COURSES OF STUDIES

PHYSICS SYLLABUS FOR B.Sc. DEGREE UNDER SEMESTER SYSTEM

UNDER CHOICE BASED CREDIT SYSTEM

SCHOOL OF PHYSICS
GANGADHAR MEHER UNIVERSITY
AMRUTA VIHAR, SAMBALPUR-768004, ODISHA

27th Sep
~~12th March~~ 2024

HOD, Physics
G.M. University, Sambalpur

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VISION

To take the leadership in setting the standard of Physics Education in terms of Teaching and Research in the State and in the Country that will have a transformative impact on society through continual innovation in education, research and creativity.

MISSION

M1 - To make quality education accessible to students.
M2- To maintain high academic standards in teaching and research consistent with global scenario.
M2 - To encourage and facilitate faculty, researchers and students to work synergistically.
M3 - To establish collaboration with other academic and research institutes.

PROGRAMME OUTCOMES
(Chosen from the allowed list as set by UGC)

PO-1: Disciplinary Knowledge: Demonstrate comprehensive knowledge and skills of the disciplines that constitute a programme of study.

PO2-: Communication Skill: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO-3: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO-4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO-5: Research related skills: Demonstrate a sense of inquiry and capability for asking relevant questions; ability to recognize cause-and effect relationships, define problems, formulate and test hypotheses, analyze, interpret and draw conclusions from data; plan, execute and report the results of an investigation.

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PO-6: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO-7: Multicultural competencies: Possess knowledge of the values and beliefs of multiple culture and a global perspective; capacity to work effectively in multiple socio-cultural context and interact respectfully with diverse social groups

Po-8: Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PROGRAMME OBJECTIVES
(Set by School of Physics, Gangadhar Meher University)

- Apply theoretical and Experimental knowledge in Physics to solve various problems in physical sciences.
- Develop abilities and skills that encourage research and development activities and are useful in everyday life.
- Impart quality education in physics to students through well designed courses of fundamental interest and of technological importance.
- Develop the skill to plan, execute and report the result of extended experimental and theoretical Physics.

PROGRAMME SPECIFIC OUTCOMES
(Set by School of Physics, Gangadhar Meher University)

PSO-1: Demonstrate the critical knowledge in Physical Sciences.
PSO-2: Apply theoretical Knowledge of Physics to solve various practical problems.
PSO-3: Interpret various Mathematical techniques and Mathematical models of physical behavior to apply in various ICT based techniques.
PSO-4: Learn to design and conduct an experiment and understand the basic physics behind it.
PSO-5: Develop the proficiency in the handling of laboratory instruments.
PSO-6: Enhance Intellectual, Computational, Experimental and Analytical skills of Physical Science.
PSO-7: Develop aptitude of doing research through undertaking small projects and research centre visit.

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Matching

Matching Percentage	Level Indicator
> 70	3
= 60 %	2
< 50%	1

MISSION TO PO MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO6	PO-7	PO-8
M1	3	3	3	3	3	3	2	3
M2	3	2	3	3	3	2	3	2
M3	3	2	2	3	2	2	2	2
M4	1	2	1	3	1	1	1	2

PSO TO PO MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
PSO1	3	3	2	3	3	3
PSO2	1	3	3	2	3	3
PSO3	3	2	2	2	2	3
PSO4	1	2	3	3	3	2
PSO5	2	3	3	2	3	2
PSO6	1	2	2	3	1	1

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A Brief Overview of Syllabus

FIRST SEMESTER			
Course No.	**Name of Course**	**Marks**	**Credit**
Core - 1	P1. Mathematical Physics -I P2. Mechanics		4 × 2 = 8
CC-II	Mechanics		4
CC-III			
MDC	Physics		3
AECC	Odia/Hindi/Sanskrit		4
VAC	Environmental studies and disaster management		3
Total			22

SECOND SEMESTER			
Core - I	P1. Electricity and Magnetism P2. Mathematical Physics -II		4 × 2 = 8
CC-II			
CC-III	Electricity and Magnetism		4
MDC	Biophysics		3
AEC	English		4
SEC	Type setting in Latex		3
Total			22

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FIRST SEMESTER

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Semester-I

Core -I

Paper-1

Course Name- Mathematical Physics- I

Course Objective: Can able to solve differential equation and vector integrals in various problems of Physics

Prerequisites: *Elementary idea of differentiation, integration, vectors and their dot and cross products*

Syllabus

UNIT	Content	Hours
I	**Calculus-I:** Plotting of functions, Intuitive ideas of continuous, differentiable functions and plotting of curves, Approximation: Taylor and binomial series (statements only), First Order Differential Equations and Integrating Factor, Second Order Differential equations: Homogeneous Equations with constant coefficients, Wronskian and general solution, Statement of existence and Uniqueness Theorem for Initial Value Problems, Particular Integral. **Calculus-II:** Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor with simple illustration, Constrained Maximization using Lagrange Multipliers	10
II	**Vector algebra:** Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations, Vector product, Scalar triple product and their interpretation in terms of area and volume respectively, Scalar and Vector fields. **Vector Differentiation:** Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Del and Laplacian operators, Vector identities	10
III	**Vector Integration:** Ordinary Integrals of Vectors, Multiple integrals, Jacobian, Notion of infitesimal line, surface and volume elements, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss ' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs) **Dirac Delta function and its properties:** Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function, Properties of Dirac delta function	10
IV	**Orthogonal Curvilinear Coordinates:** Orthogonal Curvilinear Coordinates, Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems, Comparison of velocity and acceleration in cylindrical and spherical coordinate system.	10

