BANKURA UNIVERSITY

(West Bengal Act XIX of 2013- Bankura University Act, 2013)

Main Campus, Bankura Block-II, P.O.: Purandarpur, Dist.: Bankura, Pin- 722155, West Bengal

Office of the Secretary

Faculty Council for Undergraduate Studies

BKU/FCUG/ 187 /2023 Date: 11/07/2023

NOTIFICATION

As directed, the undersigned is pleased to inform all concerned that Bankura University has initiated the process to implement New Curriculum and Credit Framework for Undergraduate Programme, UGC 2022 (as per NEP 2020) for 4-years Undergraduate programme with Physics as Major, Minor etc. from the academic session 2023-2024. The Syllabus for the purpose will be framed and finalized as per the guidelines of appropriate authority. As an important corollary to the process, the workshop through online mode will be organized on the date mentioned herewith to get the feedback from the stakeholders. Present Students, Alumni, Guardians, Academicians and other stakeholders related to the specific programme/course are requested for their kind participation in the workshop and to present their views/ observations etc. The stakeholders may go through the draft syllabus attached herewith and convey their observations to the office of the undersigned on ugsecretaryoffice@bankurauniv.ac.in within seven days from the date of publication of notice.

Date: 14th July, 2023.

Time: 12.00 Noon onwards

Google Meet joining info

Video call link: https://meet.google.com/rrx-wsaj-ypk

Sd/-
Secretary
Faculty Council for Undergraduate Studies

BKU/FCUG/ 187(6) /2023 Date: 11/07/2023

Copy forwarded for information and necessary action to:
1. Registrar (Addl. Charge), Bankura University.
2. Dean (Officiating), Faculty Council of P.G. Studies in Arts, Science etc.
3. Chairman/Convenor, Undergraduate Board of Studies in Physics
4. System Administrator, Bankura University with request to upload this in website.
5. Secretary, Hon'ble Vice Chancellor, Bankura University.
6. Guard File

Sd/-
Secretary
Faculty Council for Undergraduate Studies

PROGRAMME AND COURSE STRUCTURE WITH CREDIT DISTRIBUTION

FOR

UG Degree Programmes with Single Major

IN

PHYSICS

(w.e.f. 2023-2024)

BANKURA UNIVERSITY

BANKURA

WEST BENGAL

PIN 722155

STRUCTURE IN PHYSICS (UG Degree Programmes with Single Major)

SEMESTER –I

Category of Course	Course Code	Course Title	Credit	Marks			No. of Hours		
				I.A.	ESE	Total	Lec.	Tu.	Lab.
1. Major (MJ) :: DSC	S/PHS/101/MJC-1	Mechanics and General Properties of Matter	**3 (Th.) + 1 (Lab.) = 4**	**10**	**25 (Th.) 15 (Lab.)**	**50**			
2. Minor Stream	S/PHS/102/MN-1	Mechanics and General Properties of Matter	**3 (Th.) + 1 (Lab.) = 4**	**10**	**25 (Th.) 15 (Lab.)**	**50**			
3. Multidisciplinary	S/PHS/103/MD-1	Physics-I	**3**	**10**	**40**	**50**			
4. Skill Enhancement Courses	S/PHS/104/SEC-1	Python Programming	**3**	**10**	**40**	**50**			
5. Ability Enhancement Course	ACS/105/AEC-1	Compulsory English	**2**	**10**	**40**	**50**			
6. Value Added Course	ACS/106/VAC-1	Environmental Studies	**4**	**10**	**40**	**50**			
Total Credit = 4+4+3+3+2+4 = 20				**Total Number of Courses = 6**					

