INDIRA GANDHI UNIVERSITY
MEERPUR
(Established by the State Legislature
Act XII of 1956)

Scheme of Examination and Syllabus for Undergraduate Programme
Subject: PHYSICS

Under Multiple Entry-Exit,
Internships and CBCS-LOCF in
accordance to NEP 2020
w.e.f. 2024-25 (in phased manner)

Indira Gandhi University Meerpur

Scheme and Syllabus of Examination for Undergraduate programme
Subject: PHYSICS
Under Multiple Entry-Exit, Internships and
CBCS-LOCF in accordance to NEP 2020
w.e.f. 2024-25 (in phased manner)

Semester	Applicable Scheme	Course Type	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T+P
1	A, B & C	CC-1/ MCC-1	24L4.5-PHY-101	Mechanics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	C	MCC-2	24L4.5-PHY-102	Mathematical Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	A, B, C & D	CC-M1	24L4.5-PHY-103	Elementary Mechanics	1	1	10	20	30	3
				Practicum	1	2	5	15	20	3
	A, B, C & D	MDC1	24L4.5-PHY-104	Physics Fundamentals -I	2	2	15	35	75	3
				Practicum	1	2	5	20	25	3
	C	CC-M1 4credits	From Available CC-1/MCC-1 of 4 credits as per NEP							
Sc	A, B & C	AEC-1 2credits	From Available pool of AEC-1 of 2 credits as per NEP							
		SEC-1 3credits	From Available pool of SEC-1 of 3 credits as per NEP							
		VAC-1 2credits	From Available pool of VAC-1 of 2 credits as per NEP							
	CC : Core Course MDC : Multidisciplinary Course SEC : Skill Enhancement Course				CC-M : Minor Course AEC : Ability Enhancement Course VAC : Value Added Course					
2	A, B & C	CC-2 MCC-3	24L4.5-PHY-201	Electricity and Magnetism & EM Theory	3	3	20	50	70	3
				Practicum	1	3	10	20	30	3
	A, B & D	CC-M2	24L4.5-PHY-202	Elementary Electricity, Magnetism & EM Theory	1	1	10	20	30	3
				Practicum	1	2	5	15	20	3

	C	DSEC-1	24L4.5-PHY-203	Computational Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	A, B & D	MDC-2	24L4.5-PHY-204	Physics Fundamentals-II	2	2	15	35	50	3
				Practicum	1	2	5	20	25	3
Sc	C	CC-M2 4credits	From Available CC-2/MCC-3 of 4 credits as per NEP							
Sc	A, B & C	AEC-2 2credits	From Available Pool of AEC-2 of 2 credits as per NEP							
		SEC-2 3credits	From Available Pool of SEC-2 of 3 credits as per NEP							
		VAC-2 2credits	From Available Pool of VAC-2 of 2 credits as per NEP							
	* Internship of 4credits of 4-6weeks duration									

CC : Core Course
MDC : Multidisciplinary Course
SEC : Skill Enhancement Course
DSEC : Discipline Skill Enhancement Course
CC-M : Minor Course
AEC : Ability Enhancement Course
VAC : Value Added Course

*Applicable for those students who wish to exit after 2nd Semester
Note: UG Certificate in Physical Sciences (with credits 52) / Physics (with 48 Credits) will be provided, if student want to exit after 2nd Semester, on submitting 4-6 weeks Internship Report (4 Credits).

3	A, B & C	CC-3/ MCC-4	24L5.0-PHY-301	Thermodynamics & Statistical Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B	MCC-2	24L5.0-PHY-102	Mathematical Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B & C	MCC-5	24L5.0-PHY-303	Classical Mechanics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	A, B, C & D	MDC3	24L5.0-PHY-304	Physics Fundamentals-III	2	2	15	35	50	3
				Practicum	1	2	5	20	25	3
	A & C	CC-M3 4credits	From Available CC-3/MCC-4 of 4 credits as per NEP							
	B	CC-M3 (V) 4 credits	From Available pool of VOC-1 of 4 credits as per NEP							

	A,B&C	AEC-3 2credits	From Available pool of AEC-3 of 2 credits as per NEP								
		SEC-3 3credits	From Available pool ofSEC-3 of 3 credits as per NEP								
	C	VAC-3 2credits	From Available pool ofVAC-3 of 2 credits as per NEP								
	CC: Core Course MDC : Multidisciplinary Course SEC : Skill Enhancement Course				CC-M (V) : Minor (Vocational) AEC : Ability Enhancement Course VAC : Value Added Course						
4	A,B & D	CC-4/ MCC-6	24L5.0-PHY-401	Waves and Optics	3	3	20	50	70	3	
				Practicum	1	2	10	20	30	3	
	B & C	MCC-7	24L5.0-PHY-402	Introductory Quantum Mechanics	3	3	20	50	70	3	
				Practicum	1	2	10	20	30	3	
	B & C	MCC-8	24L5.0-PHY-403	Atomic Spectroscopy	3	3	20	50	70	3	
				Practicum	1	2	10	20	30	3	
	B & C	DSE-1	24L5.0-PHY-404	Laser Physics and Fiber Optics	3	3	20	50	70	3	
				Practicum	1	2	10	20	30	3	
			OR								
			24L5.0-PHY-405	Physics of Nano Materials	3	3	20	50	70	3	
				Practicum	1	2	10	20	30	3	
	A, B &C	CC-M4 (V) 4 credits	From Available pool of VOC-2 of 4 credits as per NEP								
		AEC-4 2 credits	From Available AEC-3 of 2 credits as per NEP								
	A & B	VAC-3 2 credits	From Availablepool of VAC-3 of 2 credits as per NEP								
	C	VAC-4 2 credits	From Available pool of VAC-4 of 2 credits as per NEP								
	*Internship of 4 credits of 4-6 weeks duration for students who wish to exit after 4th semester										
	CC : Core Course MDC : Multidisciplinary Course SEC : Skill Enhancement Course				CC-M(V) : Minor (Vocational) AEC : Ability Enhancement Course VAC : Value Added Course						

Note: UG Diploma in Physical Sciences (with credits 96) / Physics (with 92 Credits) will be provided, if student want to exit after 4th Semester on submitting the 4-6 weeks Internship Report (4 Credits).

5	A, B & C	CC-5 MCC-9	24L5.5-PHY-501	Modern Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B & C	MCC-10	24L5.5-PHY-502	Nuclear Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B & C	DSE-2	24L5.5-PHY-503	Environmental Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
			OR							
			24L5.5-PHY-504	Non-Linear Dynamics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B & C	DSE-3	24L5.5-PHY-505	Instrumentation and Analytical Methods	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
			OR							
			24L5.5-PHY-506	Renewable Energy and Energy Harvesting	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	A, B &C	Internship 4 credits	If not done in II & IV Semester							
Sc	A & C	CC-M5(V) 4 credits	From Available pool of VOC-1 of 4 credits as per NEP							

CC : Core Course
MDC : Multidisciplinary Course
SEC : Skill Enhancement Course
DSE : Discipline Specific Elective Course
CC-M(V) : Minor (Vocational)
AEC : Ability Enhancement Course
VAC : Value Added Course

*Internship # 4credit after 4th semester (If not done in II & IV Semester)

6	A, B & C	CC-6 MCC-11	24L5.5-PHY-601	Electronics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B & C	MCC-12	24L5.5-PHY-602	Solid State Physics-1	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B & C	DSE-4	24L5.5-PHY-603	Condensed Matter Physics-1	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3

			OR							
	B & C		24L5.5-PHY-604	Material Science	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	B & C	DSE-5	24L5.5-PHY-605	Nuclear and Particle Physics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
			OR							
	B & C		24L5.5-PHY-606	Modern Characterization Techniques	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
Sch	A	CC-M6 4credits	From Available CC-6/MCC-11 of 4credits as per NEP							
Sch	A	CC-M7(V) 4credits	From Available Pool ofVOC-3of4creditsasperNEP							
	B	CC-M5(V) 4credits	From Available Pool ofVOC-3 of4creditsasperNEP							
	C	CC-M6(V) 4credits	From Available Pool ofVOC-3 of4creditsasperNEP							
	C	SEC-4 2credit	From Available Pool ofSEC-4of2creditsasperNEP							

CC: Core Course
MDC: Multidisciplinary Course
SEC: Skill Enhancement Course
DSE: Discipline Specific Elective Course
CC-M(V): Minor (Vocational)
AEC: Ability Enhancement Course
VAC: Value Added Course

Note: Bachelor Degree in Life Sciences/Environmental Sciences will be awarded if student want to exit after 6th Semester.

7	B & C	CC-H1	24L6.0-PHY-701	Advanced Mathematical Physics	4	4	30	70	100	3
	B & C	CC-H2	24L6.0-PHY-702	Statistical Mechanics	4	4	30	70	100	3
	B & C	CC-H3	24L6.0-PHY-703	Quantum Mechanics	4	4	30	70	100	3
	B & C	DSE-6	24L6.0-PHY-704	Molecular Physics	4	4	30	70	100	3
			OR							
			24L6.0-PHY-705	Sensors and Transducers	4	4	30	70	100	3

	B & C	PC-H1	24L6.0-PHY-706	Practicum Course	4	8	30	70	100	6
	B & C	CC-HM1 4 credits	From Available Minor of 4 credits as per NEP							
	CC-H: Core Course in Honors Subject CC-HM: Core Course in Minor Subject of Honors Programme DSE-H: Discipline Specific Elective Course in Honors Subject PC-H: Practicum Course in Honors Subject									
8	B & C	CC-H4	24L6.0-PHY-801	Electrodynamics and Plasma Physics	4	4	30	70	100	3
	B & C	CC-H5	24L6.0-PHY-802	Advance Quantum Mechanics	4	4	30	70	100	3
	B & C	CC-H6	24L6.0-PHY-803	Digital Electronics	4	4	30	70	100	3
	B & C	DSE-7	24L6.0-PHY-804	Solid State Physics-II	4	4	30	70	100	3
			OR							
			24L6.0-PHY-805	Condensed Matter Physics-II	4	4	30	70	100	3
	B & C	PC-H2	24L6.0-PHY-806	Practicum Course	4	8	30	70	100	6
	B & C	Research	24L6.0-PHY-R- 807	Project/Dissertation	12			300	300	
	B & C	CC-HM2 4 credits	From Available Minor of 4 credits as per NEP							
	CC: Core Course CC-HM: Minor PC: Practicum Course Note: Bachelor (Hons.)Degree in Subject / Discipline with 184 / 180 credits will be awarded. Note: Bachelor (Hons.)Degree (With Research) in Subject / Discipline with 184 / 180 credits will be awarded.									

Scheme of Examination for VAC/VOC

Semester	Scheme	Course Type	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T+P
3rd 4th	C A,B,D	VAC-3	24L5.0-VAC-PHY-301	Exploring the Journey of Indian Space Satellites	2	2	15	35	50	3
4th	C	VAC-4	24L5.0-VAC-PHY-402	Physics in Everyday Life	2	2	15	35	50	3
3rd 5th	B A, C,D	VOC-1	24L5.0-VOC-PHY-301	Refrigeration and Air Conditioning (RAC)	2	2	15	35	50	3
4th	A, B, C, D	VOC-2	24L5.0-VOC-PHY-401	Maintenance of Laboratory Instruments	2	2	15	35	50	3
6th	A, B, C, D	VOC-3	24L5.5-VOC-PHY-601	Solar Panel Installation	2	2	15	35	50	3

Indira Gandhi University Meerpur Undergraduate Programs

Course: CC-1/MCC-1

<table>
<tr><td colspan="4">Session:2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">1st</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Mechanics</td></tr>
<tr><td>Course Code</td><td colspan="3">24L4.5-PHY-101</td></tr>
<tr><td>Course Type:
(CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)</td><td colspan="3">CC/MCC</td></tr>
<tr><td>Level of the course
(As per Annexure-I)</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course(if any)</td><td colspan="3">Physics as main subject at level 4(i.e. 10+2 or equivalent)</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">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.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
</table>

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	**Fundamentals of Dynamics**: Rigid body, Moment of Inertia, Radius of Gyration, Theorems of perpendicular and parallel axis (with proof), Moment of Inertia of rod, 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, Fly wheel, 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 a centrally 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_0 joined together with spring of spring constant (k).	11
	Practicum 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 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. 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 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-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10Marks** • Mid-Term Exam: **Nil**		**End Term Examination :50Marks** **:20Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Mechanics "Berkeley Physics Course Vol.I", Charles Kittel, TataMcGraw-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, 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. 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.
15. B.Sc Practical Physics, Geeta Sanon

Indira Gandhi University, Meerpur Undergraduate Programs

Course: MCC-2

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	1st		
Name of the Course	**Mathematical Physics**		
Course Code	24L4.5-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)	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. 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**	

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	**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, Rank & 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 Rodrigue's formula for the Legendre's Polynomials, recursion relation for Legendre Polynomial, Hermite Polynomial, Hermite differential equation, Generating function of Hermite Polynomial, deduction of recursion relation for H_n of 1^{st} kind and 2^{nd}.	11
	<u>Practicum</u> **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 Simpson1/3rule 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. $f(x) = ax^2 + bx + c$, if $x<d$ $f(x) = 0$, if $x=d$ $f(x) = ax^2 + bx - c$, 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. Thereafter 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/classtestetc.:**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:

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,TataMcGraw-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,VivaBooks.
9. Advanced Practical Physics for students, B.L. Flint and H.T.Worsnop,1971, Asia Publishing House
10. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers
11. A Text Book of Practical Physics, I.Prakash &Ramakrishna,11th Edn,2011, Kitab Mahal
12. Engineering Practical Physics, S. Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
13. Practical 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,McGraw-Hill Pub.
17. Numerical Recipes in C:The Art of ScientificComputing,W.H.Pressetal,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,1stEdn.,2015,Scientific International Pvt. Ltd.
23. Mathematical Physics, H.K. Dass & Dr. Rama Verma.
24. Mathematical Physics, B. S. Rajput.