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Text Books:

1. MathematicalMethodsforPhysicists,G.B.Arfken,H.J.Weber,F.E.Harris (2013,7th Edition., Elsevier)
2. Advanced Engineering Mathematics, Erwin Kreyszig (Wiley India) 2008

Reference books:

1. Mathematical Physics C. Harper (Prentice Hall India), 2006
2. Complex Variable: Schaum's Outlines Series M. Spiegel (2nd Edition , McGraw Hill Education)
3. Complex variables and applications, J. W. Brown and R.V.Churchill Mathematical Physics, Satya Prakash (Sultan Chand)
4. Mathematical Physics, B. D. Gupta (4th edition, Vikas Publication), 2009
5. Mathematical Physics and Special Relativity, M. Das, P.K. Jena and B.K.Dash (Srikrishna Prakashan),2009 6. Mathematical Physics-H.K.Dass, Dr. Rama Verma (S. Chand Publishing) , 2011

Course Outcomes:

CO1: Understand/Remember the mathematical methods to solve the 1st and 2nd order linear differential equations.
CO2: Understand the methods to solve exact differentials and to optimize a multivariable function.
CO3: Apply vector algebra to scalar and vector triple products and vector rotations.
CO4: Determine various vector derivatives associated with related physical quantities in various coordinate system (Cartesian, Spherical-polar and cylindrical).
CO5: Apply vector differentiation (grad, div and curl) for evaluation of line, surface and volume integral of scalar and vector fields.

CO-PO Mapping (Core-I, paper-I)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	2	1	1	2	1	2	3
CO2	3	1	3	2	2	1	2	2
CO3	2	3	3	3	2	2	1	1
CO4	2	2	3	2	3	2	2	1
CO5	2	2	3	2	3	2	2	1

Programme articulation matrix row for **Core-I, paper-I**

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-I	3	2	3	2	3	2	2	2

CO-PSO Mapping (Core-I, paper-I)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	2
CO3	3	3	3	3	2	2	2

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CO4	2	3	3	2	3	3	2
CO 5	2	3	3	2	3	3	2

LAB: Credit-1

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems
- Evaluation done not on the programming but on the basis of formulating the problem
- Aim at teaching students to construct the computational problem to be solved
- Students can use any one operating system Linux or Microsoft Windows

Introduction and Overview: Computer architecture and organization, memory and Input/output devices. Basics of scientific computing: Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow and overflow emphasize the importance of making equations in terms of dimensionless variables, Iterative methods. Algorithm Errors and error Analysis: Truncation and round off errors, Absolute and relative errors, Floating point computations. Systematic and Random Errors, Propagation of Errors, Normal Law of Errors Standard and Probable Error.

Review of C and C++ Programming:

Introduction to Programming, constants, Variables and Fundamentals data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data format- ting, Control statements (decision making and looping statements) (If Statement, If else Statement, NestedIfstructure, ElseIfStatement, Ternary operator, Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (1D and 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects.

Programs: Sum and average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search.

Random number generation: Area of circle, area of square, volume of sphere, value of π.

Reference Books:

✓ Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.

✓ Schaum's Outline of Programming with C++.J.Hubbard, 2000, Mc Graw- HillPub.

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✓ Numerical Recipes in C: The Art of Scientific Computing, W.H.Pressetal, 3rd Edn. 2007,
Cambridge UniversityPress.
✓ A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning.
✓ Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn. , 2007 , Wiley India Edition.
✓ Numerical Methods for Scientists and Engineers, R.W. Hamming, 1973, Courier Dover Pub.
✓ An Introduction to computational Physics, T.Pang,2ndEdn., 2006,Cam- bridge Univ.Press.

Core-I
(Paper-2)

Course Name- MECHANICS

Course Objective: learn the basic concepts involving translational motion, circular motion, rotational motion, oscillatory motion and motion of fluids, concepts of special theory of relativity and its effect on motion of bodies when observed in different frames of references.

Prerequisites: *Elementary idea of differentiation, Vectors, kinematics, dynamics, idea of vibration.*

Syllabus

UNIT	Content	Hours
I	**Rotational Dynamics:** Centre of Mass, Motion of CoM, Centre of Mass and Laboratory frames, Angular momentum of a particle and system of particles, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Perpendicular and Parallel Axis Theorems, Routh Rule, Calculation of moment of inertia for cylindrical and spherical bodies, Kinetic energy of rotation, Euler's Equations of Rigid Body motion, Motion involving both translation and rotation. Moment of Inertia of a Flywheel. **Non-Inertial Systems:** Non-inertial frames and fictitious forces, uniformly rotating frame, Laws of Physics in rotating coordinate systems, Centrifugal force, Coriolis force.	10
II	**Oscillations:** Damped oscillation. Equation of motion and solution (cases of oscillatory, critically damped and over damped) Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor, Bar Pendulum, Katers Pendulum **Elasticity:** Relation between Elastic constants, Twisting torque on a Cylinder or Wire, Bending of beams, External bending moment, Flexural rigidity, Single and double cantilever **Fluid Motion:** Kinematics of Moving Fluids: Poiseuilles Equation for	10

