Programme: **M. Sc.**	Year: I	Semester: VII
Subject: **Physics**		
Course Code: **B010703T**	Course Title: **Electrodynamics and Relativity**	

Course Outcomes (COs)

After the completion of the course, students will (/be/able to)

1. familiar with the fundamental features and concepts of transmission lines and waveguides and their applications.
2. have basic understanding of tensor analysis.
3. explain the fundamental concepts of geometry of space time in special relativity and the principle of causality.
4. have knowledge about Lorentz group and electromagnetic field tensor.
5. perform Lorentz transformation of electric and magnetic fields.
6. derive equation of motion of a charge particle and determine force on it when it being in static and uniform electric fields.

Credit: **4**	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical-Research (in hours per week): L-T-P-R: 3-1-0-0

Unit	Topics	**No. of Lectures**
I	Tensor analysis: General coordinate transformation; contravariant, covariant and mixed tensors; metric tensor; raising and lowering of indices; contraction of indices; Pseudo-tensors.	9
II	Minkowsky space and Lorentz transformations: Geometry of space-time in Special Relativity; Minkowsky metric; Light cone and principle of causality; Invariance of Minkowsky metric under Lorentz transformations; Lorentz group; Proper, improper and orthochronous transformations.	9
III	Covariant formulation of electromagnetism: Charge-current density four-vector; Scalar and Vector potentials; Gauge invariance; Electromagnetic potential four-vector; Electromagnetic field tensor; Lorentz transformation of electric and magnetic fields; Invariants of the electromagnetic field.	9
IV	Electromagnetic field of a charge moving with constant velocity, Covariant form of Lorentz force law; Dynamics of charged particles in static and uniform electric fields.	8
V	Guided electromagnetic waves: Transmission Lines and Wave Guides, Modes in a rectangular wave guide, Cavity resonators.	10

Suggested Readings

1. The Feynman Lectures on Physics, Vol. II: Mainly Electromagnetism and Matter, Richard Feynman, Robert B. Leighton, Matthew Sands (Pearson Education India, 2012)
2. Schaum's Outline of Vector Analysis, Murray R. Spiegel (McGraw-Hill Education)
3. Introduction to Electrodynamics, 4th edition, D. J. Griffiths (Pearson Education India, 2015)
4. A first Course in General Relativity, 2nd edition, Bernard Schutz (Cambridge University Press, 2009)
5. Field and Wave Electromagnetics, 2nd edition, David K. Cheng (Pearson Education India, 2014)
6. Introduction To Electromagnetic Theory, 1st edition, Ram Kripal (Booksclinic Publishing, 2021)

Suggested Digital Platforms/Web Links

1. Swayam – Government of India, https://swayam.gov.in/explorer?category=Physics

2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Uttar Pradesh Higher Education Digital Library, https://heecontent.upsdc.gov.in/SearchContent.aspx 4. MIT Open Learning – Massachusetts Institute of Technology, https://openlearning.mit.edu/ 5. edX, https://www.edx.org/course/subject/physics
Course Prerequisites
Physics as a major subject in B. Sc.