Indira Gandhi University Meerpur Undergraduate Programs

Course: CC-M1

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	1st		
Name of the Course	Elementary Mechanics		
Course Code	24L4.5-PHY-103		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC-M		
Level of the Course (As per Annexure-I)	100-199		
Pre-requisite for the course(if any)	Physics as main subject at level 4 (i.e. 10+2 or equivalent) and Physics not as major subject in 1st 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	Practical	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) calculator is 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) joined together with spring of spring constant (k).	4
	Practicum 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 a sextant. 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. 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 six experiments. The examiner will allot one practical at the time of end term examination.**	
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory (10 Marks)** • Class Participation: **04 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **Nil** • Mid-Term Exam: **6 Marks** ➢ **Practicum (5 Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks** • Mid-Term Exam:**Nil**		**End Term Examination :20 Marks** **15 Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Mechanics "Berkeley Physics Course Vol.I", Charles Kittel, TataMcGraw-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., NewDelhi
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, McGraw-Hill.
7. Properties of Matter, R. Murgeshan, S.Chand & Com. Pt. Ltd., NewDelhi
8. Classical Mechanics, J.C.Upadhyaya, Himalaya Publishing House
9. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, NewDelhi
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.
15. Classical Mechanics by H. Goldstein, Charles P. Poole & J. Safko

Indira Gandhi University Meerpur

Undergraduate Programs

Course: MDC-1

<table>
<tr><td colspan="4">Session: 2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">1st</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Physics Fundamentals–I</td></tr>
<tr><td>Course Code</td><td colspan="3">24L4.5-PHY-104</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)</td><td colspan="3">MDC</td></tr>
<tr><td>Level of the course(As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course(if any)</td><td colspan="3">Not studied Physics subject at level 4 (i.e.10+2orequivalent)</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">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</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>2</td><td>1</td><td>3</td></tr>
<tr><td>Contact Hours</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td colspan="2">Max. Marks: 75
Internal Assessment Marks: 20
End Term Exam Marks: 55</td><td colspan="2">Time:3hrs</td></tr>
<tr><td colspan="4">Part B-Contents of the Course</td></tr>
</table>

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	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 Ist law of motion, inertia and mass; Newton's2nd law of motion, momentum and force; 3rd law of motion, daily life applications of Newton's laws of motion. Universal law of gravitation and its importance, acceleration due to gravity and free fall of a body; mass and weight of an object on earth and moon, concept of thrust and pressure and importance in daily life, buoyancy and Archimedes principle-the physics behind floating of objects on water.	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
	Practicum 1. To measure the diameter of a small spherical/ cylindrical body. 2. To measure the length, width and height of the given rectangular block.	30

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 sinθ.
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 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: **04 Marks**
- Seminar/presentation/assignment/quiz/classtestetc.:**04 Marks**
- Mid-TermExam:**7 Marks**

➢ **Practicum(5Marks)**

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

End Term Examination :35 Marks

:20 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, New Delhi, 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. Serwayand John W. Jewett, Jr.,Thomson Higher Education10 Davis Drive Belmont, CA 94002-3098 USA.
5. Physics For You, Fifth Edition, by Keith Johnson, OUP Oxford;5th edition (23June 2016).
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.

Indira Gandhi University Meerpur
Undergraduate Programs
Course: CC-2/MCC-3

Session: 2024-25	
Part A-Introduction	
Subject	Physics
Semester	2nd
Name of the Course	**Electricity, Magnetism and EM Theory**
Course Code	24L4.5-PHY-201
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC
Level of the Course (As per Annexure-I)	100-199
Pre-requisite for the course (if any)	Appeared or passed the 1st sem (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 electromagnetic waves in free space and in medium. 4. Understand D.C. and A.C. circuits, able to apply and analyse 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	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. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Vector Background** a**nd 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. Conservative nature of Electrostatic Field, Electrostatic Potential, Potential as line integral of field, potential difference Derivation of electric field E from potential as gradient. Derivation of Laplace and Poisson equations. Electric flux, Gauss's Law, Differential form of Gauss's law and applications of Gauss's law. Mechanical force of charged surface, Energy per unit volume.	11
II	**Magnetic Field:** Biot-Savart law and its simple applications: straight wire and circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment, Ampere's Circuital Law and its applications (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 paramagnetism, 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 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. 11. To verify the Thevenin and Norton theorems. 12. To verify the Superposition and Maximum Power Transfer Theorems. 13. Self-inductance by Anderson's bridge. 14. Verification of laws of electromagnetic induction. 15. Study of B-H curves of various materials using C.R.O, and determination of various parameters. **Note: Student will perform atleast six experiments. The examiner will allot one practical at the time of end term examination.**	30
Suggested Evaluation Methods		

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

Part C- Learning Resources

Recommended Books/e-resources/LMS:

1. Electricity and Magnetism (Berkley,Phys.Course2), EdwardM.Purcell, 1986 McGraw- Hill Education
2. Electricity and Magnetism: A.S. Mahajan & A.A. Rangwala (Tata-McGrawHill), 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(2ndEdn.), David K.Cheng, Addison-Wesley Publishing Company.
9. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, NewDelhi
10. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
11. Practical Physics, S.SSrivastava and M.K.Gupta, AtmaRam & 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
15. Electricity and Magnetism, Satya Prakash

Indira Gandhi University Meerpur

Undergraduate Programs

Course: CC-M2

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	2nd		
Name of the Course	**Elementary Electricity, Magnetism & EM Theory**		
Course Code	24L4.5-PHY-202		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC-M		
Level of the Course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Physics not as major subject in 2nd 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	Practical	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) calculator is allowed.

