

Ch. Ranbir Singh University, Jind
Scheme of Examination for Undergraduate programmes
Subject: PHYSICS
According to
Curriculum Framework for Undergraduate Programmes
as per NEP 2020 (Multiple Entry-Exit, Internships and Choice Based Credit System)

Se m	Course Type	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T + P
1	CC-1/ MCC-1	B23-PHY-101	Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	MCC-2	B23-PHY-102	Mathematical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	CC-M1	B23-PHY-103	Elementary Mechanics	1	1	10	20	30	3
			Practicum	1	2	5	15	20	3
	MDC 1	B23-PHY-104	Physics Fundamentals-I	2	2	15	35	50	3
Practicum			1	2	5	20	25	3	
2	CC-2 MCC-3	B23-PHY-201	Electricity and Magnetism & EM Theory	3	3	20	50	70	3
			Practicum	1	3	10	20	30	3

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	CC-M2	B23-PHY-202	Elementary Electricity, Magnetism & Electromagnetic Theory	1	1	10	20	30	3
			Practicum	1	2	5	15	20	3
	DSEC-1	B23-PHY-203	Computational Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	MDC- 2	B23-PHY-204	Physics Fundamentals-II	2	2	15	35	50	3
			Practicum	1	2	5	20	25	3
3	CC-3/ MCC-4	B23-PHY-301	Thermodynamics & Statistical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	MCC-2	B23-PHY-302	Mathematical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	MCC-5	B23-PHY-303	Classical Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	MDC 3	B23-PHY-304	Elements of Modern Physics	2	2	15	35	50	3
			Practicum	1	2	5	20	25	3

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4	CC-4/ MCC-6	B23-PHY-401	Waves and Optics	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	
	MCC-7	B23-PHY-402	Introductory Quantum Mechanics	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	
	MCC-8	B23-PHY-403	Atomic Spectroscopy	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	
	DSE-1	B23-PHY-404	Laser Physics and Fiber Optics	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	
		Or								
		B23-PHY-405	Physics of Nano Materials	3	3	20	50	70	3	
Practicum	1		2	10	20	30	3			
5	CC-5 MCC-9	B23-PHY-501	Modern Physics	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	
	MCC-10	B23-PHY-502	Nuclear Physics	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	

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	DSE-2	B23-PHY-503	Environmental Physics	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	
	Or									
		B23-PHY-504		Non-Linear Dynamics	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	DSE-3	B23-PHY-505		Instrumentation and Analytical Methods	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
		Or								
			B23-PHY-506		Renewable Energy and Energy Harvesting	3	3	20	50	70
	Practicum				1	2	10	20	30	3
6	CC-6 MCC-11	B23-PHY-601	Electronics	3	3	20	50	70	3	
			Practicum	1	2	10	20	30	3	
	MCC-12	B23-PHY-602		Solid State Physics-1	3	3	20	50	70	3
				Practicum	1	2	10	20	30	3
	DSE-4	B23-PHY-603		Condensed Matter Physics-1	3	3	20	50	70	3

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		Practicum	1	2	10	20	30	3	
	Or								
	B23-PHY-604	Material Science	3	3	20	50	70	3	
		Practicum	1	2	10	20	30	3	
DSE-5	B23-PHY-605	Nuclear and Particle Physics	3	3	20	50	70	3	
		Practicum	1	2	10	20	30	3	
	Or								
	B23-PHY-606	Modern Characterization Techniques	3	3	20	50	70	3	
		Practicum	1	2	10	20	30	3	
7	CC-H1	B23-PHY-701	Advanced Mathematical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	CC-H2	B23-PHY-702	Statistical Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	CC-H3	B23-PHY-703	Quantum Mechanics	3	3	20	50	70	3

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		Practicum	1	2	10	20	30	3	
DSE-6	B23-PHY-704	Molecular Physics	3	3	20	50	70	3	
		Practicum	1	2	10	20	30	3	
	Or								
	B23-PHY-705	Sensors and Transducers	3	3	20	50	70	3	
		Practicum	1	2	10	20	30	3	
PC-H1	B23-PHY-706	Practicum Course	4	8	30	70	100	6	
CC-HM1	B23-PHY-707	Photonics	3	3	20	50	70	3	
		Practicum	1	2	10	20	30	3	
8	CC-H4	Electrodynamics and Plasma Physics	3	3	20	50	70	3	
		Practicum	1	2	10	20	30	3	
	CC-H5	B23-PHY-802	Advance Quantum Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
	CC-H6	B23-PHY-803	Digital Electronics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3

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DSE-7	B23-PHY-804	Solid State Physics-II	3	3	20	50	70	3
		Practicum	1	2	10	20	30	3
	Or							
	B23-PHY-805	Condensed Matter Physics-II	3	3	20	50	70	3
Practicum		1	2	10	20	30	3	
PC-H2	B23-PHY-806	Practicum Course	4	8	30	70	100	6
CC-HM2	B23-PHY-807	Nano Technology and Nano Science	3	3	20	50	70	3
		Practicum	1	2	10	20	30	3
Research	B23-PHY-R-808	Project/ Dissertation	12			300	300	

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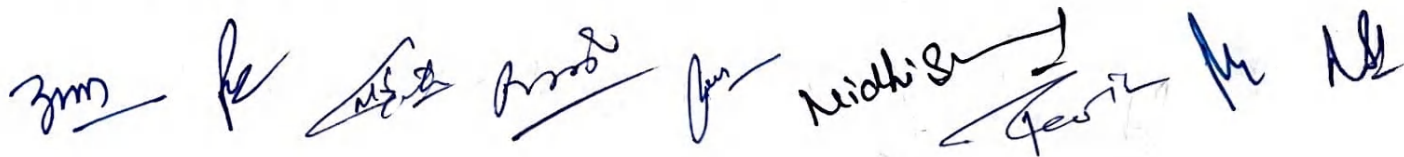
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Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: CC-1/MCC-1

Session: 2023-24			
Part A - Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Mechanics		
Course Code	B23-PHY-101		
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)	Physics as main subject at level 4 (i.e. 10+2 or equivalent)		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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 <hr style="width: 50%; margin: 10px auto;"/> <ol style="list-style-type: none"> 5. Learn to present observations, results, analysis and different concepts related to experiments of Mechanics. 		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5



Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70	Time:3hrs
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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, 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, Hooks law, Module of elasticity 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, Poisson's ratio and its limiting value, Relation between Young modulus, Bulk modulus and Poisson ratio. Derive the Relation between Young's modulus, Bulk modulus and Modulus of rigidity. Torque required for twisting cylinder, Bending of beam, bending moment and its magnitude, 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.	11
III	Special Theory of Relativity: Michelson's Morley experiments and its outcome, Postulate of special theory of relativity, Lorentz Transformation, 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.	10
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	11

	<p>problem and its solution, determination of g by means of bar pendulum, Normal coordinates and normal modes, Normal modes of vibration for given spring mass system, possible angular frequencies of oscillation of two identical simple pendulums of length (l) and small bob of mass (m) joined together with spring of spring constant (k.)</p>	
	<p>Practicum</p> <ol style="list-style-type: none"> 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 Modulus by Bending of Beam. 7. Modulus of rigidity of material of wire by Maxwell's Needle. 8. Elastic constant by Searle's method. 9. To determine the value of 'g' by using Bar pendulum. 10. To find the Poisson ratio of rubber. 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. <p>Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination.</p>	30
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory (20 Marks)</p> <ul style="list-style-type: none"> • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks <p>➤ Practicum (10 Marks)</p> <ul style="list-style-type: none"> • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil 	<p>End Term Examination : 50 Marks</p> <p>: 20 Marks</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ol style="list-style-type: none"> 1. Mechanics "Berkeley Physics Course Vol. I", Charles Kittel, Tata McGraw-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.

