

## UNIT-III

### ELECTROMAGNETIC WAVES

#### SHORT ANSWER QUESTIONS:

1. What do you mean by an electromagnetic wave?
2. Explain the scalar and vector fields along with examples?
3. Define gradient of a scalar field?
4. Define divergence of a vector field?
5. Write an equation for  $\text{div } A$ , If  $A$  be a vector function differentiable at  $(x,y,z)$  in region of space.
6. Define curl of a vector field.
7. Write an equation for  $\text{curl } A$ , If  $A$  is a function differentiable at  $x,y,z$  in a space.
8. State Stokes theorem and write an expression for it.
9. State Gauss divergence theorem and write an expression for it.
10. Write an equation for Gauss law of electricity (or) write Maxwell's first equation of electromagnetic Induction.
11. Write an equation for Gauss law for magnetism (or) write Maxwell's second equation of electromagnetic Induction.
12. Write an equation for Faraday's law for electromagnetic induction (or) write Maxwell's third equation of electromagnetic Induction.
13. Write an equation for Ampere's law by Maxwell (or) write Maxwell's fourth equation of electromagnetic Induction.
14. Define Poynting vector.
15. State Poynting theorem and write an equation for it.
16. Define Poynting Vector.
17. Write an equation for electromagnetic wave propagation in non-conducting medium.
18. Write an equation for electromagnetic wave propagation in conducting medium.

#### LONG ANSWER QUESTIONS:

1. State Stokes's theorem for curl and prove it.
2. State Gauss's theorem for divergence and prove it.
3. State and prove Gauss law for electric and magnetic fields.
4. Derive Maxwell's equations. and write it both in differential form and integral form.
5. State Poynting Theorem and derive an expression for Poynting vector by using Maxwell equations.
6. Derive an expression for electromagnetic wave propagation in non-conducting medium.
7. Derive an expression for electromagnetic wave propagation in conducting medium.

## **FIBER OPTICS:**

### **SHORT ANSWER QUESTIONS:**

1. What is an Optical fiber?
2. Explain the phenomenon of total internal reflection?
3. What principle behind the functioning of an optical fiber and write the formula for critical angle.
4. Mention the conditions for total internal reflection.
5. Define acceptance angle.
6. Define acceptance cone.
7. Define Numerical aperture.
8. Write a relation between Numerical aperture and acceptance angle of an optical fiber.
9. What is fractional Index change (or) fractional difference of refractive indices (or) relative difference of refractive indices.
10. Write a relation between Numerical aperture and fractional Index change.
11. What is V-number? Write an expression for V-number.
12. Mention the medical applications of optical fibers.
13. What are sensors? Mention different types of fiber optic sensors.

### **ESSAY QUESTIONS:**

1. Explain the principle of an optical fiber.
2. Describe the construction of a typical optical fiber and give the dimensions of various Parts.
3. Define the acceptance angle and numerical aperture. Obtain an expression for the numerical aperture of an optical fiber.
4. Derive expression for numerical aperture in terms of fractional index change of an optical fiber.
5. Describe different types of fibers by giving the refractive index and propagation details.  
(OR) ) Describe in detail the different types of optical fibers with neat diagrams.
- 6.a) Explain Step-Index single mode fiber along with its refractive index profile.  
b) Why it is of reflective type? (or) Explain the propagation (or) transmission of signal in step-Index single mode fiber.
- 7.a) Explain Step-Index multi-mode fiber along with its refractive index profile.  
b) Why it is of reflective type? (or) Explain the propagation (or) transmission of signal in step-Index multi-mode fiber.
- 8..a) Explain Graded-Index fiber along with its refractive index profile.  
b) Why it is of reflective type? (or) Explain the propagation (or) transmission of signal in Graded -Index fiber
9. Distinguish between light propagation in step index and graded index optical fibers.
10. Discuss the various advantages of communication with optical fibers over the Conventional coaxial cables.
10. Write a brief note on fiber optic sensors.

9. Draw the block diagram of an optical fiber communication system and explain the function of each block.
10. Mention the important applications of optical fibers.
11. Explain fiber optic medical endoscopy and also mention various medical applications of an optical fiber.