Unit	Topics	Contact Hours
I	**Vector background and electric field:** Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss's divergence theorem, Stoke's theorem.	4
II	**Magnetic field and magnetic properties :** Magnetic induction, Magnetic flux, Solenoidal nature of vector field of induction, properties of B (i) $\nabla.B=0$ (ii) $\nabla\times B = \mu_o J$, 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
	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.	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 six experiments. The examiner will allot one practical at the time of end term examination.**	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory (10 Marks)** • Class Participation: **04 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **Nil** • Mid-Term Exam:**6 Marks** ➢ **Practicum(5Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: 0**5 Marks** • Mid-Term Exam: **Nil**	**End Term Examination :20 Marks** **: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-McGrawHill), 1988.
3. Electricity, Magnetism & Electromagnetic Theory, S.Mahajan and Choudhury, 2012,Tata McGraw
4. Introduction to Electrodynamics, D.J.Griffiths, 3rdEdn.,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, OxfordUniversityPress.
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. Electricity and Magnetism, Satya Prakash

Indira Gandhi University Meerpur

Undergraduate Programs

Course: DSEC-1

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	2nd		
Name of the Course	**Computational Physics**		
Course Code	24L4.5-PHY-203		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	**DSEC**		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Appeared or passed the 1st 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	Practical	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			

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 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, Sterling's formula. Numerical solutions of partial differential equations using Taylors's series method.	11
IV	**Integration:** Trapezoidal rule, Simpson's1/3 and 3/8rule, Gaussian Quadrature, Legendre– Gauss Quadrature, Numerical double integration.	11
	Practicum 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 list he sum of elements at index j<=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)Simpson1/3 and 3/8 rule 11. Gauss quadrature methods for one and two dimensional integrals **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/classtestetc.:**05 Marks** • Mid-TermExam:**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. Sheetal Taneja, Naveen Kumar, Python Programming "A Modular Approach" Pearson India. 2. E.Balaguruswamy, Introduction to Computing and Problem Solving using Python, 2nd edition, McGraw Hill Education, 2018 3. RC Desai, Fortran Programming and Numerical methods,Tata McGrawHill, NewDelhi. 4. Suresh Chandra, Computer Applications in Physics, Narosa Publishing House 5. ML DeJong, Introduction to Computation Physics, Addison-Wesley publishing company. 6. RC Verma, PK Ahluwalia and KC Sharma, Computational Physics an 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 Methods, University Press 10. KE Atkinson, An introduction to numerical analysis, John Wiley and Sons.		

Indira Gandhi University Meerpur Undergraduate Programs

Course: MDC-2

Session: 2024-25			
PartA-Introduction			
Subject	Physics		
Semester	2nd		
Name of the Course	**Physics Fundamentals-II**		
Course Code	24L4.5-PHY-204		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MDC		
Level of the Course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Not studied Physics subject at level l4 (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 practical utility of heating and magnetic effects of electric current. 4. Grasp an introductory idea about the generation of X- rays, α, β and γ rays through an understanding of composition of atom & nucleus. 5. Understand the observations, results, analysis and different concepts related to experiments of light &optics.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4

Max. Marks: 75 **Internal Assessment Marks: 20** **End Term Exam Marks: 55**	**Time: 3hrs**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.

2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.

3. Four more questions are to be attempted, select in gone 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 hhre fraction- 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 practical applications. Magnetic effect of electric current- Magnetic field and field lines, bar magnet, magnetic field and direction of field due to a current-through straight conductor and through a	8

	circular loop; solenoid, electromagnet.	
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 in different shells of the atom, atomic number and atomic mass of an atom, core shell and outer shell, valence 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
	Practicum 1. To find the focal length of a convex mirror using a convex lens. 2. To find the value of v for different values of u in the case of a concave mirror and to find the focal length. 3. To find the focal length of a concave lens using a convex lens. 4. To determine the refractive index of a glass slab. 5. To find the refractive index of a liquid using a convex lens and plane mirror 6. To determine the resistivity of different wires by plotting a graph for potential difference versus current. 7. To verify Ohm's law for metallic conductor and to determine its resistance. 8. To find the frequency of AC mains with a sonometer. 9. Use of Multi meter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses. 10. Use of Multi meter to check the working condition of diode, an LED, a resistor and a 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(15 Marks)** • Class Participation: **04 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **04 Marks** • Mid-Term Exam: **7 Marks** ➢ **Practicum (05 Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **05 Marks** • Mid-Term Exam: **Nil**		**End Term Examination :35 Marks** **20 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, New Delhi, India.
3. Modern Physics(2nd edition),byS.L.Kakani and ShubhraKakani,VivaBooks, New Delhi.
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.
6. B.Sc Practical Physics, C.L. Arora, R Chand & Co.New Delhi
7. B.Sc Practical Physics, Harnam Sing hand Dr.P.S.Hemne,S Chand&Company Ltd.
8. Optics by Ajoy Ghatak.

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: CC-3/MCC-4

<table>
<tr><td colspan="4">Session: 2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">3rd</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Thermo dynamics & Statistical Physics</td></tr>
<tr><td>Course Code</td><td colspan="3">24L5.0-PHY-301</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)</td><td colspan="3">CC/MCC</td></tr>
<tr><td>Level of the Course(As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course(if any)</td><td colspan="3">Appeared or passed the 2nd sem (B.Sc. Physical Science/ equivalent)</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">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 thermo dynamics 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.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
</table>

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

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, select in gone 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	**THERMODYNAMICS-I** Thermodynamic-systems, variables and equation of state, thermal equilibrium, Zeroth law of thermodynamics; Concept of heat, work and its sign (work done- by the system on the system) & its path dependence, 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; Absolute scale of temperature, Absolute Zero and magnitude of each division on work scale and perfect gas scale, Joule's free expansion, Joule Thomson effect, Joule-Thomson (Porous plug) experiment, conclusions and explanation, analytical treatment of Joule Thomson effect, 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, (oxygen, air, hydrogen and helium) solidification of helium below 4K, Cooling by adiabatic demagnetization	11
II	**THERMODYNAMICS-II** Derivation of Clausius-Clapeyron and Clausius latent heat equations and their significance, specific heat of saturated vapours, phase diagram and triple point of a substance, development of Maxwell thermo dynamical relations, Thermo dynamical 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 Clausius- Clapeyron and Clausius equation, variation of intrinsic energy with volume for (i) perfect gas (ii) Vander wall gas (iii) solids and liquids, derivation of Stefan's law, adiabatic compression and expansion of gas & deduction of theory of Joule Thomson effect.	11
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 macro states, thermo dynamical 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, J, 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 Searle's Apparatus. 5. To determine the co efficient of thermal conductivity of cuby Angstrom's Method. 6. To determine the co efficient of thermal 7. To determine the temperature co-efficient of resistance by platinum resistance thermometer. 8. To study the variation of thermo emf across two junction sofa 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, twocoinsand10 or more coins. 12. To determine the coefficient f 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 r.m.s 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 (20 Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum (10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **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 Thermo dynamics and its Applications, Stowe Keith, University Press (India) Pvt. Ltd, Hyderabad
4. Introductory Thermo dynamics, Pierre Infelta, Brown Walker Press, Boca Ratan, Florida
5. Fundamentals of Thermo dynamics, J.K. Johnson, University of Pittsburgh 2009
6. Thermo dynamics and Its Applications, JeffersonTester,Michael Modell,3rdEdition
7. Thermo dynamics, Statistical Thermodynamics &Kinetics, Thomas Engel, PhilipReid,2nd Edition
8. Advanced Practical Physics for students,B.L. Flint &H.T.Worsnop,1971,AsiaPublishing House.
9. Advanced level Physics Practicals, Michael Nelson and JonM. Ogborn,4th Edition, reprinted 1985, Heinemann Educational Publishers
10. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011,Kitab Mahal, New Delhi.
11. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985,Vani Publication.

