Sub Code: BECT504/BECT502 **ROLL NO……..……..**

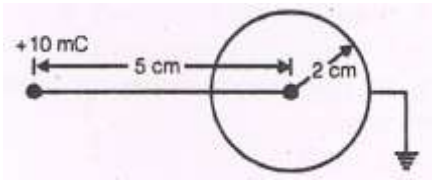
ODD SEMESTER EXAMINATION, 2024 – 25

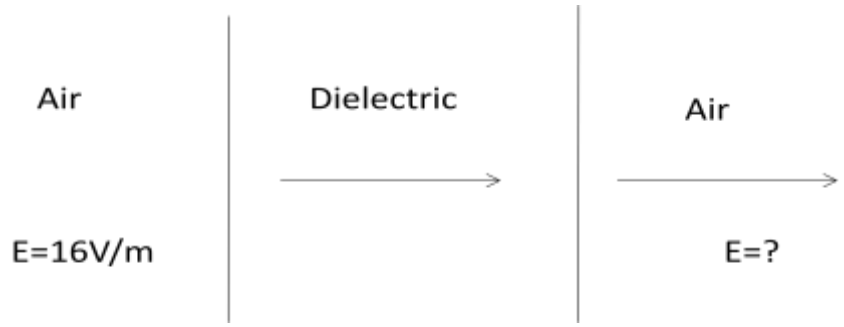
3rd Year (V Sem) B. Tech.: Electronics & Communication Engineering

ELECTROMAGNETIC FIELD THEORY/ ELECTROMAGNETIC THEORY

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any two parts of the following. (10x2= 20) a) (i) Three point charges Q_1 = 1 mC, Q_2 = 2mC,Q_3 = - 3mC are respectively located at (0,0,4),(-2,6,1) and (3,-4,-8).calculate the force on Q_1. (5 marks) (ii) Let V= $\frac{\sin\theta\cos\emptyset}{r}$. Determine ∇V. (5 marks) b) If the electric flux density is D = $\frac{10}{r}a_r nC/m^2$, find the total charge within 0≤ r ≤ 2m. (10 marks) c) A Point charge of +10 μC placed at a distance of 5 cm from the centre of a conducting grounded sphere of radius 2 cm is shown in the diagram given below:  What is the total induced charge on the conducting sphere? (10 marks)
Q 2.	Answer any two parts of the following. (10x2= 20) (i) Describe Stokes theorem, vector magnetic potential. (5 marks) (ii) Drive the expressions for the force between two current carrying wire. (5 marks) b) A 15 amp current carrying wire flow on positive X-axis with current towards the origin and same current extend on positive Y-axis, away from origin find Magnetic Field Intensity at (3,4,0). (10 marks) c) Derive the expression for the magnetic field intensity inside and outside a co-axial conductor of inner radius 'a' and outer radius 'b' and carrying a current of Iampers in the inner and outer conductor. (10 marks)
Q 3.	Answer any two parts of the following. (10x2= 20) a) (i) Write the Maxwell wave equations in point and integral form in the time varying field. (5 marks) (ii) What is the displacement current? Explain with the help of mathematical equations. (5 marks) b) Drive the wave equation. If the velocity of electromagnetic wave in free space is 3×10^8 m/s, calculate the velocity in a medium with $\in_r$ of 5.5 and μ_r of 2. (10 marks) b) Explain the Faraday's law. Drive the voltage due to change in magnetic field and due to motion of the current carrying loop in integral and point form. (10 marks)
	Answer any two parts of the following. (10x2= 20)

Q 4.	a) (i) Given H(z,t)= $\frac{50}{\eta}$ sin(wt-βz) a_x + $\frac{150}{\eta}$ sin(wt-βz) a_y, Identify the polarization of the wave (5 marks) (ii) Drive the skin depth for good conductor material (5 marks) b) If H = 0.1 sin ($10^8\pi t$ + βy) $\hat{a}_x$ A/m for a place wave propagating in free space, then the time average pointing vector is ? (10 marks) c) The electric field of a wave propagating through a lossless medium (μ_0, 81 $\in_0$) is $\bar{E}$ = 10cos ($6\pi \times 10^8$ t – βx) $\bar{a}_y$. What is the phase constant β of the wave? (10 marks)
Q 5.	Answer any two parts of the following. (10x2= 20) a) (i) Define the polarization of the wave. Also explain types of polarizations of the wave. (5 marks) (ii) For sea water with σ = 5 mho/m and $\in_r$ = 80, what is the distance for which radio signal can be transmitted with 90% attenuation at 25 kHz? (5 marks) b) Drive the expressions for reflection coefficient and transmission coefficient for vertical polarization oblique incident wave also calculate the Brewster angle for this polarization. (10 marks) c) From air-dielectric-air interface as shown in below  If the dielectric has ε_r=10 and the incident electric field E_i=16V/m. The electric flux density in the air is? (Assuming attenuation in the dielectric is zero). (10 marks)

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