun and the solar family: Solar parameters, Sun's internal structure, solar photosphere, solar atmosphere, chromosphere, corona, solar activity, origin of the solar system, the nebular model, tidal forces and planetary rings Physics of Galaxies: Basic structure and properties of different types of Galaxies, Nature of rotation of the Milky Way (Differential rotation of the Galaxy), Idea of dark matter	8
IV	Astronomy in India: Astronomy in ancient, medieval and early telescopic era of India, current Indian observatories (Hanle-Indian Astronomical Observatory, Devasthal Observatory, Vainu Bappu Observatory, Mount Abu Infrared Observatory, Gauribidanur Radio Observatory, Giant Metre-wave Radio Telescope, Udaipur Solar Observatory, LIGOIndia) (qualitative discussion), Indian astronomy missions (Astrosat, Aditya).	7
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/class test etc.: 04 Marks • Mid-Term Exam: 7 Marks		End Term Examination : 35 Marks
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. 1. Seven Wonders of the Cosmos, Jayant V Narlikar, Cambridge University Press
2. Fundamental of Astronomy, H. Karttunen et al. Springer
3. Modern Astrophysics, B.W. Carroll and D.A. Ostlie, Addison-Wesley Publishing Co.
4. Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, Saunders College Publishing.
5. The Molecular Universe, A.G.G.M. Tielens (Sections I, II and III), Reviews of Modern Physics, Volume 85, July-September, 2013
6. Astronomy in India: A Historical Perspective, Thanu Padmanabhan, Springer
7. Textbook of Astronomy and Astrophysics with elements of cosmology, V.B.Bhatia, Narosa Publication
8. <https://aladin.u-strasbg.fr/>
9. <http://www.astrometrica.at/>
10. <https://www.sdss.org/>
11. <http://stellarium.org/>
12. <https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/>
13. <https://setiathome.berkeley.edu/>
14. <https://www.radathomeindia.org/>



Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Exploring the Journey of Indian Space Satellites		
Course Code	24UN-PHY-VAC303		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VAC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Learn about the Concept, , ideas and theories of Satellite and Orbits. 2. Elementary understanding of Satellite Systems and their Applications. 3. Get the idea of Indian Communications satellites and their applications and Classification of Satellites. 4. Get knowledge about Milestones in India's Space Programme.		
Credits	Theory	Practical	Total
	2	NA	2
Contact Hours	2	NA	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
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.

Unit	Topics	Contact Hours
I	Concept of Satellite, ideas and theories, Concept of Orbits, The transfer orbit, hurdles in launching a satellite, space scarcity in space. Indian space program, Objectives of the Indian Space Program, Organizational set-up.	7
II	Communication Satellite: Orbit and Description: A brief History of Satellite Communication, Satellite Frequency bands, Satellite Systems, Applications, Orbital Period and Velocity, Effects of Orbital inclination, Azimuth and Elevation, Coverage and Slant range, Eclipse, Orbital perturbations, Placement of a Satellite in a Geo-Stationary Orbit	8
III	Space Centres and institutes, Genesis of Indian's space program, Indian Satellites, Indian Communications satellites and their applications. Classification of Satellites based on Orbit Height. Indian remote sensing satellites, Indian National Satellites	8
IV	Launch vehicle technology, Milestones in India's Space Programme.	7

Suggested Evaluation Methods

Internal Assessment:

➤ Theory (15 Marks)

- Class Participation: 4 Marks
- Seminar/presentation/assignment/quiz/class test etc.: 04 Marks
- Mid-Term Exam: 7 Marks

End Term Examination : 35 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. <https://www.indiascience.in/videos/isro-indias-space-journey-e-2>
2. <https://www.indiascience.in/videos/isro-indias-space-journey-part-2-e-1>
3. <https://www.insightsonindia.com/science-technology/space-technology/milestones-in-indias-space-programme/>
4. <https://www.clearias.com/indian-space-program/>
5. SCIENCE 366: A Chronicle of Science and Technology, Basu Biman
6. Science and technology, Praveen Chandra Mishra, Chronicle Books

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: VAC-4

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Physics in Everyday Life		
Course Code	24UN-PHY-VAC401		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VAC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Elementary understanding of the mechanical concepts and application in daily life related to Force, weight, work, energy, power. 2. Get the idea of working of refrigerator, air conditioner, Bernoulli principle, pressure cooker.in various engines. 3. Learn about the daily life activities related to sound and optics. 4. Basic understanding some electrical and electronic appliances		
Credits	Theory	Practical	Total
	2	NA	2
Contact Hours	2	NA	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
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.

Unit	Topics	Contact Hours
I	MECHANICS Every day activities related to Force, weight, work, energy, power and centrifuge; washing machine.	7
II	HEAT Variation of boiling point with pressure, pressure cooker, cooling by expansion, refrigerator, air conditioner, Bernoulli principle – Bunsen burner, aeroplane	8
III	SOUND AND OPTICS Sound waves, Doppler Effect, power of lens, long sight and short sight, microscope, telescope, binocular camera, video camera.	8
IV	ELECTRICAL AND ELECTRONIC APPLIANCES Working of the tube light and fan, kilowatt hour, fuse and heating elements, microwave oven, electric heater, photoelectric effect.	7

Suggested Evaluation Methods

Internal Assessment: Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/class test etc.: 04 Marks • Mid-Term Exam: 7 Marks	End Term Examination : 35 Marks
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. R. Murugesan, Allied Physics I & II, S. Chand & Co, New Delhi (2006).
2. D.S. Mathur, Elements of properties of matter and acoustics, S. Chand & Company Ltd., New Delhi (2010)
3. R. Murugesan, Properties of matter and acoustics, S. Chand & Co, New Delhi (2012)
4. Brijal & Dr. N. Subramanyan and P.S. Hemne, Heat and Thermodynamics, S. Chand & Co, New Delhi, (2004)
5. R. Murugesan, Electricity, S. Chand & Co, New Delhi (2010)
6. R. Murugesan and Kiruthiga Sivaprasath, Modern Physics, S. Chand & Co, New Delhi (2016)
7. N. Subramaniam, Brijlal and M.N. Avadhanulu, A textbook of Optics S. Chand & Co, New Delhi (2012)

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Course: VAC-4

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Radiations and its Hazards in Daily Life		
Course Code	24UN-PHY-VAC402		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VAC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understanding of the sources of Radiation exposure Realize the importance of radiation protection and safe disposal of radioactive 2. Get the idea of Basics of Radiation detectors. 3. Learn about Hidden hazards of various radiation sources in the daily life. 4. Basic understanding of Cares against Hidden hazards of radiations.		
Credits	Theory	Practical	Total
	2	NA	2
Contact Hours	2	NA	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u> 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.			

Unit	Topics	Contact Hours
I	Radiation and need for its measurement, Physical features of radiation, Conventional sources of radiations. Exposure to natural radiation: external to the body, Radiation from cosmic rays and solar radiation, Internal exposure to the body, Radioactivity arising from technological development: Possible health hazards from nuclear and laser radiations. Maximum permissible level of radiation. Radiation quantities and units of energy flux, energy influence, cross-section.	7
II	Biological effects of radiation: Dose response characteristics, Direct and indirect action, Acute effects, Delayed effects, Cumulative effect, Accidental exposure, Radiation induced chemical changes in tissues, Radiation protection procedures (diagnostics and therapy). Radioactive waste disposal and management: Type of radioactive waste, Airborne waste, Solid and liquid waste, Assessment of Hazard.	8
III	Hidden hazards of Non-Thermal Radiation, RF and microwave radiation, Non-Thermal Effects of Pulsed RF EMR, Power Line 50/60 Hz Electric and Magnetic Fields (EMFs), Airport Scanners, Occupational Exposure, Electricity, Non-Thermal Radiation, Cell phones, Cell Phone Towers, Wi-Fi, Smart meters, microwave oven.	8
IV	Basic radiation safety criteria, Protection from direct radiation, Energy deposition, Effect of distance and shielding, Protection from contamination, Preparation of a safe radiation area, Basic Cares against Hidden hazards, Exposure Controls, Designing of labs to reduce radiation hazards.	7
Suggested Evaluation Methods		
Internal Assessment: > Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/class test etc.: 04 Marks • Mid-Term Exam: 7 Marks		End Term Examination : 35 Marks
Part C-Learning Resources		
Recommended Books/e-resources/LMS: 1. RF and Microwave Radiation Safety Handbook by Ronald Kitchen 2. Hidden Dangers 5G By Captain Jerry G. Flynn 3. Health Physics: Radiation-Generating Devices, Characteristics, and Hazards by Joseph John Bevelacqua 4. Basics of Radiation Protection for Everyday Use by Leonie Munro 5. Radiation Safety Officer's Handbook by Gunhild von Oertzen and Detlof von Oertzen 6. Physics for Radiation Protection: A Handbook (Second Edition) by James E. Martin 7. Atoms, Radiation, and Radiation Protection (3rd edition) James E. Turner 8. Radiation Protection: A guide for Scientists, Regulators and Physicians (4th Edition) by Jacob Shapiro 9. Introduction to Radiobiology and Radiation Dosimetry - F.H. Aurix, John Wiley. 10. Techniques of Radiation Dosimetry - Eds K. Mahesh and DR Vij Wiley Eastern Limited. 11. Nuclear Energy - Raymond L. Murray Pergamon Press, N.Y.		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: VOC-2

Session: 2024-25

Part A - Introduction

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Refrigeration and Air Conditioning		
Course Code	24UN-PHY-VOC401		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199.		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Learn about the factors contributing to food spoilage, causes of food spoilage, methods of food preservation 2. Learn about the Commercial Applications of air-conditioning 3. Understand the principles of ice production, different methods of ice manufacturing 4. Learn about the Industrial Applications of air-conditioning		
Credits	Theory	Practical	Total
	2	NA	2
Contact Hours	2	NA	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	
Part B- Contents of the Course			
Instructions for Paper- Setter			
1.Nine questions will be set in total.			