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	Flow of a Liquid through a Capillary Tube, Surface tension, Gravity waves and ripple **Viscosity:** Poiseuilles Equation for Flow of a Liquid with corrections.	
III	**Gravitation and Central Force Motion** Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Differential Equation of motion with central force and its solution, The first Integrals (two), Concept of power Law Potentials, Kepler's Laws of Planetary. motion, Satellites. Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).	10
IV	**Special Theory of Relativity:** Michelson-Morley Experiment and its out-come, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, Frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum.	10

Text Books:

1. Mechanics, D.S. Mathur, PS Hemne (S. Chand Publishing) ,2012
2. Introduction to Special Relativity, R. Resnick (John Wiley), 2007

Reference Books:

1. Introduction to Mechanics Daniel Klapnner and Robert Kolenkow, McgrawHill.2007
2. Mechanics by K.R Simon, 1971
3. Mechanics, Berkeley Physics, vol.1, C.Kittel, W. Knight, etal (Tata McGrawHill), 2007
4. Physics, Resnick, Halliday and Walker (8/e.2010,Wiley)
5. Theoretical Mechanics-M.R. Spiegel (Tata McGraw Hill), 2017
6. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands (Pearson),2012
7. Mechanics-M.Das, P.K.Jena and R.N. Mishra (Srikrishna Publications), 2009

Course Outcomes:

CO1: Understand the mechanics of inertial and non-inertial Physical systems.
CO2: Interpret the properties of matter to quantify various physical properties of elastic bodies also for fluid systems.
CO3: Apply laws of gravitation for various satellite systems.
CO4: Differentiate various types of oscillations.
CO5: Develop understanding of special theory of relativity and its applications.

CO-PO Mapping (Core-I, Paper-2)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8

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CO1	3	2	2	2	2	2	3	3
CO2	3	2	3	2	1	1	2	1
CO3	2	3	3	3	2	2	1	1
CO4	2	2	3	2	3	2	2	1
CO5	2	2	3	2	3	2	2	1

Programme articulation matrix row for **Core-I, Paper-2**

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-II	3	2	3	2	3	2	3	2

CO-PSO Mapping (Core-I, Paper-2)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	2
CO3	3	3	3	3	2	2	2
CO4	2	3	3	2	3	3	2
CO5	2	3	3	1	3	3	1

CORE PAPER-I LAB

MECHANICS PRACTICAL

Course Objective: learn different techniques to determine some physical quantities associated with mechanical properties of materials like surface tension, coefficient of viscosity of any liquid, moment of inertia of an object, spring constant, elastic constants, gravitational acceleration etc.
Learning Outcome.

Pre-requisites: Use of slide caliper, screw-gauge and basic idea of compound pendulums.

(Minimum 5 experiments are to be done):

1. To study surface tension by capillary rise method
2. To determine the height of a building using a Sextant.
3. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuilles method).
6. To determine the Modulus of Rigidity of a Wire by Maxwells needle.
7. To determine the value of g using Bar Pendulum.
8. To determine the value of g using Kater's Pendulum

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Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash and Ramakrishna, 11thEdn, 2011, Kitab Mahal

Course Outcomes:

CO1: Learn to find various physical parameters of substances moment of inertia, Young's modulous, gravitational acceleration etc. by physics experiments.
CO2: Compare the experimental value of acceleration due to gravity, moment of inertia with standard values.

CO-PO Mapping (Core-I, Paper-2-PRACTICAL)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	3	3	3	3	3	3	3
CO2	3	2	3	2	3	2	2	2

Programme articulation matrix row for **Core-I, Paper-2**-practical

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-II-P	3	3	3	3	3	3	3	3

CO-PSO Mapping (Core-I, Paper-2practical)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	2

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Core-II

Course Name- MECHANICS

Course Objective: learn the basic concepts involving translational motion, circular motion, rotational motion, oscillatory motion and motion of fluids, concepts of special theory of relativity and its effect on motion of bodies when observed in different frames of references.

Prerequisites: *Elementary idea of differentiation, Vectors, kinematics, dynamics, idea of vibration.*

Syllabus

UNIT	Content	Hours
I	**Rotational Dynamics:** Centre of Mass, Motion of CoM, Centre of Mass and Laboratory frames, Angular momentum of a particle and system of particles, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Perpendicular and Parallel Axis Theorems, Routh Rule, Calculation of moment of inertia for cylindrical and spherical bodies, Kinetic energy of rotation, Eulers Equations of Rigid Body motion, Motion involving both translation and rotation. Moment of Inertia of a Fly wheel. **Non-Inertial Systems:** Non-inertial frames and fictitious forces, Uniformly rotating frame, Laws of Physics in rotating coordinate systems, Centrifugal force, Coriolis force and its applications.	10
II	**Elasticity:** Relation between Elastic constants, Twisting torque on a Cylinder or Wire, Bending of beams, External bending moment, Flexural rigidity, Single and double cantilever Surface Tension: Excess pressure across a curved membrane, Quink's drop **Fluid Motion:** Kinematics of Moving Fluids: Poiseuilles Equation for Flow of a Liquid through a Capillary Tube, Surface tension, Gravity waves and ripple Viscocity: Poiseuilles Equation for Flow of a Liquid with corrections.	10
III	**Gravitation and Central Force Motion:** Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Differential Equation of motion with central force and its solution, The first Integrals (two), Concept of power Law Potentials, Kepler's Laws of Planetary motion, **Satellites:** Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Physiological effects on astronauts.	10
IV	**Oscillations:** Simple Harmonic Oscillations. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Equation of motion and solution (cases of oscillatory, critically damped and over damped) **Forced oscillations:** Transient and steady states; Resonance,	10