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: MCC-2

<table>
<tr><td colspan="4">Session: 2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">3rd</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Mathematical Physics</td></tr>
<tr><td>Course Code</td><td colspan="3">24L4.5-PHY-102</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)</td><td colspan="3">MCC</td></tr>
<tr><td>Level of the Course(As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course(if any)</td><td colspan="3">Appearedorpassedthe2nd sem(B.Sc. Physical Science/ equivalent)</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">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 or the orthogonal properties of Hermite Polynomials, recurrence relations of complex numbers and their properties such as analyticity, poles and residues.
5. Learn about the method sto solve the mathematical problem using Fortran</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
</table>

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

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, select in gone 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-hermition 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) 1. Compute the product of two matrices of different dimension using DO loop 2. Numerical integration by Simpson1/3rule 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 $V=\sqrt{\ [\ C\ M\ G\ (\ e2 + e\ \cos\ \theta + 1\ )\ ]}$ e = 1.1, C = 3.0(E+08), M=5.893(E+24), G=6.67(E-11) for varying value ofθ from0to π. 6. To find maximum, minimum and range of a given set of numbers using computer. 7. To evaluate sum off in ite series. 8. Find the root sofa 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, d and a set of values for the variable x evaluate the function defined by. $f(x) = ax^2 + bx + c$ if $x<d$ $f(x) = 0$ if $x=d$ $f(x) = ax^2 + bx - c$ 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. Thereafter 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:	End Term Examination :50 Marks
➢ **Theory (20 Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05 Marks** • Mid-TermExam:**10 Marks**	
➢ **Practicum(10 Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **10 Marks** • Mid-Term Exam: **Nil**	**20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Mathematical MethodsforPhysicists:Arfken,Weber,2005,Harris,Elsevier
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, SusanM.Lea,2004,Thomson Brooks/Cole.
4. An Introduction to Ordinary Differential Equations, Earl ACoddington,1961,PHILearning.
5. Differential Equations,George F.Simmons,2006,TataMcGraw-Hill.
6. Essential Mathematical Methods, K.F.RileyandM.P.Hobson,2011,CambridgeUniversity 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,VivaBooks.
9. Advanced Practical Physics for students, B.L.Flint andH.T.Worsnop,1971,AsiaPublishing House
10. Advanced level Physics Practical's,MichaelNelsonandJonM.Ogborn,4th Edition, reprinted1985, Heinemann Educational Publishers
11. A Text Book of Practical Physics, I.Prakash &Ramakrishna,11th Edn,2011,Kitab Mahal
12. Engineering Practical Physics, S. Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
13. Practical 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, McGraw-Hill Pub.
17. Numerical Recipes in C: The Art of Scientific Computing,W.H.Pressetal,3rd Edn.,2007, Cambridge University Press.
18. A first course in Numerical Methods, U.M. Ascher &C. Greif,2012,PHILearning.
19. Elementary Numerical Analysis,K.E.Atkinson,3rd Edn.,2007,WileyIndia Edition.
20. Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
21. An Introduction to Computational Physics,T.Pang,2ndEdn.,2006,CambridgeUniv.Press
22. Computational Physics, Darren Walker,1st Edn.,2015,Scientific International Pvt. Ltd.
23. Mathematical Physics by H.K.Dass , Dr.Rama Verma.

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: MCC-5

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3rd		
Name of the Course	**Classical Mechanics**		
Course Code	24L5.0-PHY-303		
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 2nd 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: 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, select in gone 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	**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 as 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, the 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_o 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
	<u>Practicum</u> 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 deter mine "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 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/classtestetc.:**05 Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **10 Marks** • Mid-Term Exam: **Nil**	**End Term Examination :50 Marks** **20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Classical Mechanics by H. Goldstein(2nd Edition)
2. Mechanics, D .S.Mathur ,S.Chand & Com. Pt. Ltd., New Delhi
3. Classical Mechanics by J. C.Upadhyaya, Himalya Publishing House, Mumbai.
4. ClassicalMechanicsbyS.L.Gupta,V.Kumar&H.V.Sharma,PragatiPrakashan,Meerut.
5. Classical Mechanics by N. C. Rana & P. S. Joag, Tata McGraw-Hill Publishing company Limted, New Delhi
6. B.Sc .Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
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 PrakashanMeerut
10. Modern Approach to Practical Physics,R.K. Singla, Modern Publishers, Jalandhar
11. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop,Asia Publishing House.

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: MDC-3

<table>
<tr><td colspan="4">Session: 2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">3rd</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Physics Fundamentals-III</td></tr>
<tr><td>Course Code</td><td colspan="3">24L5.0-PHY-304</td></tr>
<tr><td>Course Type:
(CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)</td><td colspan="3">MDC</td></tr>
<tr><td>Level of the Course
(As per Annexure-I)</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">Not studied Physics subject at level4 (i.e. 10+2or equivalent)</td></tr>
<tr><td>Course Learning Outcomes (CLO):</td><td colspan="3">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 basic 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 also.
4. Have the basic 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 Fundamentals of modern Physics in this course.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>2</td><td>1</td><td>3</td></tr>
<tr><td>Contact Hours</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td colspan="2">Max. Marks:75
InternalAssessmentMarks:20 End Term Exam Marks: 55</td><td colspan="2">Time:3hrs</td></tr>
<tr><td colspan="4">Part B-Contents of the Course</td></tr>
</table>