2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	Food Preservation: Introduction, factors contributing to food spoilage, causes of food spoilage, methods of food preservation, freezing method of food preservation, preservation of food with direct contact of liquid N ₂ , freeze drying, preservation of different products, cold storage and commercial cabinets	8
II	Commercial Applications: Introduction, air-conditioning of houses, offices, hotels and restaurants, air-conditioning of departmental stores, air-conditioning of theatres and auditoriums, hospitals and medical applications	7
III	Ice-Manufacturing: Introduction, principles of ice production, different methods of ice manufacturing, treatment of water for making ice, brines, freezing tanks, ice cans, quality of ice	7
IV	Industrial Applications: Introduction, importance of RH in different industries, ice-cream manufacturing, refrigeration for breweries, selection of refrigerant for breweries, use of liquid N ₂ for fabric, quality, air conditioning in textile and photographic industries	8
	Practicum 1. Measurement of temperature using Thermocouples in preserved samples. 2. To perform Insulation effectiveness test using thermocol/foam boxes and thermometers. 3. To Steady various method of food preservation. 4. To Measure relative Humidity using Psy chrometer or hygrometer. 5. To study cold storage and commercial cabinates. 6. To study the effect of brine on depression of freezing point. 7. To compare the ice quality using tap vs Distilled water (observation on clarity, melting rate etc.). 8. To study energy consumption analysis of cooling devices (Refrigerator / Ac) etc. 9. To study water purification method using simple filtration. 10. To study PH of various water samples using PH meter. 11. To study the TDS level of various water samples using TDS meter. 12. To study water purification method by the using UV radiations. Note: Student will perform at least eight experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		



Internal Assessment: ➤ Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/class test etc.: 4 Marks • Mid-Term Exam: 7 marks	End Term Examination : 35 Marks
Part C-Learning Resources	
Recommended Books/e-resources/LMS: 1.Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House 2.Refrigeration and Air Conditioning by C.P.Arora, McGraw Hill education (India) (P) limited, New Delhi 3.Principles of Refrigeration by Roy J. Dossat, Pearson education, New Delhi 4.Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi 5.Course in Refrigeration and Air Conditioning by S.C.Arora and S.Domkundwar, Dhanpatrai and sons, Delhi	



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Course: VOC-2

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	4 th		
Name of the Course	Maintenance of Laboratory Instruments		
Course Code	24UN-PHY-VOC402		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the SOP related to Physics Laboratory. 2. Understand the Maintenance of Electronics experiment 3. Understand the Maintenance of mechanics experiments 4. Understand the Maintenance of optics experiments		
Credits	Theory	Practical	Total
	2	NA	2
Contact Hours	2	NA	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35		Time:3hrs	
Part B- Contents of the Course			
Instructions for Paper- Setter			
1.Nine questions will be set in total. 2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No. 3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.			

Unit	Topics	Contact Hours
I	Standard Operating Procedure for Maintenance of Lab Equipment, safety rules and policies, culture of laboratory safety, responsibility and accountability for laboratory safety, special safety considerations in Physics Lab, other factors that influence laboratory safety programs,	7
II	Equipment Maintenance Documentation, Maintenance of Electronics experiment, Symbols, Terminal identification & List applications of various semiconductor devices- Diodes, Transistors, SCR, UJT etc. Introduction to voltage regulator, List types of regulators, CRO, GM Counter.	8
III	Maintenance of mechanics experiments, Basic Terms related to experiments of Mechanics,	8
IV	Maintenance of optics experiments, Basic Terms related to experiments of optics. Circuit designing and testing.	7
	<u>Practicum</u> 1. To study proper connection techniques, zero error checks, handling knobs and terminals using voltmeter, ammeter, rheostat to verify Ohm's Law. 2. To study zero adjustment, proper reading alignment, cleaning the jaws using vernier caliper. 3. To study backlash error using ratchet, checking zero error using screw gauge. 4. To study battery check, probe condition, dial setting and safe usage of digital multimeter. 5. To identify the faults in connection, proper field maintenance using ammeter, voltmeter, connecting wires, breadboard. 6. To study the alignment checking, handling lenses safely, dust protection using optical bench, lens, screen. 7. To learn the prevention of mercury/alcohol spillage, safe heating, cleaning probes of and Thermometer and temperature sensors 8. To study battery replacement, button cell care, accuracy checking of stop watches and timers. 9. To study probe handling, CRT care, avoiding exposure to high voltage using CRO. 10. To study the capacitor safety, handling polarity, checking capacitance of capacitors using RC circuit. 11. To identify and use of fire extinguisher, safety gloves, lab coats etc. 12. To learn cable care, avoiding overloading, dial setting skills using function generator. Note: Student will perform at least eight experiments. The examiner will allot one practical at the time of end term examination.	30

Suggested Evaluation Methods	
Internal Assessment: > Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/class test etc.: 4Marks • Mid-Term Exam: 7 Marks	End Term Examination : 35 Marks
Part C-Learning Resources	
Recommended Books/e-resources/LMS: 1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi 2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi 3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi 4. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut 5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar 6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House	

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: SEC-3

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3 rd		
Name of the Course	Radiation Safety		
Course Code	24UN-PHY- SEC301		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	SEC		
Level of the course(As per Annexure-I)	100-199		
Pre-requisite for the course(if any)	Appeared or passed the 2 nd sem. (B.Sc. Physical Science)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Have introductory idea about Basic concept of atomic structure and composition of nucleus and its properties. 2. Have the knowledge about the types of Radiation: Alpha, Beta, Gamma and Neutron and their sources. 3. Understand importance of radio isotopes, Nuclear fission and fusion reactions and their hazardous aspects 4. Have the knowledge about the importance of some scientifically and technologically advanced materials. 5. Learn to present observations, results, analysis and different concepts related to experiments nuclear and radiation physics.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4
Max. Marks:70 Internal Assessment Marks:20 End Term Exam Marks: 50		Time:3 hours	



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	Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.	8
II	Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), Interaction of Neutrons- Collision, slowing down and Moderation	8
III	Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose. Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, and Gieger Muller Counter), Scintillation Detectors.	7
IV	Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, Application of nuclear techniques: Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. Industrial Uses: Tracing, Gauging, Material Modification, Sterization, Food preservation.	7

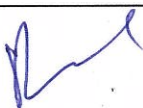
	<u>Practicum</u> 1. Study the background radiation levels using Radiation meter. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source). 2. Study of counting statistics using background radiation using GM counter. 3. Study of radiation in various materials (e.g. KSO₄ etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage. 4. Study of absorption of beta particles in Aluminum using GM counter. 5. Detection of a particles using reference source & determining its half life using spark counter 6. Gamma spectrum of Gas Light mantle (Source of Thorium) 7. Characteristics of Geiger Muller (GM) Counter: Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	30
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Suggested Evaluation Methods		
Internal Assessment: • Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/classstestetc.:4 Marks • Mid-Term Exam:7 Marks • Practicum (5 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 Marks • Mid-Term Exam: Nil		End Term Examination Marks : 35 Marks :15 Marks
Part C-Learning Resources		
Recommended Books/e-resources/LMS: 1. W.E. Burcham and M. Jobes- Nuclear and Particle Physics - Longman (1995) 2. G.F.Knoll, Radiation detection and measurements 3. Thermo luninescence Dosimetry, Mcknlly, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5) 4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". JohnWright and Sons, UK, 1989. 5. J.R. Greening, "Fundamentals of Radiation Dosimetry", Medical Physics HandBook Series, No.6, Adam Hilger I.td., Bristol 1981. 6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowentaland P.L. Airey, Cambridge University Press, U.K., 2001 7. W.R. Hendee, "MedRadiation Physics", Year Book-Medical Publishers Inc. London, 1981		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: CC-5/MCC-9

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	5 th		
Name of the Course	Modern Physics		
Course Code	24UN-PHY-501		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC/MCC		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 4 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the need for Quantum Mechanics, Heisenberg's uncertainty principle, time dependent and time independent Schrodinger equation, expectation values of position and momentum, particle confined in one dimensional box. 2. Familiar about the crystalline state, basis, crystal lattices, Reciprocal lattice to sc, bcc and fcc lattices. 3. Analyze the Hydrogen atom problem based on Sommerfeld theory, Vector Atom Model, LS&JJ coupling. 4. Familiar about various Nuclear Models, Magic Numbers, Classification of fundamental particles and Strange particles. 5. Learn to present observations, results, analysis and different concepts related to experiments of Quantum Mechanics and Solid State physics.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5



Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs
Part B-Contents of the Course		
<u>Instructions for Paper- Setter</u> 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	Foundations of Quantum Mechanics & Wave-Particle Duality: Need of Quantum Mechanics, Planck's quantum hypothesis and radiation formula, quantization of EM radiation and photoelectric effect, Compton effect, de-Broglie hypothesis, de-Broglie wave, wave packet, phase and group velocities, Heisenberg's Uncertainty Principle and its applications.	11
II	Wave Mechanics & Quantum Operators Time-dependent and time-independent Schrödinger equations, Properties of wave function, Probability current density, linear momentum and energy operators, commutator of position and linear momentum operator, expectation values of position and linear momentum, particle confined in a one-dimensional infinite box: energy eigen functions and eigenvalues	11
III	Solid State Physics: Crystalline state, crystal lattice, basis, lattice translation vectors, primitive and non-primitive unit cells, symmetry operations, Bravais lattices in two and three dimensions, Miller Indices, crystallographic planes, inter-planar spacing, simple crystal structures: NaCl, CsCl, HCP and Diamond. Introduction only: Bragg's law, Idea of Reciprocal Lattice and non-crystalline solids.	11
IV	Atomic Physics: Sommerfeld theory and relativistic corrections, Fine structure of H-alpha line, Vector Atom Model (electron spin and space quantization), Spin-orbit interaction energy, LS and jj coupling schemes, Spectral terms for non-equivalent electrons, Anomalous Zeeman effect, Landé's g-factor, Splitting of Sodium D1 and D2 lines	12

<u>Practicum</u> 1. To determine Planck's constant using a photocell. 2. To determine the specific charge (e/m) of an electron by Thomson's method. 3. To determine the ionization potential of mercury. 4. To study quantization of energy using the Frank-Hertz experiment. 5. To determine the wavelength of a laser source using Young's double-slit diffraction. 6. To determine the diameter of a thin wire using laser diffraction. 7. To study the variation of resistivity with temperature of a semiconductor using the four-probe method. 8. To determine the unknown capacitance of a capacitor using De-Sauty's bridge. 9. To determine the energy band gap of a semiconductor using the temperature dependence of the reverse saturation current of a p-n junction diode. 10. To analyze crystal structure and determine lattice parameters using powder X-ray diffraction (XRD) data (experimental or simulated). Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods	
Internal Assessment: ➤ Theory (20 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks ➤ Practicum (10 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil	End Term Examination : 50 Marks : 20 Marks
PartC-Learning Resources	

Recommended Books/e-resources/LMS:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
2. Modern Physics, R.A. Serway, C.J. Moses, and C.A. Moyer, 2005, Pearson publishing
3. Quantum Mechanics: Theory and Applications by Ajoy Ghatak and S. Lokanathan (2019), (Extensively revised 6th Edition), Laxmi Publications, New Delhi
4. Quantum Mechanics by Ishwar Singh Tyagi, Pearson publication
5. Introduction to solid state physics by C. Kittel, Wiley India
6. Solid state physics by H C Gupta, Vikas publishing house Ltd, New Delhi
7. Solid state physics by Puri & Babber, S. Chand & company, New Delhi
8. Atomic and Nuclear Physics by N. Subrahmanyam, S. Chand & company
9. Atomic & Molecular spectra by Raj Kumar, Kedar Nath Ram Nath, Meerut
10. Elements of Spectroscopy, S.L. Gupta, V. Kumar and R.C. Sharma, Pragati Prakashan, Meerut.
11. Atomic and Nuclear Physics by S.N. Ghoshal, Vol I (1996), S. Chand & Com., New Delhi
12. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
13. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MCC-10

Session: 2024-25

Part A - Introduction			
Subject	Physics		
Semester	5 th		
Name of the Course	Nuclear Physics		
Course Code	24UN-PHY-502		
Course Type: (CC/MCC/MDC/CC-M/ DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 4 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the Nuclear structure and general properties of nuclei. Determination of Nuclear size, mass and charge. Nuclear binding energy and nuclear stability. 2. Familiar about the different types of nuclear radiation decay and their energetic. What are the processes involved during the interaction of radiations with matter. 3. Understand the principle, construction, working and applications of different nuclear accelerators. Nuclear radiation detector; Types, Principle, construction and working involved to detect the nuclear radiations. 4. Acquire knowledge of different types of nuclear reaction, conservation laws and energetic of nuclear reaction. Nuclear reactor; design, classification and uses. 5. Learn to present observations, results, analysis and different concepts related to experiments of Nuclear Physics.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5

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

Time:3hrs

Part B-Contents of the Course

Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Nuclear structure and general Properties of Nuclei: Constituents of Nucleus; Nuclear composition (p-n and p-n hypotheses), Nuclear properties; Nuclear size, spin, parity, statistics, magnetic dipole moment, Electric quadrupole moment (shape concept). Nuclear mass and its determination by Bain-Bridge, Bain-Bridge and Jordan mass spectrograph. Nuclear charge and its determination by Moseley Law. Determination of size of nucleus by Rutherford Back Scattering. Binding energy, Average binding energy and its variation with mass number, main features of binding energy versus mass number curve, systematic of nuclear binding energy, nuclear stability, stability region.	10
II	Nuclear Radiation decay Processes: (a) α -decay: Basics of α -decay process and quantum mechanical explanation of α -decay. Energetics of α -decay, (b) β -decay: β^- -decay, β^+ -decay, electron capture decay, β -energy spectrum, end point energy; Origin of continuous beta spectrum (neutrino hypothesis) and energetics of beta-decay. (c) γ -decay; γ -rays emission and energetics of γ -rays. Nuclear Radiation Interaction: Interaction of heavy charged particles (α - particles); Energy loss of heavy charged particle (idea of Bethe formula, no derivation), Range and straggling of α -particles. Geiger-Nuttall law. Interaction of light charged particle (β -particle), Energy loss of β -particles (ionization), Range of electrons, absorption of β -particles. Interaction of γ -Ray; Passage of γ -radiations through matter (Photoelectric, Compton and pair production effect) electron-positron annihilation. Absorption of γ -rays (Mass attenuation coefficient) and its application.	12
III	Nuclear Accelerators: Linear accelerators: Principle, construction, theory, working and types. Tandem accelerator; Principle, construction, working, advantages and limitations. Cyclotron: Principle, construction, theory, working and its limitations. Betatron: condition, Principle, construction,	11

	theory, working and comparison with a transformer. Nuclear Radiation Detectors: Gas filled detectors; Ionization chamber, proportional counter, G.M. Counter (detailed study), Basic principle of organic and inorganic Scintillation detectors for γ and electron radiation, photomultiplier tube and Semiconductor Detector (Basic idea).	
IV	Nuclear Reactions: Nuclear reactions, Elastic and Inelastic scattering, Nuclear disintegration, photonuclear reaction, radiative capture, direct reaction, heavy ion reactions and spallation reactions, conservation laws, Q-value and reaction threshold. Nuclear Reactors: Nuclear Reactors, General aspects of reactor design. Nuclear fission and fusion reactors, (Principle, construction, working and applications).	11
	Practicum 1. Determination of Characteristics of GM tube and its operating voltage, plateau length and slop. 2. Verification of inverse square law of radiation for a gamma source. 3. Investigation of statistical nature of nuclear radiation using G. M. Counter. 4. To study the beta counting efficiency of G. M. Counter. 5. Investigation of variation of Linear Absorption Coefficient of beta rays using a GM counter. 6. To study the half-life of radioactive element using G. M. Counter. 7. Resolving time of G. M. Counter set-up. 8. To study the characteristics of Ionization Chamber. Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory (20 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks ➤ Practicum (10 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil		End Term Examination : 50 Marks : 20 Marks
PartC-Learning Resources		

Recommended Books/e-resources/LMS:

1. Kaplan I, Nuclear Physics, 2nd Ed (1962), Oxford and IBH, New Delhi
2. Sriram K, Nuclear Measurement Techniques, (1986), AEWP, New Delhi
3. Tayal D C, Nuclear Physics (1994), IHPH, Bombay
4. Ghoshal S N, Atomic and Nuclear Physics Vol II (1994), S Chand & Co New Delhi
5. Srivastava B N, Basic Nuclear Physics, (1993), Pragati Prakashan Meerut
6. Halliday, Introductory Nuclear Physics, Asia Publishing House, New Delhi
7. Sood D D, Reddy A V R and Ramamoorthy, Fundamentals of Radiochemistry, IANCAS (2007), BARC, Bombay
8. Cohen B L, Concepts of Nuclear Physics (1998), Tata Mc Graw Hill, New Delhi
9. Krane K S, Introductory Nuclear Physics (1988), John Wiley & Sons New Delhi
10. Patel S B, Nuclear Physics (1992), Wiley Eastern Ltd, New Delhi
11. Roy R R and Nigam B P, Nuclear Physics (1993), Wiley Eastern Ltd New Delhi.
12. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
13. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs
Course: DSE-2

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	5 th		
Name of the Course	Environmental Physics		
Course Code	24UN-PHY-503		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 4 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Exhibit the knowledge of Basic atmospheric physics and Atmospheric thermodynamics. 2. Learn about the Environmental physics, Human environment, Air regulation in buildings, Thermal conduction effects. 3. Understand the Scope of Environmental Physics. 4. Learn about the Transport of Heat, Mass and Momentum and Radiant Energy.		
Credits	Theory	Practicum	Total
	3	1	4
Contact Hours	3	2	5
Max.Marks: 100 Internal Assessment Marks: 30 End Term Exam Marks: 70		Time:3 hrs	
Part B-Contents of the Course			
<u>Instructions for Paper-Setter</u> 1. Nine questions will be set in total. 2. Question No. 1 will be compulsory and shall be based on the conceptual aspects of the entire syllabus..			



