

Ex:MATH/H/32/6.6/A/87/2019

**BACHELOR OF SCIENCE EXAMINATION, 2019**

(3rd Year, 2nd Semester)

**MATHEMATICS (HONOURS)**

**Mathematical Physics and Relativity - II**

**Paper : 6.6(a)**

Time : Two hours

Full Marks : 50

Use a separate Answer-Script for each part.

**PART - I (25 marks)**

Answer q.no. 4 and any *two* from the rest.

1. (a) Write Ampere's law and obtain the correction made by Maxwell for time dependent field. Hence write Maxwell's equations for Electromagnetic field. 2+4  
(b) Define scalar and vector potentials. State the Lorentz condition which satisfies these potentials. What is gauge invariance ? 2+2+2
2. (a) Obtain Poynting theorem. Write the physical interpretation of the theorem. 4+3  
(b) Prove that a uniform plane wave propagating in the x-direction has no x-component in E. 5

(Turn Over)

(2)

3. (a) Derive the wave equations for a medium for which conductivity is not zero and conduction current exists. 6
- (b) Derive the relation between E and H in a uniform plane wave. Define impedance. 6
4. What is sinusoidal wave? 1

**PART - II (25 marks)**

Answer any *five* questions. 5x5=25

5. Can an event at  $t=0, x=0$  affect the event occurred at P in the future light cone region? Discuss Geometrical representation of simultaneity.
6. Establish a relationship between spacetime diagrams in S and  $S^1$  frames.
7. Show that momentum of photon and Minkowski force for photon are null vectors.
8. Show that Maxwell's equations are invariant under Lorentz Transformations.

(3)

9. Find the relativistic Hamiltonian function. Also find its classical limit.
10. What is displacement current? Why was it introduced by Maxwell?
11. Write equation of continuity in covariant form. Also show that it is invariant under Lorentz Transformation.

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