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, select in gone question out of two-question 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); Basic idea of transistors, semiconductors in computers-integrated circuits	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. 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.	8
III	Introduction to nuclear physics- the atomic nucleus and the nucleons, atomic number, mass number, isotopes, isobars and isotones; nuclear binding energy, natural radioactivity and radioactive decay- α, β, and γ- decay; Laws of radioactivity, decay constant, relative activity, half life, average life, radioisotopes, carbon dating and other applications of radioactive isotopes; Nuclear fission reaction and its application as a source of energy(nuclear reactor) and hazardous aspect of nuclear fission; Nuclear fusion reaction and source of stellar energy.	7
IV	Magnetic Materials- Introduction, classification and applications of magnetic materials; Piezoelectricity and applications of Piezoelectric materials; Ceramics and polymers and their applications; Superconductors and their applications; Nanomaterials - Introduction to Nanomaterials, extraordinary properties of Nanomaterials, applications and limitations of nanotechnology.	7
	Practicum 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 P N 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 atleast 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: **04 Marks** • Seminar/presentation/assignment/quiz/class test etc.:**04 Marks** • Mid-TermExam:**7 Marks** ➢ **Practicum(5Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks** • Mid-Term Exam: **Nil**	**End Term Examination : 35 Marks** **: 20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Concept of Modern Physics by Arthur Beiser, McGraw-Hill Education.
2. Modern Physics(2nd edition),byS.L.Kakani and Shubhra Kakani,VivaBooks,NewDelhi.
3. Semiconductor Devices-Physic sand Technology by S.M.Sze ,Wiley(1985)
4. Laser and Non-linear optics by B.B.Laud.,Wiley Eastern Limited (1985)
5. Semiconductor Electronics by A.K.Sharma,New Age International Publisher(1996)
6. Kenneth S.Krane, Introductory Nuclear Physics,Wiley,NewYork,1988
7. Radiation detection and measurement :G.F. Knoll(Wiley,NewYork)(2000)
8. Verma and Srivastava:Crystallography for Solid State Physics
9. Rajnikant; Solid State Physics, WilleyIndia,2011.
10. J.C.Anderson,KD.Leaver,R.DRawlingsandJ.M.Alexander,MaterialsScience,4th Edition (Chapman Hall, London, 1990).
11. V.Raghavan, Materials Science and Engineering,3rd Ed.(Prentice-Hall India, New Delhi, 1993).
12. Advanced Practical Physics or students ,B.L.Flint and H.T.Worsnop,1971,Asia Publishing House

    Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn4 Edition, reprinted 1985, Heinemann Educational Publishers
13. Basic Electronics and Linear circuits by D.C. Kulshreshtha, N.N Bhargava and S.C. Gupta.
14. Nuclear Physics, D.C Tayal.
15. Nanomaterials and Nanotechnology, Sunder Singh

14. B.Sc Practical Physics, C.L. Arora, R Chand & Co.New Delhi
15. B.Sc Practical Physics, Harnam Singh and Dr. P.S.Hemne, S Chand & Company Ltd.

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: CC-4/MCC-6

Session: 2024-25	
Part A-Introduction	
Subject	Physics
Semester	4th
Name of the Course	**Waves and Optics**
Course Code	24L5.0-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 Fraunhoffer diffraction, dispersive power of grating, Rayleigh's criterion and resolving power of telescope & 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. 5. Understand various optical phenomena, principles, workings and applications optical instruments through Experiments.

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

Unit	Topics	Contact Hours
I	**INTERFERENCE** **Interference by Division of Wave front:** Young's double slit experiment, Coherence, Conditions of interference, Fresnel's biprism 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, classification of fringes in films, Interference due to transmitted light and reflected light, wedge shaped film, Newton's rings	11
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. Diffraction due to a narrow slit, diffraction due to a narrow wire. Fraunhoffer diffraction: Single slit diffraction, double slit diffraction, plane transmission grating spectrum, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of telescope and a grating.	11
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. Nicole 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, Fresnel's theory of optical rotation, Specific rotation, Polarimeters (half shade and Biquartz).	11

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: Monochromaticity, Directionality, Intensity, Coherence (Spatial & Temporal coherence); Metastable state, Excitation mechanism and 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 fibres, Applications of optical fibres, Fibre optic sensors: Fibre Bragg Grating.	12
	Practicum 1 To determine Refractive index of the material of a prism using sodium source. 2 Determination of wave length of sodium light using Newton's Rings. 3 To determine the dispersive power and Cauchy constants of the material of a prism using Mercury discharge source. 4 To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source. 5 Determination of wavelength of sodium light by using a diffraction grating. 6 Resolving power of a telescope. 7 Resolving power of a prism. 8 Resolving power of a grating. 9 Comparison of Illuminating Powers by a Photometer. 10 Measurement of(a)Specific rotation (b)concentration of sugar solution using polarimeter. 11 Ordinary and extraordinary refractive in dices for calcite or quartz. 12 To find the equivalent focal length of a lens system by nodal slide assembly. **Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.**	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory (20 Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05 Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **10 Marks** • Mid-Term Exam: **Nil**		**End Term Examination :50 Marks** **20 Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Principles of Optics, M.Bornand E.Wolf, Pergamaman Press
2. Optics by Ajoy Ghatak, 2008, Tata McGrawHill
3. Fundamentals of Optics, Jenkinsand White, McGrawHill Book Co.Ltd.,New Delhi
4. Optics, K.D.Muller,UniversityScience Books, Millally California
5. An Introductionto Interferometery,Tolansky, JohnWiley & Sons, New Delhi
6. Polarized Light Production and Use, Shurcliff, Harward UniversityPress, Cambridge, M A (USA)
7. Lasers and Non-Linear Optics, B.B. Laud, NewAge 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 by K.Thyagarajan and A.K.Ghatak,Macmillan India limited
10. A textbook of optics by N. Subrahmanyamand Brijlal,S. Chand & Company
11. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher,NewDelhi
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
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
17. Waves and Optics, S.P. Taneja.

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: MCC-7

Session: 2024-25	
Part A-Introduction	
Subject	Physics
Semester	4th
Name of the Course	**Introductory Quantum Mechanics**
Course Code	24L5.0-PHY-402
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC
Level of the Course (Asper Annexure-I)	100-199
Pre-requisite for the course (if any)	Appeared or passed the 3rd sem (B.Sc. Physical Science(H)/ equivalent)
Course Learning Outcomes (CLO):	After completing this course, he 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.

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: 3 hrs

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, select in gone 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	**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 as it	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. Eigen values 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 glycerine. 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 Photo electric Effect. 8. Determination of work function Using the Photo electric 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 a to m 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/mo fan electron by Helical method. 14. Determination of e/m of an electron by Thomson method. **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:	End Term Examination :50 Marks
➢ **Theory (20 Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05 Marks** • Mid-TermExam:**10 Marks**	
➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10Marks** • Mid-Term Exam: **Nil**	**20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Quantum Mechanics, LeonardI.Schiff,3rdEdn2010, TataMcGrawHill.
2. A Text book of Quantum Mechanics, P.M. Mathews and K.Venkatesan, 2ndEdn, 2010, McGraw Hill.
3. A.Ghatak & S.Lokanathan, Quantum Mechanics: Theory and Applications, 5thEdition, (Macmillan India , 2004)
4. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn, 2002, Wiley.
5. Quantum Mechanics, G.Aruldhas,2ndEdn2002, PHI Learning of India.
6. Quantum Mechanics, B.H.Bransden and C.J.Joachain, Pearson Education,New Delhi.
7. Introductory Quantum Mechanics, David J.Griffith,2nd Ed.2005,Pearson Education.
8. Quantum Physics of Atoms Molecules, Solids, Nucleiand Particles, R.M. Eisbergand R. Resnick, Wiley Eastern Ltd, New Delhi
9. Quantum Mechanics, GR Chatwal and SKAnand, Himalaya PublishingHouse, New Delhi
10. Quantum Physics(Berkeley Physics Course),E HWitchman,TataMcGrawHill, Chennai
11. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher,NewDelhi
12. Advanced Level Practical Physics,M.Nelkon and Ogborn,Henemann EducationBooks 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