This question may have four parts, and the answers should be brief but not limited to 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.

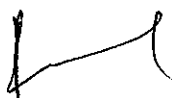
Unit	Topics	Contact Hours
I	Basic atmospheric physics: Introduction to the Atmosphere, Composition and Structure: Description of Air, Stratification of Mass, Thermal and Dynamical Structure, Trace Constituent. Concept of Albedo, solar constant, Heat budget of the earth atmospheric system. Atmospheric thermodynamics: Air (excluding and including water), Water paths, Ideal gas law, Atmospheric composition, Hydrostatic balance, Constant vertical gradient of temperature, Conservation of energy (dry case, moist case), Entropy and potential temperature, Parcel concepts, lapse rate (dry and moist adiabatic), tephigram, Cloud formation.	12
II	Human environment: Introduction, Laws of Thermodynamics, Energy and metabolism, Thermodynamics laws and the human body, Second Law of Thermodynamics and the Gibbs free energy, Conduction, Convection, Radiation, Evaporation, Energy budget equation, Survival in the cold, Thermal comfort and insulation, Boundary layer, Wind chill, Hypothermia, Survival in hot climates, Effect of heat on the human body. Built Environment: Introduction, Thermal regulation in buildings, Thermal insulation, Thermal conduction effects, Convection effects, Radiation effects, U-values, Energy use in buildings, Air regulation in buildings, Ventilation requirements, Ventilation installations, Heat pumps, Water vapour, Humidity, Condensation in buildings.	13
III	Scope of Environmental Physics: Properties of Gases and Liquids-Gases and Water Vapor, Hydrostatic Equation, First Law of Thermodynamics, and Specific Heats, Latent Heat, Potential Temperature, Water Vapor and its Specification, Vapor Pressure, Dew-Point Temperature, Saturation Vapor Pressure Deficit, Mixing Ratio, Specific and Absolute Humidity, Virtual Temperature, Relative Humidity, Wet-Bulb Temperature. Liquid-Water Content and Potential, Liquid-Air Interfaces, Stable Isotopes.	10
IV	Transport of Heat, Mass, and Momentum: Transfer Equation, Molecular Transfer Processes, Momentum and Viscosity, Heat and Thermal Conductivity, Mass Transfer and Diffusivity, Diffusion Coefficients, Diffusion of Particles. Transport of Radiant Energy: Origin and Nature of Radiation; Absorption and Emission of Radiation; Full (Black Body) Radiation; Wien's Law; Stefan's Law; Planck's Law; Quantum Unit; Radiative Transport.	10
	Practicum 1. Measurement of relative humidity using wet and dry bulb thermometer.	30

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Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: DSE-2

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	5 th		
Name of the Course	Non-Linear Dynamics		
Course Code	24UN-PHY-504		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 4 th sem (B.Sc. Physical Science or equivalent)		
Course Learning Outcomes(CI.O):	After completing this course, the learner will be able to: 1. Understand the concept of dynamical systems. 2. Learn the concept of integrability and non-integrability of dynamical systems. 3. Understand the nonlinear Schrodinger equations, solitons and their solutions. 4. Learn the basic concepts of fluids, flow phenomenon and their dynamics.		
Credits	Theory	Practical	Total
	4	-	4
Contact Hours	4	-	4
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs	
Part B-Contents of the Course			
Instructions for Paper- Setter			
1. Nine questions will be set in total. 2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No. 3. Four more questions are to be attempted, selecting one question out of two questions set			



from each unit. Each question may contain two or more parts. All questions will carry equal marks.

4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	Introduction to Nonlinearity: Dynamical systems: Linear and nonlinear forces, Mathematical implications of nonlinearity, linear and nonlinear systems, linear superposition principle, definition of nonlinearity and its effects, Definition of a continuous first order dynamical system. The idea of phase space, flows and trajectories. Concept of stability and un-stability. Simple mechanical systems as first order dynamical systems: simple and damped harmonic oscillators	15
II	Integrability: Integrable and non-integrable dynamical systems, notion of integrability, complex integrability, symmetries and integrability: invariance condition, first integral of motion and its types, applications, A direct method to find first integral of motion	15
III	Partial different equations & Solitons: Linear and nonlinear differential equations, diffusive and dispersive; boundary value problems; methods of separation of variables, characteristics; inverse scattering; symbolic computation; similarity and Backlund transformations. Soliton theory: periodic, conoidal and solitary wave solutions of Korteweg-de Vries, Nonlinear Schrodinger and sine-Gordon equations; conserved densities.	15
IV	Elementary Fluid Dynamics: Importance of fluids: Fluids in the pure sciences, fluids in technology. Study of fluids: Theoretical approach, experimental fluid dynamics, computational fluid dynamics. Basic physics of fluids: The continuum hypothesis-concept of fluid element or fluid parcel; Definition of a fluid- shear stress; Fluid properties:-viscosity, thermal conductivity, mass diffusivity, other fluid properties and equation of state; Flow phenomena- flow dimensionality, steady and unsteady flows, uniform and nonuniform flows, viscous and inviscous flows, incompressible and compressible flows, laminar and turbulent flows, rotational and irrotational flows, separated and unseparated flows.	15
Suggested Evaluation Methods		
Internal Assessment: > Theory (30 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 10 Marks Mid-Term Exam: 15 Marks		End Term Examination 70 Marks

PartC-Learning Resources

Recommended Books/e-resources/LMS:

1. Nonlinear Dynamics: Integrability, Chaos and Pattern, M. Lakshmanan & S. Rajasekar, Springer
2. Nonlinear Dynamics and Chaos, Steven H. Strogatz, Levant Books, Kolkata, 2007
3. Understanding Nonlinear Dynamics, Daniel Kaplan and Leon Glass, Springer.
4. An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge Univ. Press, 2002
5. Classical and Quantum Mechanics of Noncentral Potentials: A survey of two-dimensional systems, R. S. Kaushal, Narosa Publishing House, New Delhi, 1998
6. Elementary Fluid Mechanics, Tsutomu Kambe (World Scientific, 2007)



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

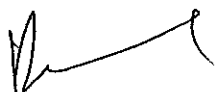
Course: DSE-3

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	5th		
Name of the Course	Instrumentation and Analytical Methods		
Course Code	24UN-PHY-505		
Course Type: (CC/MCC/MDC/CC-M/ DSEC /VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 4thsem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Have knowledge about the errors in measurements. 2. Understand the basic instrumentation of electrical and electronic measurements. 3. Understand the principles and working of basic analytical instruments – CRO, frequency signal generator and pulse generators, 4. Have awareness about the spectroscopic instruments.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time: 3hrs	
Part B-Contents of the Course			
Instructions for Paper- Setter			
1. Nine questions will be set in total. 2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus.			