SEMESTER –II

Category of Course	Course Code	Course Title	Credit	Marks			No. of Hours		
				I.A.	ESE	Total	Lec.	Tu.	Lab.
1. Major (MJ) :: DSC	S/PHS/201/MJC-2	Waves, Electricity and Magnetism	**3 (Th.) + 1 (Lab.) = 4**	**10**	**25 (Th.) 15 (Lab.)**	**50**			
2. Minor Stream	S/PHS/202/MN-2	Electricity and Magnetism	**3 (Th.) + 1 (Lab.) = 4**	**10**	**25 (Th.) 15 (Lab.)**	**50**			
3. Multidisciplinary	S/PHS/203/MD-2	Physics-II	**3**	**10**	**40**	**50**			
4. Skill Enhancement Courses	S/PHS/204/SEC-2	Basic Instrumentation Skills Experiments	**2 (Th.) + 1 (Lab.) = 3**	**10**	**25 (Th.) 15 (Lab.)**	**50**			
5. Ability Enhancement Course	ACS/205/AEC-2	MIL	**2**	**10**	**40**	**50**			
6. Value Added Course	ACS/206/VAC-2	Under Standing / Health and Wellness	**4**	**10**	**40**	**50**			
Total Credit = 4+4+3+3+2+4 = 20				**Total Number of Courses = 6**					

N.B. : S = Science, PHS = Physics, MJ = Major, MN = Minor, ACS = Arts Commerce Science, C = Core Course, AEC = Ability Enhancement Course, SEC = Skill Enhancement Course, DSC = Discipline Specific Core, DSE = Discipline Specific Elective, VAC = Value Added Course, MD = Multidisciplinary, I.A. = Internal Assessment, ESE = End-Semester Examination, Lec. = Lecture, Tu.= Tutorial, and Lab. = Laboratory

Bankura University Syllabus for Physics-2023-2027

Sem-I

For DSC paper

(Major)

Credit-3+1

CoreT-1–Mechanics and General Properties of Matter (3 Credits)

1. Vector Calculus

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.

Vector Integration: Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems (Elementary idea only)

2. Fundamentals of Dynamics

Reference frames, Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable- mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse.

3. Work and Energy

Work and Kinetic Energy Theorem. Conservative and non- conservative forces. Potential Energy. Qualitative study of one-dimensional motion from potential energy curves. Stable and unstable equilibrium. Elastic potential energy/ instantaneous and average power. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.

4. Rotational Dynamics

Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation. Condition of pure rolling without sleeping. Ellipsoid

of inertia.

5. Fluid Motion

Motion of ideal fluids. Streamlines and streamline flow. The continuity equation. Euler's equation for an incompressible fluid. Steady flow. Bernoulli's theorem and its applications. Toricelli's expression for the velocity of efflux of a liquid. Venturimeter. Kinematics of Moving Fluids, Poiseuille's Equation for flow of a liquid through Capillary, Bernoulli's theorem for gaseous flow-isothermal and adiabatic flow. Principle of Pitot tube.

6. Elasticity

Stress and strain. Hooke's law. Elastic moduli and their interrelationship. Strain-energy in a stretched wire. Strain-energy associated with a pure strain. Torsion of a wire. Torsional oscillations. Loaded beams. Bending moment. Stresses induced by bending. The cantilever. Beam supported at its two ends and carrying a load at any point of the beam/ reciprocal theorem of light cantilever. Strain and stress tensor.

7. 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. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS)/ energy and nature of orbits for particle motion under central force.

Reference Books

► An Introduction to Mechanics, D. Kleppner, R. J. Kolenkov,1973, McGraw-Hill.
► Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al.2007, Tata McGraw-Hill.
► Physics, Resnick, Halliday and Walker 8/e.2008, Wiley.
► Analytical Mechanics, G.R. Fowles and G.L. Cassiday, 2005, Cengage Learning.
► Feynman Lectures, Vol.-I, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education.
► Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
► University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Additional Books for Reference

► Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
► University Physics, F.W. Sears, M.W. Zemansky, H. D. Young13/e,1986, Addison Wesley.
► Physics for Scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning
► Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

CoreP-1–Mechanics and General Properties of MatterLab(1 Credit)

List of practical (Minimum *Three* from the following experiments)

1. To study the Motion of Spring and calculate, (a)Spring constant, (b)g and (c)Modulus of rigidity.
2. Determination of the Young's modulus of a material in the form of a bar by the method of flexure.
3. Determination of the coefficient of viscosity of highly viscous liquid by Stoke's method.
4. To determine the value of **g** by using Bar Pendulum.
5. To determine the value of **g** by using Kater's Pendulum.

