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| **Course Title** | **ELECTRICITY AND MAGNETISM** |
| **Course Code** | **MPHY-221** |
| **Credit Hours** | **CH3** |
| **Pre- requisites** | **FSc / A-Level (Physics) or equivalent** |
| **Learning outcomes** | To develop understanding of basic concepts of electricity and magnetism and to strengthen problem solving skills. |
| **Contents** | **Electric field and Guass's Law:** Electric charge, conductors and insulators, Induced charges, Coulomb's law, Electric fields and force, Electric field lines, electric dipole, electric flux, Gauss' law and its applications (planar, cylindrical and spherical symmetry), Charges on conductors, Electric Potential, Equipotential surfaces, potential gradient, Electrostatic accelerator.<br>**Capacitance, dielectrics and electric current:** Capacitors, Capacitance, series and parallel, energy storage in capacitors, dielectrics, induced charge, Gauss's law in dielectrics, current, resistivity, resistance, Ohm's law, electromotive force, energy and power, metallic conductors, resistors in series and parallel, Kirchhoff's rules, electrical measuring meters, RC circuits, power distribution systems.<br>**Magnetic field, forces and sources:** Magnetism, magnetic fields, field lines and flux, charged particle in magnetic field, applications, magnetic force on a current carrying conductor, force and torque on a current loop, DC motor, Hall effect, Magnetic field of a moving charge, magnetic field of a current element and conductor, circular loop, force between parallel conductor, Ampere's law and applications, Magnetic materials.<br>**Electromagnetic induction and inductance:** Faraday's and Lenz's laws, motional electromotive force, induced electric fields, Eddy currents, Displacement current and Maxwell's equations, superconductivity, mutual inductance, self-inductance and inductors, magnetic field energy, RL, LC, LRC series circuits.<br>**Alternating current and electromagnetic waves:** Phasors and alternating current, resistance and reactance, LRC series circuit, power in alternating current, resonance, transformers, Maxwell's equations, plane electromagnetic waves and speed of light, sinusoidal electromagnetic waves, energy and momentum in electromagnetic waves, standing electromagnetic waves. |
| **Teaching-learning Strategies** | Classroom teaching / Lecturing |
| **Assignments- Types and Number** | Problem sheets: 3-4 |
| **Assessment and Examinations** | Mid-Term Assessment: 35%<br>Formative Assessment: (25%): It includes classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.<br>Final Term Assessment: 40% |
| **Text Books** | 1. Fundamentals of Physics (Extended), by D. Halliday, R. Resnick and J. Walker, Wiley, 10th Edition, (2013).<br>2. Physics Vol. II (extended) by Resnick, Halliday and Krane, 5th Edition, Wiley, (2001).<br>3. Electricity and Magnetism by E. M. Purcell, D. J. Morin, Cambridge, (3rd Ed.), (2013).<br>4. University Physics with Modern Physics, by R. A. Freedman, H. D. Young, and A. L. Ford (Sears and Zeemansky), Addison-Wesley-Longman, 13th Edition, (2010).<br>5. Physics for Scientists and Engineers, by R. A. Serway and J. W. Jewett, Golden Sunburst Series, 8th Edition, (Physics for Scientists and Engineers, with Modern Physics, by D. C. Giancoli, Addison-Wesley, 4th Edition (2008). |

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| **Course Title** | **THERMAL PHYSICS** |
| **Course Code** | **MPHY-213** |
| **Credit Hours** | **CH 3** |
| **Pre- requisites** | **FSc / A-Level (Physics) or equivalent** |
| **Learning outcomes** | The objective of this course is to develop an understanding about the laws and methods of thermodynamics and enable the student to apply their knowledge to practical systems. |
| **Contents** | **Temperature and heat:** Temperature and thermal equilibrium, thermometers, kelvin scales, thermal expansion, Ideal gas, quantity of heat, calorimetry, phase changes, heat transfer.<br>**Thermal properties:** Equations of states, van der Waals equation, molecular properties of matter, molecular view of pressure, mean free path, kinetic model of ideal gas, heat capacities, molecular speeds and energies.<br>**First law of thermodynamics:** Thermodynamics systems, work done, Thermodynamics states, internal energy, Zeroth and First law of Thermodynamics, Thermodynamics processes, internal energy and heat capacities of an ideal gas, Adiabatic processes,<br>**Second Law of thermodynamics:** Heat engines, combustion engines, refrigerator, Second law of **t**hermodynamics, Perpetual motion, Carnot Cycle, Carnot engine, Entropy, Microscopic interpretation of entropy, Efficiencies of real engines, thermoelectricity, Seebeck effect, Peltier effect, thermocouple.<br>**Applications of thermodynamics:** Thermodynamics functions and equations, TdS equations, Joule-Thomson effect, Stephan law, Adiabatic demagnetization, production and measurements of low temperatures, Third law of thermodynamics, Clausius-Clapeyron equation. |
| **Teaching-learning Strategies** | Classroom teaching / Lecturing |
| **Assignments- Types and Number** | Problem sheets: 3-4 |
| **Assessment and Examinations** | Mid-Term Assessment: 35%<br>Formative Assessment: (25%): It includes classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.<br>Final Term Assessment: 40% |
| **Text Books** | 1. Physics (Volume 1 & 2) by R. Resnick, D. Halliday and K. S. Krane (5th Edition), Wiley (2002)<br>2. Concepts in Thermal Physics, by S. J. Blundell and K. M. Blundell, Oxford, (2009)<br>3. University Physics with Modern Physics by H. D. Young, R. A. Freedman (14th Edition), Addison-Wesley (2015).<br>4. Principle of Modern Thermodynamics by B. N. Roy, Institute of Physics, London (1995)<br>5. Physics for Scientists and Engineers by R. A. Serway and J. W. Jewett (8th Edition), Golden Sunburst Series (2010).<br>6. An Introduction to Thermal Physics, D. V. Schroeder, Pearson, (1999).<br>7. Heat and Thermodynamics by M. W. Zemansky (7th Edition), McGraw Hill (1999). |