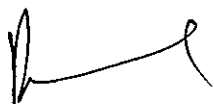
- This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
 4. 20% numerical problems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

Unit	Topics	Contact Hours
I	Errors in measurement-Gross errors and systematic errors, absolute errors and relative errors; Measurement error combinations-Sum of errors, difference of errors, product of errors, quotient of quantities and quantity raised to a power. Statistical analysis of errors: Arithmetic Mean value, deviation, standard deviation of mean, least square fitting, normal distribution, covariance and correlation, Binomial distribution, Poisson distribution and Chi square test.	11
II	Electrical instrumentation: AC bridges-Measurements of inductance by Maxwell's bridge, Measurement of capacitance and high resistance by De Sauty's bridge, measurement of mutual inductance by Carry Foster bridge Signal generators: Block diagram, explanation of low frequency signal generator, pulse generator and function generator	10
III	Display devices: Cathode Ray Oscilloscope: Block diagram of general purpose oscilloscope and its basic operation, Construction of CRT, electron gun, Electrostatic focusing and deflection, screen for CRT, Dual trace oscilloscopes, Front panel controls, Measurement of voltage, frequency and phase; Pulse measurements-Pulse amplitude, pulse width and space width; Display of device characteristics; Time based measurements LED: Construction and use of LED in display. Liquid crystal, types of liquid crystals. Basic principle of LCD and its construction, Comparison between LED and LCD.	12
IV	Spectroscopic Instrumentation: UV-visible spectrophotometer: Beer-Lambert law, absorptivity, UV and Visible absorption, Instrumentation, essential parts of spectrophotometer (double beam spectrophotometer), grating and prisms, radiant energy sources, filters, photosensitive detectors, photomultiplier tubes, relation between absorption in visible and UV region and molecular structure, applications of UV-visible spectroscopy. IR spectrophotometry: Fourier Transform Infrared (FTIR) spectrometer, Principle, working and applications.	12



Recommended Books/e-resources/LMS:

1. Theory of Errors in Physical Measurements, New Central Book Agency, 2010 by J. C. Pal.
2. Measurement, Instrumentation and Experimental Design in Physics and Engineering, PHI Learning Private Limited, Delhi, 2015 by Michael Sayer and Abhai Mansingh.
3. Electronic Instrumentation and Measurements, PHI Learning Private Limited, Delhi, 2nd Edition, 2010 by David A. Bell.
4. Handbook of Analytical Instruments, Tata McGraw-Hill, 3rd Edition, 2006 by R. S. Khandpur.
5. Measurement and Instrumentation Principles, Elsevier, 2006 by Alan S. Morris.
6. Polymer Characterization: Physical Techniques, Chapman and Hall by D. Campbell and J. R. White.



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: DSE-3

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	5 th		
Name of the Course	Renewable Energy and Energy Harvesting		
Course Code	24UN-PHY-506		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 4 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the significance of renewable energy in addressing global energy challenges 2. Differentiate between various renewable energy sources and their applications 3. Analyze the environmental, social and economic implications of renewable energy adoption 4. Explain the mechanisms of renewable energy conversions.		
Credits	Theory	Practical	Total
	4	-	4
Contact Hours	4	-	4
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs	
Part B- Contents of the Course			
Instructions for Paper- Setter			
1. Nine questions will be set in total. 2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus.			



This question may have 4 parts and the answer should be in brief but not in Yes/No.

3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	Introduction to Renewable Energy: Overview of renewable energy sources, Importance of renewable energy in sustainable development, Comparison between renewable and non-renewable energy sources, Basic principles of energy conversion in renewable energy systems, Environmental and economic benefits of renewable energy	15
II	Solar Energy Harvesting: Principles of solar energy conversion, Photovoltaic effect and solar cell technology, Types of solar panels and their efficiency, Solar thermal energy systems: principles and applications, Challenges and advancements in solar energy technology	15
III	Wind Energy Conversion and Geothermal Energy: Wind energy resources and distribution, Aerodynamics of wind turbine blades, Types of wind turbines and their applications, Power generation from wind energy, Wind energy integration into the electrical grid, Geothermal Energy and its sources, Geothermal power plants, its types and operation, Applications of geothermal heat pumps.	15
IV	Biomass and Hydroelectric Energy: Biomass as a renewable energy source, Biomass conversion technologies: combustion, gasification, and anaerobic digestion, Hydroelectric power generation: principles and types of hydroelectric plants, Environmental and social impacts of biomass and hydroelectric energy, Future trends and innovations in biomass and hydroelectric energy.	15

Suggested Evaluation Methods

Internal Assessment:

➤ Theory (30 Marks)

- Class Participation: **05 Marks**
- Seminar/presentation/assignment/quiz/class test etc.: **10 Marks**
- Mid-Term Exam: **15 Marks**

End Term Examination

:70 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Renewable Energy: Power for a Sustainable Future by Godfrey Boyle, Oxford University Press, 3rd edition, 2012.
2. Introduction to Renewable Energy by Vaughn C. Nelson, CRC Press, 2016.
3. Renewable Energy: Sources for Fuels and Electricity by Thomas B. Johansson et al.,

Island Press, 1992.

4. Solar Engineering of Thermal Processes by John A. Duffie and William A. Beckman, John Wiley & Sons., 3rd edition, 2006.
5. Solar Electricity Handbook: A Simple, Practical Guide to Solar Energy by Michael Boxwell, Greenstream Publishing, 2023.
6. Wind Power: Renewable Energy for Home, Farm, and Business by Paul Gipe, Chelsea Green Publishing, 2004.
7. Introduction to Wind Energy: Renewable Energy and the Environment by John Twidell and Tony D. Weir, Taylor and Francis, 1986.
8. Wind Energy Handbook by Tony Burton et al., Wiley, 2011.
9. Biomass to Renewable Energy Processes by Jay Cheng, CRC Press, 2017.
10. Fundamentals of Geophysics by William Lowrie, Cambridge University Press, 2nd edition, 2012.



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: CC-6/MCC-11

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Introduction to Electronics and Nuclear Physics		
Course Code	24UN-PHY-601		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC/MCC		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 5 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the operation of pn junction, use of diode as Rectifier, voltage multiplier circuits, Zener Diode, Photo diode, solar cell, clipping and clamping circuits. 2. Familiar about Bipolar Junction Transistor, use of transistor as Amplifier in CB, CE and CC configurations. 3. Understand the concept of feedback in amplifiers, its types and effect of negative feedback on characteristics of amplifiers. 4. Analyze the operation of oscillators, classification of oscillators as LC oscillators, RC oscillators and crystal oscillators. 5. Learn to present observations, results, analysis and different concepts related to experiments of Electronics.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs	



Part B-Contents of the Course

Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Semi-Conductor Diodes: Semiconductors: Intrinsic and Extrinsic, P-N Junction diode and its V-I characteristics, Ideal Diode, Zener and Avalanche Breakdown, Zener Diode and its application as Voltage regulator, Photo-Diode, Light Emitting Diode, Solar Cell. P-N Junction as Half Wave and Full Wave Rectifiers: Efficiency and Ripple Factor, Comparison of Rectifiers, Clipping and Clamping circuits, Voltage Multiplier Circuits: Doubler and Tripler.	11
II	The Bipolar Transistor: The Bipolar Junction Transistor, Transistor Action and Working (PNP and NPN transistor), Transistor Circuit configurations: Common Base (CB), Common Emitter (CE) and Common Collector (CC) configurations, Current Amplification Factors (α , β and γ) and Relationship between them, Comparison of characteristics of Transistor in different configurations. Amplifiers: CB, CC and CE amplifiers and their characteristics.	12
III	Composition of the nucleus, constituents of the nucleus, proton and neutron, nuclear notation, isotopes, isobars, isotones and isomers, nuclear forces and their characteristics, stability of the nucleus, binding energy, mass defect, binding energy per nucleon and nuclear stability. nuclear radius and empirical radius relation, nuclear size and density, nuclear spin, parity, magnetic dipole moment, electric quadrupole moment and their significance. Nuclear Models: Liquid Drop Model, applications and limitations of the Liquid Drop Model, nuclear Shell Model (qualitative idea)	11
IV	Introduction to elementary particles: classification of fundamental particles, leptons and quarks, generations of leptons and quarks, fundamental properties and quantum numbers (charge, baryon number, lepton number, strangeness, charm, bottomness and topness). Hadrons: classification into baryons and mesons, quark composition of hadrons, baryon octet and meson nonet (qualitative idea).	11

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

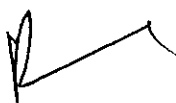
Course:MCC-12

Session: 2024-25	
Part A - Introduction	
Subject	Physics
Semester	6 th
Name of the Course	Solid State Physics-I
Course Code	24UN-PHY-602
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC
Level of the course (As per Annexure-I)	300-399
Pre-requisite for the course (if any)	Appeared or passed the 5 th sem (B.Sc Physical Science or equivalent)
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Have a brief idea about crystalline and amorphous materials, unit cell, primitive cell, miller indices, Bravais lattices and crystal structures of Zinc Sulphide, Sodium Chloride and Diamond. 2. Acquire knowledge about X-ray diffraction, Bragg's Law, experimental X-ray diffraction methods and about the reciprocal lattice to a simple cubic lattice, B.C.C. and F.C.C. lattice. 3. Understand about different types of bonding such as Vander wall's, Ionic, Covalent, hydrogen and Metallic bonding in crystals. 4. Analyze the concept of free electron gas model, density of states in one, two and three dimensions, Fermi energy, heat capacity of electron gas, Concept of thermal effective mass, Electrical conductivity and Ohm's law, Hall effect, and thermal conductivity of metals. 5. Learn about dielectric and ferroelectric properties of materials such as Polarization, Electric susceptibility, Polarizability, Complex Dielectric Constant, piezoelectric effect, pyroelectric effect, Ferroelectric effect, Curie-Weiss Law, PE Hysteresis

	loop.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs	
Part B-Contents of the Course			
<u>Instructions for Paper- Setter</u>			
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	Crystal Structure-I: Crystalline and glassy forms, liquid crystals, crystal structure, periodicity, lattice and basis, crystal translational vectors and axes. Unit cell and Primitive Cell, Winger Seitz primitive Cell, symmetry operations for atwo-dimensional crystal, Bravais lattices in two and three dimensions. Crystal planes and Miller indices, Interplanarspacing, Crystal structures of Zinc Sulphide, Sodium Chloride and Diamond.		11
II	Crystal Structure-II: X-ray diffraction, Bragg's Law and experimental X-ray diffraction methods. K-space and reciprocal lattice and its physical significance, reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, bcc and feclattices. Bonding in Crystals: Vander Waal's bonding, Ionic bonding, Covalent bonding, example of hydrogen molecule, hydrogen bonding, Metallic bonding.		11
III	Electronic Properties of Metallic Solids: Free electron gas model, Energy levels and density of states in one, two and three dimensions, Fermi momentum, Fermi energy, Fermi temperature, Effect of temperature, heat capacity of electron gas (explicit calculation), Experimental heat capacity of metals, Concept of thermal effective mass, Electrical conductivity and Ohm's law, Experimental resistivity of metals, Matthiessen's rule, Motion in magnetic fields and Hall effect, Thermal conductivity of metals and Wiedmann-Franz law.		12

