

## Curriculum plan of Prof. Rachana Kumar

### For Odd Session 2025-26 B.Sc. (H) III Year, Sem V Paper-Electromagnetic Theory

3 periods per week

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                           | Allocation of Lectures | Schedule to be followed                                                                                                                                               |
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| Unit - I: Review of Maxwell's equations; Coulomb gauge and Lorentz gauge; Poynting's theorem and Poynting's vector; electromagnetic (em) energy density; physical concept of electromagnetic field energy density                                                                                                                                                                                                                                 | 6 lectures             | August-September<br>Syllabus<br>Reference books<br>Derivations and Numericals                                                                                         |
| Unit – II: EM wave propagation in unbounded media: Plane em waves through vacuum and isotropic dielectric medium: transverse nature, refractive index, dielectric constant, wave impedance. Plane em waves through conducting medium: relaxation time, skin depth, attenuation constant; Wave propagation through dilute plasma: electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth.                        | 10 lectures            |                                                                                                                                                                       |
| Unit – III: EM waves in bounded media: Boundary conditions at a plane interface between two media; reflection and refraction of plane em waves at plane interface between two dielectric media - Laws of reflection and refraction; Fresnel's formulae for perpendicular and parallel polarization, Brewster's law; reflection and transmission coefficients; total internal reflection, evanescent waves; metallic reflection (normal incidence) | 9 lectures             | September-October<br>Derivations and Numericals<br>Problem Set and Model paper pattern discussion.<br><br>Class test on unit end<br>Discussion of Important questions |

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| Unit – IV: Polarization of EM waves: Propagation of em waves in an anisotropic media; symmetric nature of dielectric tensor; Fresnel's formula; uniaxial and biaxial crystals; light propagation in uniaxial crystal; double refraction; polarization by double refraction; Nicol prism; ordinary and extraordinary refractive indices; production and detection of plane, circular and elliptically polarized light; phase retardation plates: quarter wave and half wave plates Optical rotation; Biot's laws for rotatory polarization; Fresnel's theory of optical rotation; specific rotation | 13 Lectures | October – November<br>Assignment for IA<br>Derivations and Numerical<br>ICT presentations                                      |
| Unit – V: Wave guides: Planar optical wave guides; planar dielectric wave guide ( $-d/2 < x < d/2$ ); condition of continuity at interface; phase shift on total reflection; Eigenvalue equations; phase and group velocity of guided waves; field energy and power transmission (TE mode only)                                                                                                                                                                                                                                                                                                    | 7 lectures  | Till end November (dispersal of classes)<br><br>Derivations and Numericals<br>Doubts solving for students<br>Course completion |