2021

APPLIED PHYSICS

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. a) Write the four Maxwell's equations of Electromagnetic theory in differential and integral form. 4

   b) Show that Electromagnetic wave is transverse in nature. 6

   c) Consider the electric field intensity E of an electromagnetic signal in a free space is given by $\vec{E} = 100\ cos\ \omega\ \left(t - {}^{z}/_{V_a}\right) \hat{a}_x\ V/m$. Find the magnetic field intensity $\vec{H}$ of the signal. 4

   d) State Poynting theorem. What is a Poynting Vector? 4

   e) What is skin depth? Write its expression. 2

2. a) What is optical fibre ? Write some of its applications. 5

   b) Explain the mechanism of propagation of light signal through a step index multimode fibre. 5

   c) Define acceptance angle and numerical aperture of the optical fibre? Compute the NA and the acceptance angle of an optical fibre from the following data. $\mu_1\ (core) = 1.55$ and $\mu_2(cladding) = 1.50$. 6

   d) A glass fibre has core material of refractive index 1.466, cladding material of refractive index 1.46. If it is 4

surrounded by air, compute the critical angle (i) at the core cladding interface (ii) cladding-air boundary.

3. a) Explain the Optical Fibre Communication System with block diagram. 8

b) Write short notes on (1) Attenuation (2) Dispersion (3) V parameter 3×3=9

c) Write the differences between Step Index Fibre and Graded Index Fibre. 3

4 Choose the Correct Answer 2×5=10

a) Can a 1000 Micrometer thick material be called as thin film or not?
(a)Yes (b) No (c) Uncertain

b) The emission of particles from source in DC sputtering takes place using
(a)Heat (b) high voltage (c) Both

c) The sputtering process is classified as DC or RF depending on the type of power supply used
(a)True (b) False (c) Uncertain

d) In sputtering, the entire surface of the target is the source, unlike evaporation process where a point (where electron beam hits) on the target is the source.
(a)True (b) False (c) Uncertain

The X- ray diffraction technique is used to study

	e)	(a) the phase purity (b) crystal structure (c) None	
	f)	What is Ferroelectricity? What are the parameters which can be extracted from P-E measurements?	5+5
5	a)	Write down the merits and demerits of various deposition techniques	5
	b)	Write a short note on DC sputtering techniques and its working principle	5
	c)	Write a note on the working principle of Scanning Electron Microscope (SEM)	5
	d)	Write a short note on working principle of XRD	5
6	a)	What are Ferromagnetic Materials?	5
	b)	What is difference between Spontaneous and Saturation Magnetization?	5
	c)	What is Curie Temperature? How it is determined?	5+5