IV	Dielectric Properties of Materials: Polarization, Local electric field at an atom, Depolarization field, Electric susceptibility, Polarizability, Clausius-Mosotti equation, Classical theory of polarizability, Normal and Anomalous dispersion, Cauchy and Sellmeier relations, Langevin-Debye equation, Complex Dielectric Constant. Ferroelectric properties of Materials: Classification of crystals, piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE Hysteresis loop.	12
	Practicum - To determine Hall coefficient and mobility of a given semiconductor. - To measure the resistivity of a semiconductor (Ge) with temperature (up to 150°C) by four probe method. - To determine conductivity of given semiconductor crystal using four probe method. - To measure the magnetic susceptibility of Solids. - To measure the Coupling Coefficient of a piezoelectric crystal. - To measure the dielectric constant of a dielectric material with frequency. - To study the PE Hysteresis loop of a Ferroelectric crystal. - To determine the dielectric constant of paper. - To find the polarizability of a dielectric substance. - To determine the dielectric constant by charging and discharging of parallel plate capacitor. Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		
Internal Assessment: > Theory (20 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks > Practicum (10 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil		End Term Examination : 50 Marks : 20 Marks
Part C-Learning Resources		
Recommended Books/e-resources/LMS: - Solid State Physics by S. O. Pillai, New Age International Publisher, New Delhi. - Introduction to Solid State Physics by C. Kittel, Wiley India Pvt. Ltd. - Solid State Physics by R. K. Puri, V.K. Babbar, S. Chand & Co. New Delhi. - The Physics of Solids by Richard Turton, Oxford University Press. - Solid State Physics by Ashcroft and Mermin, Saunders college publishing. - Elements of Solid State Physics by M.N. Ruden, J. Wilson, Willey Blackwell Publishing.		

7. Solid State Physics by A.J. Dekker, Luxmi PublicationsSolid State Physics: Essential Concepts by D.W.Snoke
8. Essentials of Solid State physics by S.P.Kuila, New Central Book Agency.
9. Introductory Solid State Physics By H.P.Myres, CRC Press.
10. Solid State Physics by Vimal Kumar Jain, Springer Nature Switzerland Ag.
11. Fundamentals of Solid State physics by Saxena, Gupta, Pragati Prakashan Meerut.
12. Advanced practical Book for students, B. L. Flint and H. T. Wornsop, 1971, Asia Publishing House.
13. A text book of practical physics, I. Prakash & Ramakrishna, 11th edition., 2011 Kitab Mahal.
14. Elements of Solid-State Physics, J. P. Srivastava, 2nd Ed., 2006, Prentice Hall of India.
15. B.Sc Practical Physics, C. L. Arora, R Chand & Co. New Delhi



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: DSE-4

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Radiation Physics		
Course Code	24UN-PHY-603		
Course Type: (CC/MCC/MDC/CC-M/ DSEC /VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 5 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand and explain radiation quantities and units 2. Analyze and have better understanding of biological effects of radiation 3. Have knowledge about the principles of Radiological Protection. 4. Have awareness about the radiation hazards' types, their control and radiation emergency and preparedness. 5. Familiar with different techniques of detection of nuclear radiations.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time: 3hrs	
Part B-Contents of the Course			



Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Sources of Radiations: Sources of radiations: natural and artificial, Alpha, Beta and Gamma radiations, their origin and energetics, X-rays: Characteristic X-rays, Bremsstrahlung (continuous) X-rays, X ray targets, and Clinical X ray beams; Cosmic rays: Discovery, Nature of a cosmic rays, soft and hard component, and Geometric effects on cosmic rays; Terrestrial radiations: Radon gas and Radioactive isotopes of lighter elements, Radiation quantities and units: Activity, KERMA, Exposure, Dose, Equivalent Dose, Effective Dose, Annual Limit on Intake (ALI), and Derived Air Concentration (DAC)	10
II	Biological Effects of Ionizing Radiations: Introduction, Cell Biology: Structure and function of living cell, cell division-mitosis, meiosis and differentiation, central dogma of molecular biology, genetic codes-DNA, RNA and Proteins; Effect of Radiations on Cell: inhibition of cell division, chromosome aberrations, genes mutation, and cell death; Biological effects of Radiations on Human: Somatic Effects (Early effect) and Stochastic effect (Late effect).	12
III	Principles of Radiological Protection: Justification of Practice, Optimization of Practice, and Dose Limitations; Internal Exposure, Dose Limit for (i) Radiation Workers (ii) Public, Occupational Exposure of Women, Apprentices and Students. Production of Radioisotopes and Labeled Compounds: Introduction, Separation of Isotopes, Production of labeled compounds, Specific Activity of labeled compounds, Storage, Quality, and Purity of Radio-labeled compounds.	12
IV	Radiation Hazards: Internal and External Hazards; Evaluation and Control of Radiation Hazards, Radiation Shield, Monitoring of External Radiation, Control of Internal Hazard: (i) Containment of Source (ii) Control of Environment (iii) Contamination (iv) Air Contamination Monitoring (v) Personal Contamination Monitoring (vi) Decontamination Procedures; Radiation Emergency and Preparedness.	11

Practicum	30
1. To study the measurement of Background Radiation using G. M. Counter. 2. To study the detection of alpha, beta and gamma radiations using G. M. Counter. 3. Capturing and Detection of Radon in the Environment using G. M. Counter. 4. Detecting low level radioactivity in food using G. M. Counter. 5. To test the soil for harmful amounts of radiation inside and outside your institute using G. M. Counter. 6. To assess radiation levels in the environment. 7. Radiation detection in the scrap metal industry. 8. To identify radioactive rocks and minerals. 9. Radiation Dose mapping in the given area using Radiation Survey meter.	
Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	
Suggested Evaluation Methods	
Internal Assessment:	End Term Examination
> Theory (20 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks	: 50 Marks
> Practicum (10 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil	: 20 Marks
PartC-Learning Resources	
Recommended Books/e-resources/LMS:	
1. Radiation Oncology Physics: A handbook for teachers and students; International Atomic Energy Agency, Vienna, 2005. 2. Practical knowledge for Handling Radioactive Sources by Claus Grupen. 3. Introduction to Radiological Physics and Radiation Dosimetry by Frank Herbert Attlx. 4. Radiation Biology: A handbook for teachers and students; International Atomic Energy Agency, Vienna, 2010. 5. Measurement, Instrumentation and Experimental Design in Physics and Engineering, M. Sayer and A. Mansingh (Prentice Hall India, 2010). 6. Radiation Detection and Measurement, G. F. Knoll (John Wiley & Sons, Inc. 3rd Ed., 2000) 7. Physics & Engineering of Radiation Detection, S. N. Ahmed (Academic Press 2007) 8. Techniques for Nuclear and Particle Physics Experiments, W.R. Leo (Springer- Verlag 1987) 9. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi 10. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House	

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: DSE-4

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Thin Films and Characterization		
Course Code	24UN-PHY-604		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 5 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Familiar about the Thin Film deposition technology and various deposition techniques used for fabrication of thin films. 2. Understand the basic process of growth of thin films on a substrate and how to monitor and calculate the thickness of the film. 3. Familiar about the various characterization tools used for the study of optical, structural and morphological properties of thin films. 4. Acquire knowledge of working principle of basic elements used in thin film deposition technology. 5. Learn to present observations, results, analysis and different concepts related to experiments of fabrication and characterization of thin films.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs	