ReferenceBooks

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, I. Prakash & Ramakrishna,11th Edn,2011, Kitab Mahal.
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

(Minor)

Credit-3+1

CoreT-1–Mechanics and General Properties of Matter(3Credits)

1. Vector Calculus

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. (Elementary idea only) Divergence and curl of a vector field. (Elementary idea only) Del and Laplacian operators. Vector identities.

Vector Integration: Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems (Elementary idea only).

2. Fundamentals of Dynamics

Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable- mass system: motion of rocket. Motion of a projectile in Uniform gravitational field, Principle of conservation of momentum, Impulse.

3. Work and Energy

Work and Kinetic Energy Theorem. Conservative and non- conservative forces. Potential Energy. Qualitative study of one-dimensional motion from potential energy curves. Stable and unstable equilibrium. Elastic potential energy/ instantaneous and average power. Force as

gradient of potential energy. Work & Potential energy, Law of conservation of Energy.

4. Rotational Dynamics

Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation.

5. Fluid Motion

Motion of ideal fluids. Streamlines and streamline flow. The continuity equation. Euler's equation for an incompressible fluid. Steadyflow. Bernoulli's theorem and its applications. Venturimeter. Kinematics of Moving Fluids, Poiseuille's Equation for Flow of a Liquid through Capillary, Bernoulli's theorem for gaseous flow-isothermal and adiabatic flow.

6. Elasticity

Stress and strain. Hooke's law. Elastic moduli and their interrelationship. Strain-energy in a stretched wire. Strain energy associated with a pure strain. Torsion of a wire. Torsional oscillations. Loaded beams. Bendingmoment. Stresses induced by bending. The cantilever. Beam supported at its two ends and carrying a load at any point of the beam/ reciprocal theorem of light cantilever.

7. 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. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness.

ReferenceBooks

► An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
► Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
► Physics, Resnick, Halliday and Walker8/e.2008, Wiley.
► Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
► Feynman Lectures, Vol.I, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education
► Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
► University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Additional Books for Reference

► Mechanics, D.S. Mathur, S. Chand and Company Limited,2000
University Physics. F. W Sears, M. W Zemansky, H.D Young13/e,1986, Addison Wesley
► Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning
► Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

CoreP-1–Mechanics and General Properties of Matter Lab (1 Credit)

List of practical (Minimum Three from the following experiments)

5. To study the Motion of Spring and calculate, (a)Spring constant, (b)**g** and(c)Modulus of rigidity.

6. To determination of the Young's modulus of a material in the form of a bar by the method Of flexure.

7. Determination of the coefficient of viscosity of highly viscous liquid by Stoke's method.

8. To determine the value of **g by** using Bar Pendulum.

5.To determine the value of **g** by using Kater's Pendulum.

Reference Books

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

► Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers

► A Text Book of Practical Physics, I. Prakash & Ramakrishna,11thEdn, 2011, Kitab Mahal

► Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

Multidisciplinary
Physics-I(3Credits)

1.Vector Analysis

Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

2. Laws of Motion

Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass.

3.Momentum and Energy

Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets.

4.Rotational Motion

Angular velocity and angular momentum. Torque. Conservation of angular momentum.

5.Gravitation

Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in aplane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications.

6.Elasticity

Hooke's law–stress-strain diagram, Elastic moduli-relation between elastic constants, poisson's ratio expression for Poisson's ratio in terms of elastic constants- work done in stretching and work done in twisting a wire – twisting couple on a cylinder –Determination of Rigidity modulus by static torsion- Torsional pendulum- Determination of Rigidity modulus

and moment of inertia by Searles method.

7. Special Theory of Relativity

Postulate of special theory of relativity. Lorentz transformations. Simultaneity and order of events. lorentz contraction. Time dilation, relativistic transformation of velocity, relativistic addition of velocities.

8. Sound

Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Linearity & Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Graphical and Analytical Methods. Lissajous Figures with equal and unequal frequency and their uses. Damped oscillations. Forced vibrations and resonance.
Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation-AbsorptioncoefficientSabine'sformula-measurementofreverberationtime-Acousticaspectsofhallsandauditoria.

