Total number of printed pages: 02

Programme (UG)/III/UPH301

2023

APLIED 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 Fundamental Equations in the electromagnetic field in differential form and mention the laws from which they are obtained.	4 + 4 = 8
	b)	Show that the electromagnetic wave is transverse in nature.	6
	c)	For an electromagnetic wave propagating through free space, evaluate electric field intensity $\vec{E}$ if the magnetic field is given by $\vec{H} = 0.25\varepsilon_o cos\,(\omega t - 10z)\hat{a}_y \;\; (A/m)$.	6
2.	a)	Write and State Poynting theorem. What is the physical significance of the Poynting vector?	2 + 2 + 1 = 5
	b)	For an electromagnetic wave in a conducting medium, how that the magnetic field vector and electric filed vector are not in the same phase.	5
	c)	What is attenuation? What is the reason for the attenuation of electromagnetic waves in a conducting medium? Define Skin depth.	1+ 2+2 =5
	d)	For silver the conductivity $\sigma = 3 \times 10^8 mho.m^{-1}$. Calculate the attenuation and skin depth at a frequency of 10GHz.	5
3.	a)	Explain the structure of an optical fibre? Write some of applications of optical fibre and its advantages over the usage of conventional transmission line.	2+2+2 = 6
	b)	Discuss the differences of different types of optical fibre.	4
	c)	What do you mean by the local Numerical Aperture of an optical fibre? A glass fibre has core material of refractive index 1.466, cladding material of refractive index 1.46. If it is surrounded by air, compute the critical angle (i) at the core cladding interface (ii) cladding-air boundary. Also calculate Numerical Aperture and acceptance angle.	2 + 8 = 10
4.	a)	What are material dispersion and waveguide dispersion in optical fibre communication? Define V-parameter.	4

	b)	Explain the details of the optical fibre communication system with block diagrams.	8
	c)	What is intermodal dispersion? A step index fibre has a core of refractive index 1.500 and a cladding of refractive index 1.489. Calculate the temporal broadening of a pulse in ns/km. Also, calculate the spread in space for a length of 1km of the fibre.	8
5.	a)	What is thin film? Write the some of the important applications of thin film in devices.	5
	b)	Discuss about any two deposition techniques of thin film.	5 x 2 =10
	c)	Mention the usage of following thin film characterization techniques. X-Ray Diffraction(XRD), Scanning Electron Microscope (SEM), UV/VIS Spectrometer (UV-VIS), Energy dispersive X-ray Spectroscopy (EDX), Transmission Electron Microscopy (TEM)	5
6.	a)	Explain about the four types of polarization in dielectric material. What are piezoelectric materials?	8+2 =10
	b)	Explain about the different types of magnetic materials. What is Curie Temperature? How is Curie temperature determined for a ferromagnetic materials?	10
7.		Write short notes on (any four) X-Ray Diffractometer (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Differential Scanning Calorimeter (DSC)	5 x 4 = 20