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	sharpness of resonance; power dissipation and Quality Factor, Bar Pendulum, Katers Pendulum **Special Theory of Relativity**: Michelson-Morley Experiment and its out- come, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time-dilation, Relativistic transformation of velocity, Frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum.	

Text Books:

1. Mechanics, D.S. Mathur, PS Hemne (S. Chand Publishing) ,2012
2. Introduction to Special Relativity, R. Resnick (John Wiley), 2007

Reference Books:

1. Introduction to Mechanics Daniel Klapnner and Robert Kolenkow, McgrawHill.2007
2. Mechanics by K.R Simon, 1971
3. Mechanics, Berkeley Physics, vol.1, C.Kittel, W. Knight, etal (Tata McGrawHill), 2007
4. Physics, Resnick, Halliday and Walker (8/e.2010,Wiley)
5. Theoretical Mechanics-M.R. Spiegel (Tata McGraw Hill), 2017
6. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands (Pearson),2012
7. Mechanics-M.Das, P.K.Jena and R.N. Mishra (Srikrishna Publications), 2009

Course Outcomes:

CO1: Understand/Remember the mechanics of inertial and non-inertial Physical systems.
CO2: Interpret the properties of matter to quantify various physical properties of elastic bodies also for fluid systems.
CO3: Apply laws of gravitation for various satellite systems.
CO4: Differentiate various types of oscillations.
CO5: Develop understanding of special theory of relativity and its applications.

CO-PO Mapping (Core-II)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	2	2	2	2	2	3	3
CO2	3	2	3	2	1	1	2	1
CO3	2	3	3	3	2	2	1	1
CO4	2	2	3	2	3	2	2	1
CO5	2	2	3	2	3	2	2	1

Programme articulation matrix row for **Core-II**

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-II	3	2	3	2	3	2	3	2

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CO-PSO Mapping (Core-II)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	2
CO3	3	3	3	3	2	2	2
CO4	2	3	3	2	3	3	2
CO5	2	3	3	1	3	3	1

CORE PAPER-II LAB

MECHANICS PRACTICAL

Course Objective: learn different techniques to determine some physical quantities associated with mechanical properties of materials like surface tension, coefficient of viscosity of any liquid, moment of inertia of an object, spring constant, elastic constants, gravitational acceleration etc.
Learning Outcome.

Pre-requisites: Use of slide caliper, screw-gauge and basic idea of compound pendulums.

(Minimum 5 experiments are to be done):

1. To study surface tension by capillary rise method
2. To determine the height of a building using a Sextant.
3. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuilles method).
6. To determine the Modulus of Rigidity of a Wire by Maxwells needle.
7. To determine the value of g using Bar Pendulum.
8. To determine the value of g using Kater's Pendulum

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I. Prakash and Ramakrishna, 11thEdn, 2011, Kitab Mahal

Course Outcomes:

CO1: Learn to find various physical parameters of substances moment of inertia, Young's modulous, gravitational acceleration etc. by physics experiments.
CO2: Compare the experimental value of acceleration due to gravity, moment of inertia with standard values.

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CO-PO Mapping (Core-II-PRACTICAL)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	3	3	3	3	3	3	3
CO2	3	2	3	2	3	2	2	2

Programme articulation matrix row for **Core-II**-practical

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-II-P	3	3	3	3	3	3	3	3

CO-PSO Mapping (Core-II-practical)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	2

Multi-disciplinary course (MDC)
Physics

Course objective:
The course has objectives to provide Basic knowledge of Physics with a special reference to electronics part.
Students will be able to know the fundamentals of electronics devices.

Course Outcome:
After completion of this course, the students will be able to
- Understand the basic of electric current as they have to deal with electronic devices.
- Get idea regarding semiconductor and components like diode.
- Know the fundamentals of transistor

UNIT-I
Electric Current, Electric Currents in Conductors, Ohm's law, Drift of Electrons and the Origin of Resistivity, Limitations of Ohm's Law, Resistivity of Various Materials, Temperature Dependence of Resistivity, Electrical Energy, Power, Cells, emf, Internal Resistance, Cells in Series and in Parallel, Kirchhoff's Rules, Wheatstone Bridge.

UNIT-II
Semiconductor: Bonds in Semiconductors, Crystals, Commonly Used Semiconductors, Energy Band Description of Semi- conductors, Effect of Temperature on Semi-conductors, Hole Current, Intrinsic &Extrinsic Semiconductor, n-type & P-Type Semiconductor, Charge on n- type and p-type Semiconductors, Majority and Minority, Carriers.