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: MCC-8

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	4th		
Name of the Course	**Atomic spectroscopy**		
Course Code	24L5.0-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)	Appeared or passed the 3rd sem (B.Sc. Physical Science(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 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, select in gone 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 to nuclear motion online spectra (correction of finite nuclear mass), variation in Rydberg constant due to finite mass, short comings 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 megnaton), 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, Rydeburg-Ritze 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 principal and	12

	periodic classification of the elements. Interaction energy in JJ Coupling (sp, pd configuration), equivalent and non-equivalent electrons, Two valance 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
	Practicum 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 Focusing or (b) Bar Magnet. 4. To determine the wave lengths 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 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-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **10 Marks** • Mid-Term Exam: **Nil**		**End Term Examination :50 Marks** **20 Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Concep t of Modern Physics (1987), A.Beiser, McGrawHill Co Ltd. New Delhi
2. Atomic Physics (2007),J.B.Rajab,S Chand & Co,New Delhi
3. Atomic PhysicsVolII(1991),J.H.Fewkes and J.Yarwood, Oxford University Press
4. Physics of Atoms and Molecules2nd Ed (2009), B.H.Bransdenand C.J. Joachain, Pearson Education, New Delhi
5. Fundamental of Molecular Spectroscopy,ColinN.Banwell and Elaine M. McCash,McGraw Hill Co Ltd. New Delhi
6. Atomic and Nuclear PhysicsVolI(1996) S.N.Ghoshal,S.Chand&Com.,New Delhi
7. Atomic andNuclear Physics(1982),K.Gopalkrishnan, McMillanIndia,New Delhi
8. Elements of SpectroscopyS.L.Gupta,V.Kumar and R.C.Sharma,Pragati Prakashan, Meerut.
9. Geeta Sanon,BScPracticalPhysics, 1stEdn. (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 BookofPracticalPhysics, Kitab Mahal,New Delhi.
12. D.P.Khandelwal, ALaboratory Manual of Physics for Undergraduate Classes,Vani Publication House, New Delhi.
13. Nelson and Jon Ogborn, Practical Physics.
14. Atomic and Molecular Spectroscopy, Rajkumar

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: DSE-1

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	4th		
Name of the Course	**Laser Physics & Fiber Optics**		
Course Code	24L5.0-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 the3rdsem (B.Sc. Physical Science(H)/ 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: 3 hrs**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, select in gone 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, meridonal 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
	Practicum **1.** To determine wave length and angular divergence of LASER beam.	30

	2. Demonstration of Temporal coherence and measurement of wavelength of laser light using Michelson interferometer. **3.** Measurement of refractive index using Brewster angle. **4.** Febry-Parrot interferometer. **5.** Study of spectrum of iodine vapour and deduce force constant for the iodine molecule. **6.** To study modulation and demodulation (Amplitude and frequency). **7.** To study and perform Pulse Amplitude Modulation and Demodulation. **8.** To study and perform Pulse Width Modulation and Demodulation. **9.** To study and perform Pulse Position Modulation and Demodulation. **10.** To determine Numerical aperture and acceptance angle of a given optical fiber. **11.** Determination of diameter of wire using He-Ne Laser. **12.** Study double slit interference by He-Ne laser **13.** Determination of wavelength of He-Ne Laser by using a diffraction grating. **14.** To measure then numerical aperture of an optical fibre using He-Ne laser source. **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-TermExam:**10 Marks** ➢ **Practicum(10 Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **10 Marks** • Mid-Term Exam: **Nil**	**End Term Examination :50 Marks** **20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Laser and Optical Engineering P.Das, Narosa Publication.
2. Lasers and Nonlinear Optics-B.B. Land.
3. Optical Electronics-A Ghatak and K.Thyagarayan.
4. Principles of Lasers, O.Svelto,Plenum(1989)
5. Laser Physics,L.V.Tarasov, Mir (1983)
6. Quantum Electronics,A.Yavir, JohnWiley(1992)
7. Laser: Theory & Applications, A.Ghatak & K.Tayagrajan, MacmillanIndia
8. Optical fibre communication(second edition)-GerdKeiser, McGrawHill,Inc.NewYork.
9. Optical fibres and fibre optic communication systems- S.Sarkar.
10. Lasers:Principle,Types and applications-K.R.Nambiar New Age International Publishers.
11. Optical fibres and Laser: Principles and Applications, De Annuradha.

Indira Gandhi University Indira Gandhi
Undergraduate Programs
Course: DSE-1

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	4th		
Name of the Course	**Physics of Nano materials**		
Course Code	24L5.0-PHY-405		
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 3rd sem (B.Sc. Physical Science(H)/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the properties of Nano materials/ nanostructures 2. Understand the basic Physics of methods for preparation of Nano materials/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 of experimental data 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. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.

3. Four more questions are to be attempted, select in gone 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, Nano wires, 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 Nano materials/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 Nano materials	10

	Practicum 1. To analyze the crystal structure of simple cubic, FCC and associated defects using XRD data. 2. To study the crystallite by W-H analysis of XRD data. 3. To study wavelength used by using standard FCC/BCC lattice in XRD. 4. To analyze the structural of different carbonaceous material (Quantum dot, CNT, grapheme, amorphous, graphite)using RAMAN spectroscopy data. 5. To study the RAMAN spectra of Poly carbon ate monomer structure. 6. To study the band gap/energy gap of different materials using UV-visible spectroscopy data. 7. To study the Transmission spectra using UV-visible spectroscopy data. 8. To study the Absorption spectra using UV-visible spectroscopy data. 9. To study the band transition in different luminescent materials using PL spectroscopy data. 10. To study the e mission and absorption spectra of a material using PL spectroscopy data. **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: **05Marks** • Seminar/presentation/assignment/quiz/class test etc.:**05 Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab record set c.: **10 Marks** • Mid-Term Exam: **Nil**	**End Term Examination :50 Marks** **20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Nano technologies: The Physics of Nano materials Volume I, David S. Schmool.