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Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: MCC-2

Session: 2023-24			
Part A - Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Mathematical Physics		
Course Code	B23-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+2 or equivalent)		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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 and solve Hermite equation and study orthogonal properties of Hermite Polynomials and recurrence relations of complex numbers and their properties such as analyticity, poles and residues. <hr style="width: 20%; margin-left: 0;"/> <ol style="list-style-type: none"> 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, 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 a 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 an elastic string, vibrations of rectangular and circular membrane, Power series, Method of Frobenius, Diffusion equation, Laplace's equation in problems of rectangular, cylindrical and spherical symmetry.	12
III	Fourier series and Integrals: Introduction, Evaluation of coefficients of Fourier series, cosine series, sine series, Dirichlet's theorem, Graphic; 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, A sawtooth wave, A triangular wave, Fourier Integrals, Starting with the Fourier series, deduction of expressions for the Fourier Transform	11

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	and its inverse.	
IV	<p>Beta, Gamma, Legendre and Hermite Functions: Definition of gamma function, value of $(1/2)$, Beta function, other forms of beta function, Relationship between beta and gamma function, Legendre's equation, Legendre's Polynomial, 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.</p>	11
	<p>Practicum</p> <p>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.</p> <p>To print out all natural (even/odd) numbers between given limits using computer.</p> <ol style="list-style-type: none"> 1. Compute the product of two matrices of different dimension using DO loop 2. Numerical integration by Simpson 1/3 rule 3. Fitting of a straight line using Least-Square method 4. Using array variable, find out the average and standard deviation 5. Write a program to evaluate the function $Y=1 / [C (1 + e \text{ Cos } \theta)]$ and $V=\sqrt{ [C M G (e^2 + e \text{ Cos } \theta + 1)]}$ $e = 1.1$, $C = 3.0(E+08)$, $M = 5.893(E+24)$, $G = 6.67(E-11)$ for varying value of θ from 0 to π. 6. To find maximum, minimum and range of a given set of numbers using computer. 7. To evaluate sum of finite series. 8. Find the roots of a quadratic equation. 9. To find integration of a definite integral by trapezoidal rule. 10. To find the area of a triangle, sphere and cylinder. 11. Given values for a, b, c and d and a set of values for the variable x evaluate the function defined by. $f(x) = ax^2 + bx + c \text{ if } x < d$ $f(x) = 0 \text{ if } x = d$ $f(x) = ax^2 + bx - c \text{ if } x > d$ <p>For each value of x and print the value of x and f(x). Write a program for an arbitrary number of x values.</p> <p>Note: Teachers have to give the review of FORTRAN Programming fundamentals to the students. Thereafter student will perform at least five experiments. The examiner will allot one practical at the time of end term examination.</p>	30

Suggested Evaluation Methods

Internal Assessment:

> Theory (20 Marks)

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

> Practicum (10 Marks)

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

End Term
Examination
: 50 Marks

20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. An Introduction to Ordinary Differential Equations, Earl A Coddington, 1961, PHI Learning.
5. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
6. Essential Mathematical Methods, K.F. Riley and M.P. Hobson, 2011, Cambridge University Press
7. Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications.
8. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Books.
9. Advanced 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, reprinted 1985, 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, 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.

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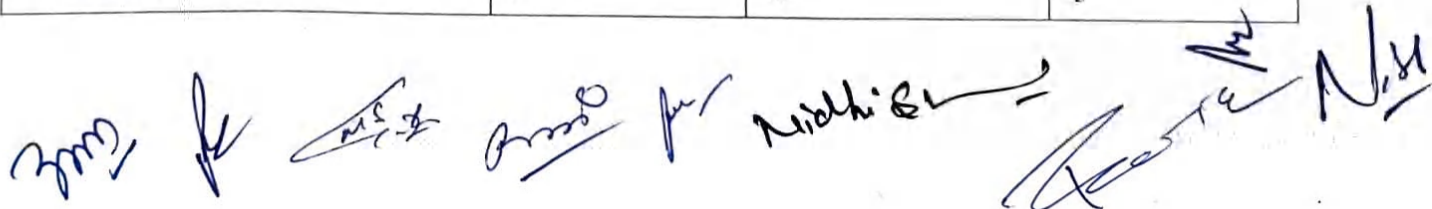
21. An Introduction to Computational Physics, T.Pang, 2 nd Edn. , 2006,Cambridge Univ. Press

22. Computational Physics, Darren Walker, 1 st Edn., 2015, Scientific International Pvt. Ltd.

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Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: CC-M1

Session: 2023-24			
Part A - Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Elementary Mechanics		
Course Code	B23-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 1 st sem		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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 body. 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 experiments and its finding 4. Analyze the two body Central Force problem and its applications <hr/> <ol style="list-style-type: none"> 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, Hooke's law, Modulus 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 experiments and its outcome, Postulate of special theory of relativity, Lorentz Transformation, Lorentz contraction, Time dilation, Relativistic transformation of velocity, relativistic addition of velocities, variation of mass-energy equivalence	4
IV	Gravitation and central force motion: Law of gravitation, Potential and field due to spherical shell and solid sphere. Motion of a particle under central force field, Normal coordinates and normal modes, Normal modes of vibration for given spring mass system, possible angular frequencies of oscillation of two identical simple pendulums of length (l) and small bob of mass (m ₀) joined together with spring of spring constant (k).	4
	<u>Practicum</u> 1. Measurement of length (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 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. 9. Elastic constant by Searle's method.	15

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Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: MDC-1

Session: 2023-24			
Part A - Introduction			
Subject	Physics		
Semester	1 st		
Name of the Course	Physics Fundamentals –I		
Course Code	B23-PHY-104		
Course Type: (CC/MCC/MDC/CC-M/ DSEC /VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Not studied Physics subject at level 4 (i.e. 10+2 or equivalent)		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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. <hr style="width: 50%; margin-left: 0;"/> <ol style="list-style-type: none"> 5. Learn to present observations, results, analysis and different concepts related to experiments of Physics Fundamental –I 		
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			

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for *10/22*

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, Physics in relation to other sciences, Impact of Physics on Society, latest developments in Science and 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.	8
III	Causes of motion- concept of force, Newton's 1st law of motion, inertia and mass; Newton's 2 nd law of motion, momentum and force; 3 rd law of motion, daily life applications of Newton's laws of motion. Universal law of gravitation and its importance, acceleration due to gravity and free fall of a body; mass and weight of an object on earth and moon, concept of thrust and pressure and importance in daily life.	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.	7
	<u>Practicum</u> 1. To measure the diameter of a small spherical / cylindrical body. 2. To measure the length, width and height of the given rectangular block. 3. To measure the internal diameter and depth of a given beaker/calorimeter and hence find its volume. 4. Use of screw gauge:(i) to measure diameter of a given wire and (ii) to	30

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Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: CC-2/MCC-3

Session: 2023-24	
Part A - Introduction	
Subject	Physics
Semester	2 nd
Name of the Course	Electricity, Magnetism and EM Theory
Course Code	B23-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 1 st sem (B.Sc. Physical Science/ equivalent)
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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

- Nine questions will be set in total.
- 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.
- 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.
- 20% numerical problems are to be set.
- 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. 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 to (1) Solenoid and (2) Toroid, properties of B: curl and divergence, Magnetic Properties of Matter: Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H and M, Electronic theory of dia and 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	<p>Time varying electromagnetic fields: Electromagnetic induction, 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.</p> <p>Electromagnetic Waves: Electromagnetic waves, Transverse nature of electromagnetic wave, energy transported by electromagnetic waves, Poynting vector, Poynting's theorem.</p>	11
IV	<p>DC current Circuits: Electric currents and current density, Electrical conductivity and Ohm's law (Review), Kirchhoff's laws for D.C. networks.</p> <p>Alternating Current Circuits: A resonance circuit, Phasor, Complex Reactance and Impedance, Analysis for RL, RC and RLC Circuits, Series LCR Circuit: (1) Resonance, (2) Power Dissipation (3) Quality Factor and (4) Band Width, Parallel LCR Circuit.</p>	10
	<p>Practicum</p> <ol style="list-style-type: none"> 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's bridge. 8. To study the Characteristics of a Series RC Circuit. 9. To study a series LCR circuit 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 Q. 11. Self-inductance by Anderson's bridge. 12. Verification of laws of electromagnetic induction. 13. Study of B-H curves of various materials using C.R.O, and determination of various parameters. <p>Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination.</p>	30
Suggested Evaluation Methods		