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UNIT-III

Properties of pn-Junction, Applying D.C. Voltage across pn- Junction or Biasing a pn-Junction, Current Flow in a Forward Biased pn-Junction, Volt-Ampere Characteristics of pn Junction, Important Terms, Limitations in the Operating Conditions of pn- Junction.

UNIT-IV

Transistor, Some Facts about the Transistor, Transistor Symbols, Transistor Connections, Characteristics of Common Base Connection, Measurement of Leakage Current, Common Collector Connection, Commonly Used Transistor Connection, Transistor Load Line Analysis, Practical Way of Drawing CECircuit, Performance of Transistor, Amplifier, Power Rating of Transistor, Semiconductor Devices Numbering System.

Text Books:

✓ PHYSICS PART - I TEXTBOOK FOR CLASS XII

Reference Books:

✓ Principles of Electronics by V K Mehta & Rohit Mehta

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Value added Course (VAC)

Environmental Studies and disaster management

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SECOND SEMESTER

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2ND Semester

Core-I

Paper-1

Course Name- ELECTRICITY AND MAGNETISM

Course Objective: To learn the theory of electricity-magnetism and to apply in various electromagnetic system.

Prerequisites: *Knowledge of Vector differentiation and integration, electrostatic and magnetostatic.*

Syllabus

UNIT	Content	Hours
I	**Electric Field and Electric Potential Electric field:** Electric field lines, Electric flux, Gauss Law with applications to charge distributions with spherical, cylindrical and planar symmetry, Conservative nature of Electrostatic Field. Electrostatic Potential, Potential and Electric Field of a dipole, Force and Torque on a dipole placed in electric field, Potential calculation indifferent simple cases, Laplace and Poisson's equations, The Uniqueness Theorem, Method of Images and its application to (1) Plane Infinite Sheet and (2) Sphere. Electrostatic energy of system of charges, Electrostatic energy of a charged sphere, Conductors in an electrostatic Field, Surface charge and force on a conductor.	10
II	**Magnetic Field:** Magnetic Force, Lorentz Force, BiotSavarts Law, Current Loop as a Magnetic Dipole and its Dipole Moment (analogy with Electric Dipole), Amperes Circuital Law and its application to (1) Solenoid (2) Toroid (3) Helmhotz coil, **Properties of B:** curl and divergence, Vector Potential, **Ballistic Galvanometer:** Torque on a current Loop, Current and Charge Sensitivity, Electromagnetic damping, Logarithmic damping, CDR.	10
III	**Dielectric Properties of Matter:** Electric Field in matter, Polarization, Polarization Charges, Electrical Susceptibility and Dielectric Constant, Capacitor (parallel plate, spherical, cylindrical) filled with dielectric, Displacement vector D, Relations between E, P and D, Gauss Law in dielectrics. Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Ferromagnetism, B-H curve and hysteresis. Electromagnetic Induction: Faradays Law, Lenzs Law, Self-Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations	10

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IV	**Electrical Circuits:** AC Circuits: Kirchhoffs laws for AC circuits, Complex Reactance and Impedance, Series **LCR Circuit:** (1) Resonance (2) Power Dissipation (3) Quality Factor, (4) Band Width, Parallel LCR Circuit. **Network theorems:** Kirchoff's law for electrical circuits, Ideal Constant voltage and Constant-current Sources. **Network Theorems:** Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem, Applications to DC circuits. Transient Currents Growth and decay of current in RC and LR circuits	10

Text Books:

1. Introduction to Electrodynamics - D.J. Griffiths (Pearson, 4th edition, 2015)
2. Foundations of Electromagnetic Theory-Ritz and Milford (Pearson) 4th Edition

Reference Books:

1. Classical Electrodynamics, J. D. Jackson (Wiley), 1998
2. Electricity and Magnetism D. C. Tayal (Himalaya Publishing house), 2014
3. Electricity, Magnetism and Electromagnetic Theory- S. Mahajan and Choudhury (Tata McGraw Hill)-2012
4. Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands (Pearson)-2008
5. Electricity and Magnetism, J. H. Fewkes and J. Yarwood. Vol. I (Oxford Univ. Press)

Course Outcomes:

CO1: understand the basic concepts of electric and magnetic fields.
CO2: Apply theory of magnetism for working of Ballistic galvanometer
CO3: Analyze the electromagnetic induction principles for various applications
CO4: Design various electrical networks by the principle of network theorems.

CO-PO Mapping (Core-I, Paper-1)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	2	2	2	3	2	2	2
CO2	3	2	3	1	2	2	3	2
CO3	2	3	2	2	3	2	1	1
CO4	2	1	2	1	2	2	2	1

Programme articulation matrix row for **Core-I, Paper-1**

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-III	3	3	3	2	3	2	3	2

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CO-PSO Mapping (Core-I, Paper-1)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	2
CO3	3	3	3	3	2	2	2
CO4	2	3	3	2	3	3	2

CORE PAPER I (paper-1) LAB

ELECTRICITY AND MAGNETISM

PRACTICAL

Course Objective: To understand the working of different bridge circuits and resonance circuits to determine unknown quantities like resistance, current/ voltage, inductance, capacitance etc.

Pre-requisites: Knowledge of using potentiometer, wheatstone's bridge.

SYLLABUS

1. To study the characteristics of a series RC Circuit.
2. To determine an unknown Low Resistance using Potentiometer.
3. To determine an unknown Low Resistance using Carey Fosters Bridge.
4. And compare capacitances using DeSautys bridge.
5. Measurement of field strength B and its variation in a solenoid/ artificial coil (determine dB/dx)
6. To verify the Thevenin and Norton theorems.
7. To determine self-inductance of a coil by Andersons bridge.
8. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
9. To study the response curve of a parallel LCR circuit and determine its (a) Antiresonance frequency and (b) Quality factor Q.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

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Course Outcomes:

CO1: Apply theory of electricity and magnetism to operate various electrical bridges and potentiometer.

CO-PO Mapping (Core-I, Paper-1-PRACTICAL)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	3	3	2	3	2	2	3

Programme articulation matrix row for **Core-I, Paper-1**-practical

	PO-1	PO-2		PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-III-P	3	3		3	2	3	2	2	3

CO-PSO Mapping (Core-I, Paper-1-practical)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3

Core-I

Paper-2

Course Name- MATHEMATICAL PHYSICS-II

Course Objective: Learn problem solving in Physics by understanding the concepts of Fourier series and to solve ordinary differential equations using standard procedures like separation of variables, series expansion (Fourier-type series)

Pre-requisites: *Knowledge of solving differential equations, basic integrations.*

Syllabus

UNIT	Content	Hours
I	**Fourier Series-I:** Periodic functions, Orthogonally of sine and cosine functions, Dirichlet Conditions (Statement only), Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients, Complex representation of Fourier series, Expansion of functions with arbitrary period, Expansion of non-periodic functions	10

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	over an interval, Even and odd functions and their Fourier expansions and Application, Summing of Infinite Series, Term-by-Term differentiation and integration of Fourier Series, Parseval Identity.	
II	**Frobenius Method and Special Functions:** Singular Points of Second Order Linear Differential Equations and their importance, Singularities of Bessel's and Laguerre Equations, Frobenius method and its applications differentialequations:LegendreandHermiteDifferentialEquations,Legendre andHermitePolynomials: Rodrigue's Formula, Generating Function, Orthogonally.	10
III	**Polynomials:** Simple recurrence relations of Legendre and Hermite Polynomials, Expansion of function in a series of Legendre Polynomials, Associated Legendre Differential Equation, Associated Legendre polynomials, Spherical Harmonics. **Some Special Integrals:** Beta and Gamma Functions and relation between them, Expression of Integrals in terms of Gamma Functions, Error Function (Probability Integral).	10
IV	**Partial Differential Equations:** Solutions to partial differential equations using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Conducting and dielectric sphere in an external uniform electric field. Wave equation and its solution for vibrational modes of a stretched string.	10

Text Books:

1. Mathematical Methods for Physicists, G.B.Arfken, H.J.Weber, F.E.Harris (2013, 7th Edn., Elsevier).
2. Advanced Engineering Mathematics, Erwin Kreyszig (Wiley India) 9th Edition2011
3. Mathematical Physics-H. K. Dass (S. Chand Publishing) -2011

Reference Books:

1. Mathematical Physics C. Harper (Prentice Hall India)-1978
2. Schaum's Outlines Series M. Spiegel (2nd Edition, McGraw Hill Education)-2004
3. Complex variables and applications J.W.Brown and R.V.Churchill-2017
4. Mathematical Physics, Satya Prakash (Sultan Chand)-2014
5. Mathematical Physics B.D. Gupta (4th edition, Vikas Publication-2009
6. Mathematical Physics and Special Relativity, M. Das, P.K. Jena and B.K. Dash (Srikrishna Prakashan)-2009

Course Outcomes:

CO1: Understand the Fourier series expansion of periodic and nonperiodic functions and their importance.
CO2: Solve ordinary second order differential equations using Frobenius Method
CO3: Differentiate the various types of polynomials (Legendre and hermite) in various problems of Physics.
CO4: Solve partial differential equations usingseparation of variables

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CO-PO Mapping (Core-I, apper-2)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	3	3	3	3	3	2	2
CO2	3	3	2	2	2	2	2	2
CO3	3	2	3	3	2	2	2	2
CO4	2	2	2	2	2	2	2	2

Programme articulation matrix row for **Core-I, apper-2**

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-V	3	3	2	3	3	2	2	2

CO-PSO Mapping (Core-I, apper-2)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	2	3	3
CO2	3	2	2	3	2	2	3
CO3	2	3	2	2	2	2	2
CO4	2	2	2	2	2	3	2

LAB: Credit 1

The aim of this Lab is to use the computational methods to solve physical problems. Course will consist of Lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem.

Topics

Introduction to Numerical computation software Scilab: Introduction to Scilab, Advantages and disadvantages, Scilab computation software Scilab environment, Command window, Figure window, Edit window, Variables and arrays, Initialising variables in Scilab, Multidimensional arrays, Subarray, Special values, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting (2),

Branching Statements and program design, Relational and logical operators, the while loop, for loop, details of loop operations, break and continue statements, nested loops, logical arrays and vectorization (2) User defined functions, Introduction to Scilab functions, Variable passing in Scilab, optional arguments, preserving data between calls to a function, Complex and Character data, string function, Multidimensional arrays (2) an introduction to Scilab file processing, file opening and closing, Binary I/o functions, comparing binary and formatted functions, Numerical methods and developing the skills of writing a program(2).

Curve fitting, Least square fit Goodness of fit, standard constant Deviation: Ohms law to calculate R, Hookes law to calculate spring constant **Solution of Linear system of equations by Gauss elimination Solution method and Gauss Seidal method. Diagonalization matrices, Inverse of a matrix, Eigen vectors, problems:** Solution of mesh equations of electric circuits (3meshes), Solution of coupled spring mass systems (3meshes). Solution of ODE First order Differential equation Euler, modifted Euler

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Runge-Kutta second methods Second order differential equation. Fixed difference method:

First order diferential equation

- Radioactivedecay
- Current in RC, LC circuits with DCsource
- Newtons law ofcooling
- Classical equations of motion

Second order Differential Equation

- Harmonic oscillator (no friction)
- Damped Harmonic oscillator
- Overdamped
- Critical damped
- Oscillatory
- Forced Harmonic oscillator
- Transient and Steady state solution
- Apply above to LCR circuits also

Reference Books:

✓ *Mathematical Methods for Physics and Engineers, K.FRiley, M.P.Hobson and S. J.20 Bence,*
3rd ed., 2006, Cambridge University Press.
✓ *Complex Variables, A.S. Fokas and M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press.*
✓ *Firstcourseincomplexanalysiswithapplications,D.G.ZillandP.D.Shana-han, 1940, Jones and*
Bartlett.
✓ *Simulation of ODE/PDE Models with MATLAB, OCTAVE and SCILAB: Scientific and Engineering*
Applications: A.V. Wouwer, P. Saucez, C.V. Fern- ndez. 2014 Springer.
✓ *Scilab by example: M. Affouf 2012, ISBN: 978-1479203444*
✓ *Scilab (Afreesoftwareto Matlab):H.Ramchandran,A.S.Nair.2011S.Chand andCompany*
✓ *Scilab Image Processing: Lambert M. Surhone. 2010 Beta script Publishing*

Course Outcomes:

CO1: Learn the methods of curve fitting, least square fit and standard constant deviation to find physical quantities from various laws like resistance from Ohm's law, spring constant from Hooke's law and computational technique to find solutions of linear equations, first order and second order differential equations used to describe different physical phenomena

CO-PO Mapping (Core-I, apper-2-PRACTICAL)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8

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CO1	3	3	3	2	3	2	2	3

Programme articulation matrix row for **Core-I, apper-2-practical**

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-V-P	3	3	3	2	3	2	2	3

CO-PSO Mapping (Core-I, apper-2practical)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3

Core-III

Course Name- ELECTRICITY AND MAGNETISM

Course Objective: To Learn the theory of electricity-magnetism and to apply in various electromagnetic system.

Prerequisites: *Knowledge of Vector differentiation and integration, electrostatic and magnetostatic.*

Syllabus

UNIT	Content	Hours
I	**Electric Field and Electric Potential Electric field:** Electric field lines, Electric flux, Gauss Law with applications to charge distributions with spherical, cylindrical and planar symmetry, Conservative nature of Electrostatic Field. Electrostatic Potential, Potential and Electric Field of a dipole, Force and Torque on a dipole placed in electric field, Potential calculation indifferent simple cases, Laplace and Poisson's equations, The Uniqueness Theorem, Method of Images and its application to (1) Plane Infinite Sheet and (2) Sphere. Electrostatic energy of system of charges, Electrostatic energy of a charged sphere, Conductors in an electrostatic Field, Surface charge and force on a conductor.	10
II	**Magnetic Field:** Magnetic Force, Lorentz Force, BiotSavarts Law, Current Loop as a Magnetic Dipole and its Dipole Moment (analogy with Electric Dipole), Amperes Circuital Law and its application to (1)	10

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	Solenoid (2) Toroid (3) Helmhotz coil, **Properties of B:** curl and divergence, Vector Potential, **Ballistic Galvanometer:** Torque on a current Loop, Current and Charge Sensitivity, Electromagnetic damping, Logarithmic damping, CDR.	
III	**Dielectric Properties of Matter:** Electric Field in matter, Polarization, Polarization Charges, Electrical Susceptibility and Dielectric Constant, Capacitor (parallel plate, spherical, cylindrical) filled with dielectric, Displacement vector D, Relations between E, P and D, Gauss Law in dielectrics. Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Ferromagnetism, B-H curve and hysteresis. Electromagnetic Induction: Faradays Law, Lenzs Law, Self Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations	10
IV	**Electrical Circuits:** AC Circuits: Kirchhoff's laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance (2) Power Dissipation (3) Quality Factor, (4) Band Width, Parallel LCR Circuit. Network theorems: Ideal Constant-voltage and Constant-current Sources, **Network Theorems:** Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem, Applications to DC and AC circuits. Transient Currents Growth and decay of current in RC and LR circuits.	10

Text Books:

1. Introduction to Electrodynamics - D.J. Griffiths (Pearson, 4th edition, 2015)
2. Foundations of Electromagnetic Theory-Ritz and Milford (Pearson) 4th Edition

Reference Books:

1. Classical Electrodynamics, J. D. Jackson (Wiley), 1998
2. Electricity and Magnetism D. C. Tayal (Himalaya Publishing house), 2014
3. Electricity, Magnetism and Electromagnetic Theory- S. Mahajan and Choudhury (Tata McGraw Hill)-2012
4. Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands (Pearson)-2008
5. Electricity and Magnetism, J. H. Fewkes and J. Yarwood. Vol. I (Oxford Univ. Press)

Course Outcomes

CO1: understand the basic concepts of electric and magnetic fields.
CO2: Apply theory of magnetism for working of Ballistic galvanometer
CO3: Analyze the electromagnetic induction principles for various applications
CO4: Design various electrical networks by the principle of network theorems.

CO-PO Mapping (Core-III)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	2	2	2	3	2	2	2
CO2	3	2	3	1	2	2	3	2

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CO3	2	3	2	2	3	2	1	1
CO4	2	1	2	1	2	2	2	1

Programme articulation matrix row for **Core-III**

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-III	3	3	3	2	3	2	3	2

CO-PSO Mapping (Core-III)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	2
CO3	3	3	3	3	2	2	2
CO4	2	3	3	2	3	3	2

CORE PAPER III LAB
ELECTRICITY AND MAGNETISM PRACTICAL

Course Objective:
Know the working of different bridge circuits and resonance circuits to determine unknown quantities like resistance, current/ voltage, inductance, capacitance etc.

Pre-requisites: Knowledge of using potentiometer, wheatstone's bridge.

SYLLABUS

1. To study the characteristics of a series RC Circuit.
2. To determine an unknown Low Resistance using Potentiometer.
3. To determine an unknown Low Resistance using Carey Fosters Bridge.
4. And compare capacitances using DeSautysbridge.
5. Measurement of field strength B and its variation in a solenoid/ artificial coil (determine dB/dx)
6. To verify the Thevenin and Norton theorems.
7. To determine self-inductance of a coil by Andersons bridge.
8. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
9. To study the response curve of a parallel LCR circuit and determine its (a) Ant resonance frequency and (b) Quality factor Q.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House

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2. A Text Book of Practical Physics, I. Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

Course Outcomes:

CO1: Apply theory of electricity and magnetism to operate various electrical bridges and potentiometer.

CO-PO Mapping (Core-III-PRACTICAL)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO1	3	3	3	2	3	2	2	3

Programme articulation matrix row for **Core-III**-practical

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course CC-III-P	3	3	3	2	3	2	2	3

CO-PSO Mapping (Core-III-practical)

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CO1	3	3	3	3	3	3	3

Multi-disciplinary course (MDC)
2nd Semester
BIO PHYSICS

CO-1: Basic fundamentals of living organism and its interactions in domains of Physics in biology
CO-2: Understating of heat transfer in biomaterials and its mechanism
CO-3: Diversifying of thermal, statistical physics in biological domain.
CO-4: Understating fluid mechanisms in living organism in the domain of Physics

UNIT 1:
Building Blocks & Structure of Living State: Atoms and ions, molecules essential for life, what is life Living state interactions: Forces and molecular bonds, electric &thermal interactions, electric dipoles, casimir interactions, domains of physics in biology. (10 Lectures)

UNIT 2:
Heat Transfer in biomaterials: Heat Transfer Mechanism, The Heat equation, Joule heating of tissue. Living State Thermodynamics: Thermodynamic equilibrium, first law of thermodynamics and conservation of energy. Entropy and second law of thermodynamics, Physics of many particle systems, Two state systems, continuous

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energy distribution, Composite systems, Casimircontribution of free energy, Protein folding and unfolding. (**10 Lectures**)

UNIT 3:

Open systems and chemical thermodynamics: Enthalpy, Gibbs free energy and chemical potential, activation energy and rate constants, enzymatic reactions, ATP hydrolysis & synthesis, Entropy of mixing, the grand canonical ensemble, Hemoglobin. Diffusion and transport Maxwell-Boltzmann statistics, Fick's law of diffusion, sedimentation of Cell Cultures, diffusion in a centrifuge, diffusion in an electric field, Lateral diffusion in membranes, Navier stokes equation, low Reynold's Number Transport, Active and passive membrane transport. (**10 Lectures**)

UNIT 4

Fluids: Laminar and turbulent fluid flow, Bernoulli's equation equation of continuity, venture effect, Fluid dynamics of circulatory systems, capillary action. Bioenergetics and Molecular motors: Kinesics, Dyneins, and microtubule dynamics, Brownian motion, ATP synthesis inMitochondria, Photosynthesis in Chloroplasts, Light absorption in biomolecules, vibrational spectra of bio-biomolecules. (**10 Lectures**).

Reference Books:

1. Introductory Biophysics, J. Clay comb, JQP Tran, Jones &Bartelett Publishers
2. Aspects of Biophysics, Hughe S W, John Willy and Sons.
3. Essentials of Biophysics by P Narayanan, New Age International

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Skill enhancement Course (SEC)

Type Setting in Latex

Course will be as per the model syllabus of HEI.

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