2. Introduction to Nano science by Gabor L Hornyak and Joydeep Dutta

3. Nano physics and Nano technology by Edward L Wolf

4. Essentials inNano-science and nanotechnology byNarendra Kumar,Sunit Kumbhat

5. Nano structures & Nanomaterials: Synthesis, Properties & Applications by Guozhong Cao

6. Nano technology: Principles and Practices by Sulabha K Kulkarni

7. Introduction to Nano:Basics to Nano science and Nano technology by Amretash is Sengupta and Chandan Kumar Sarkar.

8. Physics of Nanomaterials, Sundar Singh

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: VAC-3

Session: 2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3rd (Scheme-C) / 4th (Scheme-A,B,D)		
Name of the Course	**Exploring the Journey of Indian Space Satellites**		
Course Code	24L5.0-VAC-PHY-301		
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			
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, select ing 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 pace 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 Centers 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-TermExam:**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- India's-space-programme/
4. https://www.clearias.com/indian-space-program/
5. SCIENCE366: A Chronicle of Science and Technology, BasuBiman
6. Science and technology, Praveen Chandra Mishra, Chronicle Books

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: VAC-4

<table>
<tr><td colspan="4">Session:2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">4th (scheme-C)</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Power of Physics in Everyday Life</td></tr>
<tr><td>Course Code</td><td colspan="3">24L5.0-VAC-PHY-402</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)</td><td colspan="3">VAC</td></tr>
<tr><td>Level of the Course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3"></td></tr>
<tr><td>Course Learning Outcomes (CLO):</td><td colspan="3">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 of some electrical and electronic appliances</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>2</td><td>NA</td><td>2</td></tr>
<tr><td>Contact Hours</td><td>2</td><td>NA</td><td>2</td></tr>
<tr><td colspan="2">Max. Marks: 50
Internal Assessment Marks: 15 End Term Exam Marks: 35</td><td colspan="2">Time: 3hrs</td></tr>
<tr><td colspan="4">Part B-Contents of the Course</td></tr>
<tr><td colspan="4"><u>Instructions for Paper-Setter</u>
6. Nine questions will be set in total.</td></tr>
</table>

7. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.

8. Four more questions are to be attempted, select ing 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, aero plane	8
III	**SOUND ANDOPTICS** Sound waves, Doppler Effect, power of lens, long sight and short sight, microscope, telescope, binocular camera, video camera.	8
IV	**ELECTRICALANDELECTRONICAPPLIANCES** Working of the tube light and fan, kilowatt our, 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**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

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

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: VOC-1

<table>
<tr><td colspan="4">Session:2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">3rd (Scheme-B) / 5th (Scheme- A,C,D)</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Refrigeration and Air Conditioning</td></tr>
<tr><td>Course Code</td><td colspan="3">24L5.0-VOC-PHY-301</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)</td><td colspan="3">VOC</td></tr>
<tr><td>Level of the Course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3"></td></tr>
<tr><td>Course Learning Outcomes (CLO):</td><td colspan="3">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 Application so fair-conditioning
3. Understand the principles of ice production, different methods of ice manufacturing
4. Learn about the Industrial Applications of air-conditioning</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>2</td><td>NA</td><td>2</td></tr>
<tr><td>Contact Hours</td><td>2</td><td>NA</td><td>2</td></tr>
<tr><td colspan="2">Max. Marks: 50
Internal Assessment Marks: 15
End Term Exam Marks: 35</td><td colspan="2">Time: 3hrs</td></tr>
<tr><td colspan="4">Part B-Contents of the Course</td></tr>
<tr><td colspan="4"><u>Instructions for Paper-Setter</u>
1. Nine questions will be set in total.</td></tr>
</table>

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, select in gone 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 N2, 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 N2 for fabric, quality, air conditioning in textile and photographic industries	8

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory (15 Marks)** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.:**10 Marks** • Mid-Term Exam: **NA**	**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, Newage International(P)limited, New Delhi

5. Course in Refrigeration and Air Conditioning by S.C. Arora and S.Domkundwar, Dhanpatrai and sons, Delhi

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: VOC-2

<table>
<tr><td colspan="4">Session:2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">4th</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Maintenance of Laboratory Instruments</td></tr>
<tr><td>Course Code</td><td colspan="3">24L5.0-VOC-PHY-401</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)</td><td colspan="3">VOC</td></tr>
<tr><td>Level of the Course(As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course(if any)</td><td colspan="3"></td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">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</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>2</td><td>NA</td><td>2</td></tr>
<tr><td>Contact Hours</td><td>2</td><td>NA</td><td>2</td></tr>
<tr><td colspan="2">Max. Marks: 50
Internal Assessment Marks: 15
End Term Exam Marks: 35</td><td colspan="2">Time: 3hrs</td></tr>
<tr><td colspan="4">Part B-Contents of the Course</td></tr>
<tr><td colspan="4"><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, select in gone question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.</td></tr>
</table>

Unit	Topics	Contact Hours
I	Standard Operating Procedure for Maintenance of Lab Equipment, safety rules and policies, culture of laboratory safety, responsibility and account ability 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

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory (15 Marks)** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.:**10 Marks** • Mid-Term Exam: **NA**	**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, NewDelhi
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, AtmaRam & 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

Indira Gandhi University Indira Gandhi Undergraduate Programs

Course: VOC-3

<table>
<tr><td colspan="4">Session:2024-25</td></tr>
<tr><td colspan="4">Part A-Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">Physics</td></tr>
<tr><td>Semester</td><td colspan="3">6th</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Solar Panel Installation</td></tr>
<tr><td>Course Code</td><td colspan="3">24L5.5-VOC-PHY- 601</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/ VOC/DSE/PC/AEC/VAC)</td><td colspan="3">VOC</td></tr>
<tr><td>Level of the Course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3"></td></tr>
<tr><td>Course Learning Outcomes (CLO):</td><td colspan="3">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 system sand their Installation
3. Get the knowledge about the testing method sand techniques SPV.
4. Learn about Maintenance and Troubleshooting process of SPV.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>2</td><td>NA</td><td>2</td></tr>
<tr><td>Contact Hours</td><td>2</td><td>NA</td><td>2</td></tr>
<tr><td colspan="2">Max. Marks: 50
Internal Assessment Marks: 15 End Term Exam Marks: 35</td><td colspan="2">Time: 3hrs</td></tr>
<tr><td colspan="4">Part B-Contents of the Course</td></tr>
<tr><td colspan="4">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, select in gone question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.</td></tr>
</table>

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 photovoltaic (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, sealents, 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, earthling 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
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory(15Marks)** • Class Participation: **5Marks** • Seminar/presentation/assignment/quiz/class test etc.:**10Marks** • Mid-Term Exam: **NA**		**End Term Examination :35Marks**
Part C-Learning Resources		
Recommended Books/e-resources/LMS: 1. Solar Photo voltaic technology PHI 2013, Chetan Singh Solanki 2. Solar Electrical Handbook2021, Michael Box well 3. Hand book for rooftop solar panel installation in Asia,2014Asian Development Bank (ADB)		