9. Electrostatics

Electrostatic Field, electric flux, Gauss's law in electrostatics. Applications of Gauss's law-Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet and disc, charged conductor, Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel-plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Parallel-plate capacitor completely filled with dielectric.

Reference Books

► UniversityPhysics. F.W. Sears, M.W. Zemansky and H.D. Young,13/e, 1986. Addison-Wesley
► Mechanics Berkeley Physics, vol-1: Charles Kittel, et.al. 2007, Tata McGraw-Hill.
► Physics –Resnick, Halliday & Walker 9/e, 2010, Wiley
► Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
► University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Skill Enhancement Course (SEC T-1)(3Credits)

Python Programming

1. Introduction to programming in python:

Introduction to programming, constants, variables and data types, dynamical typing, operator sand expressions, modules, I/O statements, iterables, compound statements, indentation in python, theif-elif-else block, for and while loops, nested compound statements, lists, tuples, dictionaries and strings, basic ideas of object-oriented programming**.**

2. Introduction to Computer Programming

Sum & 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 pi (π).

3. Introduction to Numerical Computation

Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods, Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation, Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method, Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods.

Reference books

►Introduction to Numerical Analysis, S.S. Sastry, 5thEdn., 2012, PHI Learning Pvt. Ltd.
► Learning with Python-how to think like a computer scientist, J. Elkner, C. Meyer, and A. Downey, 2015, Dreamtech Press.
► Introduction to computation and programming using Python, J. Guttag, 2013, Prentice Hall India.
► Effective Computation in Physics-Field guide to research with Python, A. Scopatzand K.D. Huff, 2015, O'Rielly
► A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
► Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition.
► Numerical Methods for Scientists &Engineers, R.W. Hamming, 1973, Courier Dover Pub.
► An Introduction to computational Physics, T. Pang, 2nd Edn., 2006, Cambridge Univ. Press
Computational Physics, DarrenWalker,1stEdn., 2015, Scientific International Pvt. Ltd

Sem II

For DSC paper

(Major)

Credit-3+1

CoreT-2– Waves , Electricity and Magnetism(3Credits)

1. Oscillations

SHM: Simple Harmonic Oscillation. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.

2. Superposition of Collinear Harmonic oscillations

Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. Superposition of two perpendicular Harmonic Oscillations. Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

3. Wave Motion and Superposition of two Harmonic Waves

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.

4. Electric Field and Electric Potential

Electric field: Electric field lines. Electric flux. Gauss's Law with applications to charge Distributions with spherical, cylindrical and planar symmetry.

Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole.

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Uniqueness theorem (statement). Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

5. 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.

6. Magnetic Field

Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart'sLaw and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole).

Ampere's Circuital Law and its application to (1) infinite straight wire, (2) Infinite planar surface current, and (3) Solenoid. Properties of B: curl and divergence. Axial vector property of B and its consequences. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

7. Electromagnetic Induction and Magnetic Properties of Matter

Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current. Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B,H,M. Ferromagnetism. B-H

curve and hysteresis.

8. Electrical Circuits

AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit

ReferenceBooks

► Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw Hill.
► Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
► Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
► FeynmanLecturesVol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education
► Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
► Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol-I,1991, Oxford Univ. Press.

Core P-2–ElectricityandMagnetismLab(1Credit)

List of Practical (Minimum three from the following experiments should be done)
1. To verify the Thevenin, Norton and Maximum power transfer theorems.
2. 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)Bandwidth.
3. To study the response curve of a parallel LCR circuit and determine its (a)Anti-resonant frequency and (b) Quality factor Q.
4. Determination of the boiling point of a suitable liquid using a platinum resistance thermometer.
5. Construction of one Ohm coil.

Reference Books

► Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
► A Text Book of Practical Physics, I. Prakash &Ramakrishna,11thEd., 2011, Kitab Mahal
► Advanced level Physics Practicals, Michael Nelson and J. M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
► Engineering Practical Physics, S. Panigrahi and B.Mallick, 2015,Cengage Learning.
► A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

(Minor)

Credit-3+1

CoreT-2–Electricity and Magnetism(3Credits)

1. Electric Field and Electric Potential

Electric field: Electric field lines. Electric flux. Gauss's Law with applications to charge Distributions with spherical, cylindrical and planar symmetry.
Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem (statement only). Potential and Electric Field of a dipole. Force and Torque on a dipole.
Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Parallel-plate capacitor. Capacitance of an isolated conductor.

2. 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.

3. Magnetic Field

Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole).
Ampere's Circuital Law and its application to (1) infinite straight wire and (3) Solenoid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

4. Electromagnetic Induction

Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Reciprocity Theorem , Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and displacement current. 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.

5. Electrical Circuits

AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

6. Network theorems

Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Maximum Power Transfer theorem. Applications to simple dc circuits.

Reference Books

► Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw Hill.
► Electricity and Magnetism, Edward M. Purcell,1986 McGraw-Hill Education
► Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
► Feynman LecturesVol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education.
► Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
► Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol-I,1991, Oxford Univ. Press.

Core P-2–ElectricityandMagnetismLab(1Credit)

List of Practical (Minimum three from the following experiments should be done)
1. To verify the Thevenin, Norton and Maximum power transfer theorems.
2. 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) Bandwidth.
3. To study the response curve of a parallel LCR circuit and determine its (a)Anti-resonant frequency and (b) Quality factor Q.
4. Determination of the boiling point of a suitable liquid using a platinum resistance thermometer.
5. Construction of one Ohm coil.

Reference Books

► Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
► A Text Book of Practical Physics, I. Prakash & Ramakrishna,11thEd., 2011, Kitab Mahal
► Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
► Engineering Practical Physics, S. Panigrahi and B.Mallick, 2015,CengageLearning.
► A Laboratory Manual of Physics forunder graduate classes, D.P. Khandelwal, 1985, Vani Pub.

Multidisciplinary– Physics-II(3Credits)

1. Magnetism

Magnetostatics: Biot-Savart's law and its applications-straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro-magnetic materials.
Electromagnetic Induction
Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, Mutual inductance of two coils. Energy stored in magnetic field.

2. Maxwell`s equations and Electromagnetic wave propagation

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves.

3.Kinetic Theory of Gases

Mean free path (zeroth order), Law of equipartion of energy (no derivation) and its applications to specific heat of gases, mono-atomic and diatomic gases.

4.Theory of Radiation

Blackbody radiation, Plank's distribution law (statement only), Stefan Boltzmann Law and Wien's displacement law (statement only and graphical explanation)

5.Laws of Thermodynamics

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature.Firstlawandinternalenergy,conversionofheatintowork,VariousThermodynamicalProcesses, Applications of First Law: General Relation between CP and CV, Work DoneduringIsothermalandAdiabaticProcesses,CompressibilityandExpansionCoefficient,Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem,Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

6.Statistical Mechanics

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law Quantum statistics- Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law (Only distribution formula with explanation) comparison of three statistics.

Reference Books

► Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
► Electricity & Magnetism, J.H. Fewkes & J.Yarwood. Vol-I, 1991, Oxford Univ. Press
► Electricity and Magnetism, D. C. Tayal, 1988, Himalaya Publishing House.
► University Physics, Ronald LaneReese,2003, Thomson Brooks/Cole.
► D.J. Griffiths, IntroductiontoElectrodynamics,3rdEdn,1998, Benjamin Cummings
► Thermal Physics, S. Garg, R. Bansal and C.Ghosh, 1993, Tata McGraw-Hill.
► A Treatise on Heat, Meghnad Saha, and B.N. Srivastava,1969, Indian Press.
► Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
► Heat and Thermodynamics, M.W. Zemasky and R. Dittman, 1981, McGrawHill
► Thermodynamics, Kinetic theory & Statistical Thermodynamics, F.W. Searsand
► G.L. Salinger.1988, Narosa
► University Physics, Ronald LaneReese,2003, Thomson Brooks/Cole.
► Thermal Physics, A. Kumar and S.P.Taneja, 2014,R.chandPublications.

Skill Enhancement Course (SEC T-2)(3Credits)

Basic Instrumentation Skills Experiments:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil/ transformer.
7. Study the layout of receiver circuit.
8. Troubleshooting a circuit
9. Balancing of bridges

Laboratory Exercises

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q-meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.

Open Ended Experiments

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)