Internal Assessment: > Theory (20 Marks) <ul style="list-style-type: none"> • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.: 05 Marks • Mid-Term Exam: 10 Marks > Practicum (10 Marks) <ul style="list-style-type: none"> • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Marks • Mid-Term Exam: Nil 	End Term Examination : 50 Marks 20 Marks
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Electricity and Magnetism (Berkley, Phys. Course 2), Edward M. Purcell, 1986 McGraw-Hill Education
2. Electricity and Magnetism: A.S. Mahajan & A.A. Rangwala (Tata- McGraw Hill), 1988.
3. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
4. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
5. Feynman Lectures Vol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education
6. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
7. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.
8. Field and Wave Electromagnetics (2nd Edn.), David K. Cheng , Addison-Wesley Publishing Company.
9. B.Sc. 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

Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: CC-M2

Session: 2023-24	
Part A - Introduction	
Subject	Physics
Semester	2 nd
Name of the Course	Elementary Electricity, Magnetism & Electromagnetic Theory
Course Code	B23-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 2 nd sem
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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 <hr/> <ol style="list-style-type: none"> 5. Learn to present observations, results, analysis and different concepts related to experiments of Electricity and Magnetism

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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) $\nabla \cdot B = 0$ (ii) $\nabla \times B = \mu_0 J$, 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	DC current Circuits: Electric currents and current density, Electrical conductivity and Ohm's law (Review), Kirchhoff's laws for D.C. networks.	4
	<u>Practicum</u> 1. Use of Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses. 2. Low resistance by Carey Foster's bridge with calibration. 3. Determination of Impedance of an A.C. circuit and its verification.	30

Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: DSEC-1

Session: 2023-24			
Part A - Introduction			
Subject	Physics		
Semester	2 nd		
Name of the Course	Computational Physics		
Course Code	B23-PIIY-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 1 st sem (B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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. <hr style="width: 50%; margin: 10px auto;"/> <ol style="list-style-type: none"> 5. Understand how to develop a programme for a particular problem and it will improve logical thinking that helps to solve scientific problems using Python language. 		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100 Internal Assessment Marks:30 End Term Exam Marks: 70		Time:3hrs	



Part B- Contents of the Course

Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Introduction to Programming using Python: Structure of a Python Program, Functions, Interpreter shell, Indentation. Identifiers and keywords, Literals, Strings, Basic operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment Operator, Bit wise operator). Standard libraries in Python, notion of class, object and method.	11
II	Creating Python Programs: Identifiers and keywords; Literals, numbers, and strings; Operators; Expressions; Input/output statements; Defining functions; Control structures (conditional statements, loop control statements, break, continue and pass, exit function), default arguments. Mutable and immutable objects. Testing and debugging a program	12
III	Differentiation: Taylor series method, Newton's forward and backward difference formula, Stirling's formula. Numerical solutions of partial differential equations using Taylors's series method	11
IV	Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Gaussian Quadrature, Legendre- Gauss Quadrature, Numerical double integration.	11
	<u>Practicum</u> <ol style="list-style-type: none"> 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. 	30

Ch. Ranbir Singh University, Jind
Undergraduate Programs
Course: MDC-2

Session: 2023-24			
Part A - Introduction			
Subject	Physics		
Semester	2 nd		
Name of the Course	Physics Fundamentals-II		
Course Code	B23-PHY-204		
Course Type: (CC/MCC/MDC/CC-M/ DSEC /VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Not studied Physics subject at level 4 (i.e. 10+2 or equivalent)		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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 <hr style="width: 20%; margin-left: 0;"/> <ol style="list-style-type: none"> 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
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Part B- Contents of the Course

Instructions for Paper- Setter

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

Unit	Topics	Contact Hours
I	Light and optics -Nature and properties of light, its speed, frequency and wavelength; Reflection of light-types of reflection and their importance in daily life, laws of reflection. 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.	7
II	Image formation through reflection -images formed by plane mirrors, multiple images formed by two flat mirrors and optical illusions; images formed by parabolic mirrors and spherical mirrors- Concave and convex mirrors, ray diagrams, mirror equation and magnification; applications of plane and curved mirrors in daily life. Image formation through refraction - images by convex and concave lenses, ray diagrams and lens equation.	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 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.	8

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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, 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, OUP Oxford; 5th edition (23 June 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.

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