Part B-Contents of the Course

Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Thin Film Deposition Technology: Physical Deposition Processes: Introduction, Schematic diagram and working process of (a) Vacuum Evaporation (b) Thermal Evaporation by Resistive heating; Flash evaporation; Arc Evaporation; Exploding wire technique; Laser Evaporation; Electron Beam Evaporation.Chemical Deposition Processes: Introduction, Schematic diagram and working process of (a) Electro Deposition; Electrolytic Deposition; Electroless Deposition; Chemical Vapour Deposition (CVD); Anodic oxidation.	12
II	Thin Film Deposition Cathodic Sputtering Technology: Introduction, The Sputtering Yield; Glow-discharge sputtering, Pressure, Deposit Distribution Current and Voltage Dependence, Cathode, Contamination Problem, Deposition Control, Sputtering Variants, Low-pressure Sputtering: RF Sputtering, Ion Beam Sputtering, Reactive Sputtering, Ion Beam Sputtering, Reactive Sputtering.	10
III	Film Thickness: Thin Film, Foil and Sheet: Basic introduction, range of their thickness and difference between these three. Monitoring Processes: Introduction, schematic diagram and working process of Optical Monitoring, Quartz Crystal monitoring system. Thin Film Characterization Techniques: Introduction and measurement of Film thickness by Interference method. Optical Constants: Measurement of Intensity of light as a function of wavelength by Spectrophotometer; Determination of refractive index, absorption coefficient and thickness of thin film by Ellipsometry; Absorption measurement by Calorimetry. Crystalline structure and morphological properties of thin films. Electrical conduction, Defects, Hardness, Humidity and Temperature testing,	11
IV	Basic Elements of Vacuum Technology: Vacuum: Basic Concept, different levels of vacuum and terms used in vacuum technology. Atmosphere and how atmospheric pressure is created. Basic concept and measure of Gas Pressure. Brief history of vacuum its requirement and applications in science and technology. Vacuum Pumps: Basic principles and processes for production of vacuum. Construction, working, advantages and disadvantages of Rotary, Roots, Diffusion and Turbo molecular Pumps.	12



	Vacuum Measuring Gauges: Introduction construction and working of different types of vacuum measuring Gauges: (a) Direct Measuring Gauges; Bourdon Vacuum Gauge, Mercury Manometer, Macleod Gauge (b) Indirect Measuring Gauges; Thermal Conductivity Gauge, Thermocouple Gauge, Pirani Gauge, Leak detection.	
	<u>Practicum</u> 1. Determination of thickness of a thin film optically. 2. Determination of electrical conductivity of a thin film. 3. Study of surface roughness of a thin film by optical microscope. 4. To measure the I-V characteristics of a thin film. 5. To calculate the sheet resistance of thin films of different thickness and compare the results. 6. Determination of thickness of a given sheet or foil using G M Counter. 7. Study of grain size in the surface of a polycrystalline thin film by optical microscope. 8. To study the thin film interference and to find out its thickness. Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory (20 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks ➤ Practicum (10 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil		End Term Examination: 50 Marks : 20 Marks
PartC-Learning Resources		
Recommended Books/e-resources/LMS: 1. Thin Film Phenomena - Kasturi L. Chopra, McGraw Hill Book Company. 2. Nuclear Measurement Techniques, K. Sriram, (1986), AEWP, New Delhi 3. Hand Book of Thin Film Technology - Leon 4. Handbook of Analytical Instrumentation - R.S. Khandpur 5. Vacuum Science and Technology - A. Roth. 6. Thin Film technology –A Layman's Perception, V.V. Shah, A. Basu, Vigyan Prasar(An Autonomous Organisation Under the DST, Govt. of India 7. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi 8. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: DSE-5

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Numerical Methods in Physics		
Course Code	24UN-PHY-605		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 5 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand different type of errors, their propagation, and to minimize errors while writing a program. 2. Solve a set of simultaneous linear algebraic equations numerically and able to find numerically the eigenvalues and eigenvectors of matrices using polynomial and power methods. 3. Solve numerical problems involving interpolation and/or extrapolation using different methods. 4. Solve ordinary and partial differential equations using numerical methods. 5. Understand how to develop a programme for a particular problem and it will improve logical thinking that helps to solve scientific problems using Python language.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs	
Part B-Contents of the Course			

Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Errors and Solutions of Algebraic Equations: Round off error, Truncation error, Machine error, Random error, Propagation of errors. Loss of Significance: Significant Digits, Computer caused loss of significance, Avoiding loss of significance in subtraction. Solutions of algebraic equations: Bisection method, Iteration method, Method of false position, Newton-Raphson method, Convergence conditions, Muller's method, Secant Method.	12
II	Systems of Linear Equations and Eigenvalue Problem: Solutions of simultaneous linear algebraic equations: Gauss elimination method, Gauss Jordan elimination method, Doolittle method, Matrix inversion method, Ill-conditioned matrix and error correction, Jacobi Method, Gauss Seidel iterative method, Matrix eigenvalues and eigenvectors: Polynomial method, Power method.	11
III	Interpolation and Curve fitting: Interpolation and Extrapolation: Finite differences, Forward differences, Backward differences, Central differences, Newton's formula for interpolation, Gauss central difference formula, Stirling's formula, Bessel's formula, Lagrange's interpolation formula, error of interpolation, Least square curve fitting: The principle of least square fitting, Linear regression, Polynomial regression, Fitting exponential and trigonometric functions, Data fitting with cubic splines, Data fitting using Gnuplot.	11
IV	Solutions of ordinary differential equations: Numerical solution of ordinary differential equations: Single step method, multi-step method, Taylor's series method, Euler's method, Modified Euler's method, Fourth-order Runge Kutta method, Cubic splines method; Second order differential equations: Initial and boundary value problems.	11
	<u>Practicum</u> 1. Least Square fitting (Linear). 2. Least square fitting (polynomial) 3. Least square fitting (exponential function) 4. Solution of Simultaneous Linear Algebraic equations by Gauss-Jordan elimination method.	

	5. To find roots of an equation of degree 1, 2 and 3 by using Bisection method. 6. Numerical Integration using Gauss quadrature methods for one and two-dimensional integrals. 7. Solution of second-order differential equation using Runge-Kutta method. 8. Finding eigenvalues and eigenvectors of square matrices. 9. To solve differential equations by Euler's method. 10. Interpolation and extrapolation using Bessel's formula. Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.	
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory (20 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks ➤ Practicum (10 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-vocce/Lab records etc.: 10 Marks Mid-Term Exam: Nil	End Term Examination : 50 Marks : 20 Marks	
PartC-Learning Resources		
Recommended Books/e-resources/LMS: 1. R C Desai, Fortran Programming and Numerical methods, Tata McGraw Hill, New Delhi. 2. P B Patil and U. P. Verma, Numerical Computational Methods, Narosa Publishing House 3. S S Sastry Introductory methods of numerical Analysis, Prentice Hall of India Pvt. Ltd. 4. R C Verma, P K Ahluwalia and K C Sharma, Computational Physics an Introduction, New Age International Publisher. 5. C Balachandra Rao and C K Santha, Numerical Methods, University Press 6. K E Atkinson, An introduction to numerical analysis, John Wiley and Son		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs
Course: DSE-5

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Applied Nuclear Techniques		
Course Code	24UN-PHY-606		
Course Type: (CC/MCC/MDC/CC-M/ DSEC /VOC/DSE/PC/AEC/VAC)	DSE		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Appeared or passed the 5 th sem (B.Sc Physical Science or equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the basic principles of working and applications of various Particle Accelerators, Synchrotron and Synchrocyclotrons. 2. Familiar about the Proton induced X-ray Emission spectroscopy for elemental analysis and its variety of applications in various field of science and technology. 3. Acquire knowledge of working principle of X-ray Fluorescence spectroscopy and its application in material research and industry. 4. Familiar about the basic principle of Neutron Activation analysis and possible applications in Material Science, Chemistry, Biology, radiation assessment, mineral exploration, Medical and Forensic Science 5. Learn to present observations, results, analysis of spectra recorded using different nuclear techniques.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5

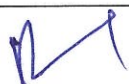


Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks:70		Time:3hrs
Part B-Contents of the Course		
<u>Instructions for Paper- Setter</u> 1. Nine questions will be set in total. 2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may 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	Particle Accelerators: Basic principle, construction, working, advantages and limitations of Van-de-Graff, Basic principle, construction, Theory, working, advantages and Relativistic limitation of Cyclotron. Magnetic Resonance Accelerator. Synchrotrons: Electron synchrotron, Proton synchrotron. Basic principle, construction, theory, advantages and limitations of Synchrocyclotrons. Medical applications of accelerators, Mega volt therapy.	12
II	Nuclear Spectroscopy Technique: Charged Particle Induced X-ray Emission (PIXE) spectrometry: Basic Principle, X-ray production process, Radiative and Non-radiative transitions, Coster Krönig transitions, continuous background, Brenmsstrahlung, PIXE set-up, Instrumentation, Qualitative analysis: Energy calibration, comparison with standard. Quantitative analysis: Absolute method, Relative method, Relationship between X-ray intensities and concentrations, Limits of detection, Application of PIXE in air and water pollution industries.	12
III	X-rays Fluorescence Spectrometry (XRF): Nature and origin of X-rays, characteristic X-rays, notation for spectrum, Continuous spectra, Duane - Hunt Law, Relationship between X-rays emission and atomic number, Sources of X-rays: X-ray tube, Function and requirements, Radioisotope source, XRF spectrometer, wave length dispersive devices, Energy dispersive devices, pulse height selection. Application of XRF in various fields, Advantages and disadvantages of XRF.	10
IV	Neutron Activation Analysis (NAA): Introduction, Theory of activation method, Neutron energy distribution, Classification of neutron activation methods: Prompt γ -ray neutron activation, Delay γ -ray neutron activation. Instrumental NAA. Analysis of the gamma spectra, Applications: NAA for semiconductor materials, Soil science, Geological science, Accuracy and sensitivity of NAA.	11

