R18

Code No: 154AV

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, November/December - 2020
ELECTROMAGNETIC FIELDS AND WAVES
(Electronics and Communication Engineering)

Time: 2 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Using Gauss's law, find $\overline{E}$ at any point due to long infinite charged wire.
b) Derive the expression for energy stored and energy density in a static electric field. [8+7]

2.a) What is the capacitance between two concentric spheres and obtain an expression for it.
b) State and explain Biot-Savart law. [7+8]

3.a) Define and explain the terms scalar and vector magnetic potential. How to determine these quantities for a magnetic field.
b) A steady current element $10^{-3}\,\overline{a_z}$ Am is located at the origin in free space. What is the magnetic field $\overline{B}$ due to this element at point (0,0,1) m. [8+7]

4.a) Write Maxwell's equations for free space in both point and integral form.
b) Derive boundary conditions between two perfect dielectrics. [8+7]

5.a) Explain modified ampere's law for time varying fields.
b) Derive the equation of continuity for time varying fields. [8+7]

6.a) A plane wave travelling in air is normally incident on a material with $\varepsilon_r = 4$ and $\mu_r = 1$ Find the reflection and transmission coefficients.
b) State and prove Poynting theorem. [8+7]

7.a) Explain why the wavelength in a rectangular waveguide is greater than the free space wavelength.
b) The magnetic field in the TE_{10} mode in a rectangular waveguide is given by $H_\omega = -\frac{j\beta a}{\pi}\sin\frac{\pi x}{a}e^{j(\omega t-\beta z)}$, $H_z = \cos\frac{\lambda x}{a}e^{j(\omega t-\beta z)}$, $H_y = 0$. Using Maxwell's equations determine the components of the electric field E. [7+8]

8.a) Derive the field component for TE waves in a metal rectangular waveguide.
b) Explain about dominant and degenerate modes. [9+6]

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