

R18

Code No: 154AV

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, September/October - 2023

ELECTROMAGNETIC FIELDS AND WAVES

(Electronics and Communication Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) State Gauss law. [2]
- b) Describe about capacitance and capacitors. [3]
- c) What is vector magnetic potential? [2]
- d) Write about magnetic flux and flux density. [3]
- e) Summarize the expression for Maxwell's equation in integral form. [2]
- f) Mention the significance on displacement current. [3]
- g) Define Poynting theorem. [2]
- h) Describe the characteristics of uniform plane wave? [3]
- i) What is cut off frequency? [2]
- j) Define Phase Velocity and group velocity. [3]

PART – B

(50 Marks)

2. Derive the equation of potential due to point, line, and surface and volume charge and obtain the relation between E and V. [10]

OR

- 3.a) Derive the capacitance of general spherical capacitor.
- b) For a conducting sphere of 2 cm in diameter, covered with a layer of polyethylene with $\epsilon_r = 2.26$ and 3 cm thick, Estimate the capacitance. [5+5]

4. From the Biot-Savart's law, write the expression for magnetic field intensity at a point P and distance R from the infinitely long straight current carrying conductor. [10]

OR

- 5.a) Distinguish between magnetic scalar potential from the vector potential.
- b) Examine the magnetic field intensity within a magnetic material where $M=150A/m$ and $\mu=1.5 \times 10^{-5} H/m$. [5+5]

- 6.a) Deduce the detailed steps for the derivation of electromagnetic boundary conditions for a time varying fields.

- b) Find the transformer EMF induced in a stationary closed path in a time varying B field? [5+5]

OR

7. Illustrate the integral and point form of Maxwell's equations for static fields. [10]

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8. Examine the expressions for the transmission and reflection coefficients at the interface of two media for normal incidence. [10]

OR

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9. Estimate the frequency of a wave and the conductivity of the medium for a uniform plane wave travelling at a velocity of 2.5×10^5 m/s having a wavelength of 0.25 mm in a non-magnetic good conductor. [10]

10. Write a note on:

a) Electromagnetic Spectrum and Bands

b) Rectangular Waveguides. [5+5]

OR

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11.a) Derive the field component for TE waves in a metal rectangular waveguide.

b) Explain why the wavelength in a rectangular waveguide is greater than the free space wavelength. [6+4]

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