PHYSICS

SEMESTER II

MAJOR COURSE- MJ 2:

(Credits: Theory-04, Practicals-02)

Marks: 15 (5 Attd. + 10 SIE: 1Hr) + 60 (ESE: 3Hrs) = 75 Pass Marks: Th (SIE + ESE) = 30

Instruction to Question Setter for Semester Internal Examination (SIE 10+5=15 marks):

The Semester Internal Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 10 Marks, (b) Class Attendance Score (CAS) including the behavior of the student towards teachers and other students of the college of 5 marks.

End Semester Examination (ESE 60 marks):

There will be two group of questions. Group A is compulsory which will contain three questions. Question No.1 will be very short answer type(not MCQ) consisting of five questions of 1 mark each. Question No.2 & 3 will be short answer type of 5marks each. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to be answered.

Note:

1. Group A is compulsory question 1 (very short answer type)(max 50 words) will have eight question out of which five has to be answered (1 marks each).
2. For question 2 and 3, each question will have one alternative question (to be answered in 100 words) (5 marks each).
3. There may be subdivisions in each question of group B. There will be five question out of which any three are to be answered (15 marks each)

ELECTRICITY & MAGNETISM

Theory: 60 Lectures

Course Learning Outcomes:

After going through the course, the student should be able to

- Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.
- Apply Gauss's law of electrostatics to solve a variety of problems.
- Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.

- Describe the magnetic field produced by magnetic dipoles and electric currents.
- Understand the dielectric properties, magnetic properties of materials and the phenomena of electromagnetic induction.
- Describe how magnetism is produced and list examples where its effects are observed.

- Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.
- In the laboratory course the student will get an opportunity to verify various laws in electricity and magnetism such as Lenz's law, Faraday's law and learn about the construction, working of various measuring instruments.
- Should be able to verify of various circuit laws, network theorems elaborated above, using simple electric circuits.

Skills to be learned:

- This course will help in understanding basic concepts of electricity and magnetism and their applications.
- Basic course in electrostatics will equips the student with required prerequisites to understand electrodynamics phenomena.
- Derive expression for a) Energy density, b) Momentum density, c) Angular momentum density of the electromagnetic field.

Course Outline:

Electric field and Potential, Dielectric properties of matter, Magnetic field, Magnetic properties of matter, Electrical circuits, Ballistic Galvanometer, Transients, Alternating current, Network Theorem, AC bridges.

Course Content:

Electric Field and Electric Potential

Conservative nature of Electrostatic Field.Electrostatic Potential.Laplace's and Poisson equations. Solution of Laplace's equation in Cartesian co-ordinates, Application of Laplaces equation, Gauss's law in integral and differential form, Potential and Electric Field of a dipole. Force and Torque on a djpole. Multipole expansion (monopole, dipole & quadrupole), Electrostatic energy of system of charges.Electrostatic energy of a charged sphere. (10 Lectures)

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. (5 Lectures)

Transients:- Growth and decay of current in L-R circuit, Charging and discharging of capacitor in R-C, & L-C-R circuits. Time constant. (5 Lectures)

Alternating current:- J-Operator & vector method, reactance and impedance, Theory of circuits containing L, C, & R and their different combinations, Series L-C-R circuit, resonance, quality factor, sharpness of resonance, band width, Acceptor circuit, power dissipation, parallel L-C-R circuit, dynamic resistance, antiresonance, rejector circuit, current magnification, quality factor.(10 Lectures)

Network theorem:- Ideal constant voltage and constant current source, Network theorem, Thevenin's theorem, Norton's theorem and their applications, Maximum power transfer theorem and superposition theorem.(4 Lectures)

A.C. bridge:- Anderson's bridge, De- Sauty's bridge and Owen's bridge and their vector diagram representation, (3 Lectures)

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) Solenoid and (2) Toroid. 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. (10 Lectures)

Magnetic Properties of Matter: Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B, H, M., Concept of Para, Dia and Ferro magnetism, Langevin's theory of diamagnetism and Paramagnetism, Weiss theory of ferromagnetism, Curie Weiss law , Curie temperature, ferromagnetic domain, Hysteresis and hysteresis loss. (10 Lectures)

Ballistic Galvanometer: Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping.. (3 Lectures)

Reference Books:

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
2. Electricity and Magnetism, P. K. Chakraborty, New Age International Pvt. Ltd.
3. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
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. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
9. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
10. Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill

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PHYSICS PRACTICAL- MJ 2 LAB:

Marks : Pr (ESE: 3Hrs) =25 Pass Marks: Pr (ESE) = 10

Instruction to Question Setter for End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment (1)	= 15 marks
Practical record notebook	= 05 marks
Viva-voce	= 05 marks

PRACTICALS:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De' Sauty's bridge.
6. To verify the Thevenin and Norton theorems.
7. To verify the Superposition, and Maximum power transfer theorems.
8. To determine self- inductance of a coil by Anderson's bridge.
9. 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.
10. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant

frequency and (b) Quality factor Q.

11. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer

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 & 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. Engineering Practical Physics, S.Panigrahi and B.Mallick, 2015, Cengage Learning.

5. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

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

7. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

8. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal