# 23EC2201-EM WAVES AND TRANSMISSION LINES

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| **CourseCategory:** | ProgramCore | **Credits:** | 3 |
| **CourseType:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Prerequisite:** | Basic concepts of coordinate system & fundamentals of electricity & magnetism | **Sessional Evaluation:ExternalEvaluation:****TotalMarks:** | 3070100 |
| **CourseObjectives** | Students under going this course are expected: |
| 1. To understand and analyze different laws and theorems of electrostatic fields.
2. To study and analyze different laws and theorems of magnetostatic fields.
3. To Analyze Maxwell’s equations in different forms.
4. To learn the concepts of wave theory and its propagation through various mediums.
5. To get exposure to the proper cties of transmission lines.
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| **CourseOutcomes** | At the end of this course the student will be able to: |
| CO1 | Learntheconceptsofwavetheoryanditspropagationthroughvariousmediums.(L2) |
| CO2 | Understand the properties of transmission lines and their applications.(L2) |
| CO3 | Apply the laws & theorems of electrostatic fields to solve there lated problems(L3) |
| CO4 | Gain proficiency in the analysis and application of magnetostatic laws andtheorems(L4). |
| CO5 | Analyze Maxwell’s equations in different forms.(L4) |
| **CourseContent** | **UNITI****Review of Co-ordinate Systems ,Electrostatics:** Coulomb’s Law, Electric FieldI ntensity ,Electric Flux Density ,Gauss Law and Applications ,Electric Potential ,Maxwell’s Two Equations for Electrostatic Fields ,Energy Density ,Illustrative Problems. Convection and Conduction Currents ,Dielectric Constant ,Poisson’s and Laplace’s Equations ;Capacitance–Parallel Plate, Coaxial Capacitors, Illustrative Problems.**UNITII****Magnetostatics:** Biot-Savart Law, Ampere’s Circuital Law and Applications, Magnetic Flux Density, Maxwell’s Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere’s Force Law, Inductances and Magnetic Energy,Illustrative Problems**.****Maxwell’s Equations (Time Varying Fields):** Faraday’s Law and Transformer EMF, Inconsistency of Ampere’s Law and Displacement Current Density, Maxwell’s Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface, Illustrative Problems.**UNITIII****EM Wave Characteristics:** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance ,Poynting Vectorand Poynting Theorem, |

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| **CourseContent** | Illustrative Problems.**UNITIV****Transmission Lines - I** : Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations ,Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines,distortion less lines,Illustrative Problems.**UNITV****Transmission Lines – II:** Input Impedance Relations, Reflection Coefficient, VSWR ,Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Lowlos sradio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart–Construction and Applications, Quarter wave transformer ,Single Stub Matching, Illustrative Problems. |
| **Text BooksandReferenceBooks** | **Textbooks:**1. ElementsofElectromagnetics,MatthewN.O.Sadiku,4thEdition,OxfordUniversity Press,2008.
2. ElectromagneticWavesandRadiatingSystems,E.C.JordanandK.G.Balmain,2ndEdition,PHI,2000.

**References:**1. Electromagnetic Field Theory and Transmission Lines, G. S. N. Raju, 2nd Edition,PearsonEducation,2013.
2. EngineeringElectromagnetics,WilliamH.HaytJr.andJohnA.Buck,7thEdition,TataMcGrawHill,2006.
3. Electromagnetics,JohnD.Krauss,3rdEdition,McGrawHill,1988.
4. Networks,Lines,andFields,JohnD.Ryder,2ndEdition,PHIpublications,2012.
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| Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low) |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |