Total number of printed pages: **2** **Programme (UG)/III/UPH301**

2022

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 Fundamental Equations in the electromagnetic field in integral and differential form?	4
	b)	Show that electromagnetic wave is transverse in nature.	5
	c)	Show that electromagnetic energy is equally contributed by electric and magnetic fields equally.	5
	d)	*Evaluate displacement current density* $\vec{D}$ *and electric field intensity* $\vec{E}$ *for the given field* $\vec{H} = 0.25\varepsilon_o cos\ (\omega t - 10z)\hat{a}_y\ (A/m)$.	6
2.	a)	Derive the Poynting theorem starting from Maxwell's fundamental equations in electromagnetism.	6
	b)	What is the physical significance of the Poynting vector? The average intensity of the sunlight reaching the earth's surface is about 1300 $W.m^{-2}$. Calculate the strength of the electric field of the incoming sunlight.	2 + 5 = 7
	c)	What is the reason for the attenuation of electromagnetic waves in a conducting medium?	2
	d)	Define Skin depth. For silver the conductivity $\sigma = 3 \times 10^7 mho.m^{-1}$. Find its skin depth at a frequency of 10GHz.	2 + 3 = 5
3.	a)	What is the structure of an optical fibre?	3
	b)	Mention and explain briefly the different types of optical fibre.	5
	c)	Write some of the applications of optical fibre and its advantages over the usage of conventional transmission lines.	3+3 = 6
	d)	What do you mean by the Numerical Aperture of an optical fibre?	2
	e)	A fibre has a refractive index of its core of 1.46 and cladding of 1.45. Compute the NA and the fractional difference in the refractive index.	4
4.	a)	Write short notes on attenuation, dispersion and V-parameter in the optical fibre communication system.	2 x 3 = 6
	b)	Explain the propagation mechanism of the light signal through an optical fibre.	4
	c)	Explain the details of the optical fibre communication system with block	10

diagrams.

5.	a)	What are thin films?	2
	b)	Write short notes (any two): Physical Vapor Deposition (PVD), Chemical Vapor Deposition (CVD), Sputtering Technique.	5 x 2 =10
	c)	Mention the usage of the 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
	d)	Write some of the important applications of thin film in devices.	3
6.	a)	Explain the four types of polarization in the dielectric material.	8
	b)	What are piezoelectric materials? Mention a few important piezoelectric materials most used.	2 + 3 = 5
	c)	What are ferromagnetic materials? What is Curie Temperature?	4
	d)	Mention some of the important applications of ferromagnetic material.	3
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