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: SEC-4

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Introduction to Astrophysics		
Course Code	24UN-PHY- SEC601		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	SEC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course(if any)	Appeared or passed the 5 th sem. (B.Sc. Physical Science)		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the basic concepts of astrophysics. 2. Explain stellar properties and evolution. 3. Describe the Solar System, galaxies, and the Universe. 4. Understand the working principles of basic astronomical instruments.		
Credits	Theory	Practical	Total
	2	-	2
Contact Hours	2	-	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks: 35			Time:3 hours
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	Fundamentals of Astrophysics: Scope and importance of astrophysics, Celestial sphere and apparent motion of celestial objects, Celestial coordinate systems (Horizon and Equatorial coordinate systems), Astronomical distance units (Astronomical Unit, Light Year and Parsec), Basic methods of astronomical distance measurement, Electromagnetic spectrum, Atmospheric windows, Applications of different regions of the electromagnetic spectrum in astronomy.	8
II	Radiation and Astronomical Instruments: Blackbody radiation, Stellar spectra and surface temperature, Apparent and absolute magnitude, Luminosity and inverse square law, Distance modulus (basic concept), Refracting telescopes, Reflecting telescopes, Modern astronomical observatories (optical, radio and space telescopes).	8
III	Stars: Formation of stars, Classification of stars, Spectral classification of stars, Hertzsprung–Russell (H–R) diagram, Stellar evolution, White dwarfs, Neutron stars and black holes.	7
IV	Solar System and Universe: The Solar System, Formation of the Solar System, Milky Way galaxy, Types of galaxies, Big Bang Theory (basic idea and observational evidence), Dark matter (introduction), Exoplanets and their detection methods.	7

Suggested Evaluation Methods	
Internal Assessment: Theory (15 Marks) - Class Participation: 4 Marks - Seminar/presentation/assignment/quiz/class test etc.: 4 Marks - Mid-Term Exam: 7 Marks	End Term Examination Marks : 35 Marks
Part C-Learning Resources	
Recommended Books/e-resources/LMS: - B.W. Carroll and D.A. Ostlie - An Introduction to Modern Astrophysics - Cambridge University Press (2017). - M.A. Seeds and D. Backman - Foundations of Astronomy - Cengage Learning (2019). - J.V. Narlikar - Introduction to Cosmology - Cambridge University Press (2002). B. Basu - An Introduction to Astrophysics - Prentice-Hall of India Pvt. Ltd., New Delhi (2003). T. Padmanabhan - Theoretical Astrophysics, Volume I: Astrophysical Processes - Cambridge University Press (2000).	



Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: VOC-3

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Installation and Maintenance of Solar Panels		
Course Code	24UN-PHY-VOC601		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the basics of solar energy and solar panels 2. Learn about the SPV Panels systems and their Installation 3. Get the knowledge about the testing methods and techniques SPV. 4. Learn about Maintenance and Troubleshooting process of SPV.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u> 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.			



Unit	Topics	Contact Hours
I	Introduction to solar energy and solar panels Solar Energy and its potential, Harnessing solar energy, need for Solar energy to electrical energy conversion, Solar photo voltaic (SPV) system, SPV panels and their types, ratings and specifications. Advantages and disadvantages of SPV panels, basics of load calculation and SPV requirement	7
II	SPV Panels systems and their Installation Solar panel to SPV systems: OFF grid and ON grid solar systems, Areas of applications of SPV systems, components of solar systems; solar panel, inverter (Stand alone and grid tied) , Battery Energy system (BES), Charge controller, Tools and equipments : Digital Multimeter Clamp Meter Hydrometer, Sun pathfinder Thermography Camera , drills and fasteners, sealants, pliers and strippers, Pyranometer, Personal Protective Equipments (PPE), Battery maintenance kit Battery water filler etc. Installation: Site selection criteria, steps and procedure for solar panel array installation, different mounting structures, installation of AC and DC distribution boxes, earthing and grounding pits, optimal cable sizing and cable laying.	8
III	Testing and Inspection Testing methods and techniques, testing of SPV open circuit and load voltage, Battery SOC testing, testing of protective systems and earth resistance, Inspection of connected systems and running a test,	8
IV	Maintenance and Trouble shooting Scheduled and unscheduled maintenance, checking dust accumulation, Module Shading Module Mismatch, Physical Integrity, standard trouble shooting procedure.	7
	Practicum 1. Identification of Components of a Solar Photovoltaic (SPV) System. 2. Measurement of Open Circuit Voltage (V_{oc}) and Short Circuit Current (I_{sc}) of a Solar Panel. 3. Study of Current–Voltage ($I-V$) Characteristics of a Solar PV Module. 4. Measurement of Solar Panel Output under Different Light Intensities. 5. Study of the Effect of Panel Tilt Angle on Solar Panel Output. 6. Measurement of Battery Voltage and State of Charge (SOC) in an SPV System. 7. Study of the Operation of a Solar Charge Controller. 8. Installation and Testing of a Small Off-Grid Solar PV System. 9. Load Calculation and Estimation of Solar PV System Capacity for	

	Domestic Applications. 10. Testing of Continuity and Polarity of Solar PV Wiring using a Digital Multimeter. 11. Inspection and Preventive Maintenance of a Solar PV System. 12. Identification and Troubleshooting of Common Faults in a Solar PV System. Note: Student will perform at least eight experiments. The examiner will allot one practical at the time of end term examination.	
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory (15 Marks) • Class Participation: 4 Marks • Seminar/presentation/assignment/quiz/class test etc.: 4 Marks • Mid-Term Exam: 7 Marks ➤ Practicun (15 Marks) • Class Participation: 5 Marks • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil		End Term Examination : 35 Marks : 35 Marks
Part C-Learning Resources		
Recommended Books/e-resources/LMS: 1. Solar Photovoltaic technology PHI 2013, Chetan Singh Solanki 2. Solar Electrical Handbook 2021, Michael Boxwell 3. Handbook for rooftop solar panel installation in Asia, 2014 Asian Development Bank (ADB) 4. Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd. 5. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGraw Hill Education. 6. Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Chetan Singh Solanki, PHI Learning Pvt. Ltd.		

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: VOC-3

Session: 2024-25			
Part A - Introduction			
Subject	Physics		
Semester	6 th		
Name of the Course	Introduction to AI and ML for Physical Sciences		
Course Code	24UN-PHY-VOC602		
Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Explain the fundamental concepts of Artificial Intelligence, Machine Learning, and different learning paradigms, and demonstrate the use of basic Python libraries for data analysis. 2. Apply regression and classification techniques to analyze simple datasets and evaluate the performance of machine learning models. 3. Describe the working principles of artificial neural networks and convolutional neural networks, and utilize pre-trained models for basic image recognition tasks. 4. Illustrate the applications, limitations, and ethical considerations of AI in physical sciences, and implement a simple AI workflow for solving basic physics-related problems.		
Credits	Theory	Practical	Total
	4	NA	4
Contact Hours	4	NA	4
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs	
Part B- Contents of the Course			



Instructions for Paper- Setter

1. Nine questions will be set in total.
4. 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.
5. 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.

Unit	Topics	Contact Hours
I	Introduction to Artificial Intelligence (AI) and Machine Learning (ML); applications of AI in everyday life and physical sciences; concepts of data, features, labels, training and testing datasets; supervised and unsupervised learning; introduction to Python tools for ML: NumPy, Pandas, and Matplotlib.	12
II	Learning from Data – Regression and Classification: Data preprocessing and dataset splitting; linear regression using scikit-learn; model evaluation and concept of overfitting; classification using k-Nearest Neighbours (k-NN); performance evaluation using accuracy and confusion matrix; applications to simple physics datasets (e.g., Ohm's law, pendulum data, noisy signals).	12
III	Introduction to Neural Networks: Concept of deep learning; artificial neuron (perceptron); basic neural network architecture; learning process in neural networks (qualitative); introduction to Convolutional Neural Networks (CNNs); use of pre-trained models for simple image recognition.	12
IV	Applications of AI in physics: image classification, signal–noise separation, pattern recognition in experimental data and spectra; limitations of AI and importance of data quality; introduction to a simple AI workflow: data collection, model training, testing, and interpretation of results; demonstration through a small case study or mini-project (optional).	12
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory (30 Marks) • Class Participation: 5 Marks • Seminar/presentation/assignment/quiz/class test etc.: 10 Marks • Mid-Term Exam: 15 Marks		End Term Examination : 70 Marks
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig.
2. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow by Aurélien Géron.
3. Python Machine Learning by Sebastian Raschka and Vahid Mirjalili.
4. Artificial Intelligence and Machine Learning by Vinoj Kumar Jain (Indian Author).
5. Machine Learning Using Python by U. Dinesh Kumar and Manaranjan Pradhan (Indian Authors).

