

**B.Sc. PHYSICS  
SIXTH SEMESTER  
ELECTROMAGNETIC THEORY  
BSP – 601 [SPECIAL REPEAT]  
[USE OMR SHEET FOR OBJECTIVE PART]**

**SET  
A**

Duration : 3 hrs.

Full Marks : 70

Time : 30 min.

**( Objective )**

Marks : 20

*Choose the correct answer from the following:*

**1X20=20**

- Out of the following options which one can be used to produce a propagating electromagnetic wave?
  - A chargeless particle
  - An accelerating charge
  - A charge moving at constant velocity
  - A stationary charge
- If the amplitude of the magnetic field is 0.1 mT, then amplitude of the electric field for a electromagnetic waves is
  - 3 V/m
  - 0.3 V/m
  - 30 KV/m
  - 300 V/m
- Which of the following is correct?  
At a point on the interface of the two different media (symbols have their usual meaning)
  - tangential component of  $\vec{E}$  is continuous
  - tangential component of  $\vec{H}$  is continuous
  - normal component of  $\vec{D}$  is continuous
  - normal component of  $\vec{B}$  is discontinuous
- According to the Poynting theorem, the energy flow per unit time out of any closed surface is
  - Integral of  $\vec{S}$  over the length of the surface
  - Integral of  $\vec{S}$  over the area of the surface
  - Differential of  $\vec{S}$  over the length of the surface
  - Differential of  $\vec{S}$  over the area of the surface
- Which of the following is not an electromagnetic wave?
  - X-ray
  - Sound waves
  - Microwaves
  - Radiowaves
- For an EM wave in free space the Electric Field  $E$  and Magnetic Field  $H$  are
  - Perpendicular to each other and along the direction of propagation
  - Both are in the same phase
  - Perpendicular to each other and also perpendicular to the direction of propagation
  - Both b and c

7. In an electromagnetic wave the field vectors are functions of
- only space coordinate
  - only time coordinate
  - both space and time coordinates
  - none
8. Electromagnetic waves propagate through a linear homogeneous medium at a speed of
- $\sqrt{\mu_0 \epsilon_0}$
  - $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$
  - $\frac{1}{\mu_0 \epsilon_0}$
  - $\mu_0 \epsilon_0$
9. A perfect dielectric acts as a
- Perfect transmitter
  - Perfect reflector
  - Bad transmitter
  - Bad reflector
10. If the phase difference between two rays is  $\pi/2$  and the angle of incidence is equal to  $\pi/4$ , the emergent light is
- Linearly Polarized
  - Elliptically Polarized
  - Circularly Polarized
  - Non-Polarized
11. When the angle of incidence is equal to the Brewster angle, the reflected and transmitted rays are:
- Parallel to each other
  - Perpendicular to each other
  - Anti-parallel to each other
  - None of the above
12. Brewster's law in terms of refractive index can be Expressed as [symbols have their usual meaning]
- $\mu = \sin \theta_p$
  - $\mu = \cos \theta_p$
  - $\mu = \tan \theta_p$
  - $\mu = \cot \theta_p$
13. The skin depth is a phenomenon observed in
- Insulators
  - Dielectrics
  - Conductors
  - Semiconductors
14. The working of Nicole prism is based on the phenomenon of
- Refraction
  - Dispersion
  - Diffraction
  - Double Refraction
15. According to the law of Malus, the intensity of polarized light emerging through the analyzer varies as [symbols have their usual meaning]
- $I_0 \sin^2 \theta$
  - $I_0 \cos^2 \theta$
  - $I_0 \cos \theta$
  - $\frac{I_0}{2} \cos^2 \theta$
16. A Nicol prism does not act as a polarizer when
- The angle of incidence is less than the critical angle for the O-ray
  - The angle of incidence is greater than the critical angle for the O-ray
  - The angle of incidence is less than the critical angle for the E-ray
  - The angle of incidence is greater than the critical angle for the E-ray



- b. Prove that electromagnetic waves are transverse in nature.
4. Obtain the expression for reflection coefficient (R) and transmission coefficient (T) when the electromagnetic wave hits the interface between two linear media at normal incidence. Hence show that,  
 $R + T = 1$ . 10
5. a. Describe briefly the linear and circular polarization of electromagnetic waves. 5+2+3=10  
 b. Define Brewster's angle  $\theta_B$ ?  
 c. Deduce the value of Brewster angle for a glass slab placed in air, ( $n = 1.5$  where n is the refractive index).
6. a. State and prove Poynting vector theorem. 8+2=10  
 b. Explain the physical significance of Poynting vector?
7. a. Explain the phenomenon of double refraction. 2+2+6=10  
 b. What is a Nicol prism?  
 c. Explain how a Nicol prism acts as a polarizer and an analyser.
8. a. What is waveguide? Give an example of it. 3+3+4=10  
 b. What do you mean by TE, TM and TEM modes of a waveguide?  
 c. Write down one difference between uniaxial and biaxial crystals? Give one example of each.

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