M. Sc. I Year	MPH-C201				Semester-II
	E.M. THEORY & ELECTRODYNAMICS				
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of three sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of 6 marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Learning objectives

One of the objectives of this course is to introduce electrostatics and magnetostatics in detail. It develops the concepts in electric field and scalar potential as well as magnetic field and vector potential. The unified description of these two i.e. electrodynamics in view of the Maxwell's equations is another objective of this course. The students will not only learn about fields (i.e. electric, magnetic and electromagnetic), but also about the radiations from various types of dipoles and localized sources. They will be taught to calculate power radiated in each case. Students will then be introduced by the formation and characteristics electromagnetic waves and their propagation in detail.

UNIT-I

ELECTROSTATICS

Boundry value problems, Conductor and uniqueness theorem, Method of images, Image and induced surface charge, Force and energy, Problem of sphere and charge, Multipole expansion potential- Monopole and dipole terms in detail, Electric fields of a dipole, Dielectrics- deceptive parallel, Force and energy in dielectric system.

(12 Lectures)

UNIT-II

MAGNETOSTATICS AND FIELDS IN MATTER

The divergence and curl of B, Ampere's law, Magnetic vector potential, Boundary conditions and multipole expansion, Magnetisation-Dia, para and ferromagnets, Effect of Magnetic field in atomic orbits, Bound currents and their interpretation, Magnetic field inside matter, Ampere's law in magnetised materials, Linear and nonlinear media.

(12 Lectures)

UNIT-III

ELECTRODYNAMICS

Maxwell's equation and magnetic charge, Equation inside matter, Boundary conditions, Potential formulations, Scalar and vector potentials, Gauge transformations, Coulomb and Lorentz gauge, Lorentz force law in potential form, Energy and momentum, Newton's third law in electrodynamics, Poynting theorem.

(12 Lectures)

UNIT-IV

ELECTROMAGNETIC WAVES

Polarisation, Boundary condition, Reflection and refraction, E.M. waves in nonconducting media, Monochromatic plane wave in vacuum, Energy and momentum of E.M. waves, Reflection and transmission at normal incidence and at oblique incidence, Electromagnetic waves in conductors.

(12 Lectures)

UNIT-V

ELECTROMAGNETIC RADIATION

Dispersion -Frequency dispersion, Frequency dependence of ε, μ and σ in noncondutors. Waveguides: Rectangular and circular waveguides. Coaxial transmission line, Dipole radiation, Retarded potentials, Electric dipole radiation.

(12 Lectures)

Text Books / Reference Books

1. Introduction to Electrodynamics - Griffith D.J
2. Classical Electricity and Magnetism - Panofsky & Phillips
3. lassical Electrodynamics -Bittencourt
4. Electricity & Magnetism - A. Kip, McGraw Hill

Learning outcomes

After the completion of this course, students are able to know about electromagnetic fields of different sources. The use of four vectors and tensors throughout in different derivations make students enable to deal with advance level courses in theoretical physics. During this course, the students come to know about the difference between covariance and invariance of various physical quantities. One of the major advantages of this course is that it is closely related to the real life where the electromagnetic waves are playing important role in our day-to-day routine. This course also make students enable to learn about the wave guides and transmission