Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

[Total No. of Questions: 09]
Uni. Roll No. .....

[Total No. of Pages: 02]

EVENING

11 JAN 2023

Program: B.Tech. (Scheme 2018)
Semester: 4th
Name of Subject: Electromagnetic field theory
Subject Code: PCEC-108
Paper ID: 16224
Scientific calculator is allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part – A

[Marks: 02 each]

Q1.

a) Explain briefly "Degenerate modes" and "Evanescent modes".

b) 'Waveguides act a high pass filter'. Justify the statement.

c) Summarise Maxwell's equation in differential form and hence deduce them for static fields.

d) In free space $\mathbf{H}$=100 cos (wt-10x) a_z A/m. Compute displacement current density 'J_d'.

e) Cite four major differences between Transverse Electric and Transverse Magnetic waves.

f) State Poynting theorem. Write the units of poynting vector.

Part – B

[Marks: 04 each]

Q2. The magnetic field H of a plane wave has a magnitude of 5 m A/m in a medium defined by ε_r=4, μ_r=1. Determine the maximum energy density in the plane wave.

Q3. If E (z,t)= 40 cos(10^8 t+40z)$\mathbf{a}_y$ A/m. Identify the amplitude, frequency, phase constant and the wavelength.

Q4. Derive expression for wave impedance for TM waves in parallel planes.

Q5. A low loss transmission line of 100Ω characteristic impedance is connected to a load of 400 Ω. Determine the reflection coefficient & VSWR.

Q6. Compare the types of polarisations: Linear, circular and elliptical.

Q7. Evaluate the wave equations for EM wave travelling in a waveguide.

Part – C

[Marks: 12 each]

Q8. Derive the condition for a transmission line to be distortionless. Using the derived condition, compute the values for propagation constant, characteristic impedance and phase velocity of a distortionless line.

OR

Derive the attenuation factor for TE waves travelling in parallel planes.

Q9. A parallel plate guide has plate separation of 4cm. The frequency of impresses signal is 7GHz. Check whether TE_1 or TM_1 mode propagates or not. Also, compute $(Z_g)_{TE1}$ and $(Z_g)_{TM1}$.

OR

$x < 0$ defines region 1 and $x > 0$ defines region 2. Region 1 is characterized by $\mu_{r1} = 3.0$ and region 2 is characterized by $\mu_{r2} = 5.0$. If the magnetic field in region 1 is given by $H_1 = 8.0\ a_x + 1.5\ a_y - 3.0\ a_z$, A/m. Compute H_2 and its magnitude.

****