

JK Lakshmi Pat University, Jaipur

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), July 2019

B. Tech. (Branch: ECE), Semester IV

Roll No.....

ECE403: Electromagnetic Field Theory

Time: 3 hours

Max. Marks: 80

Instructions to students:

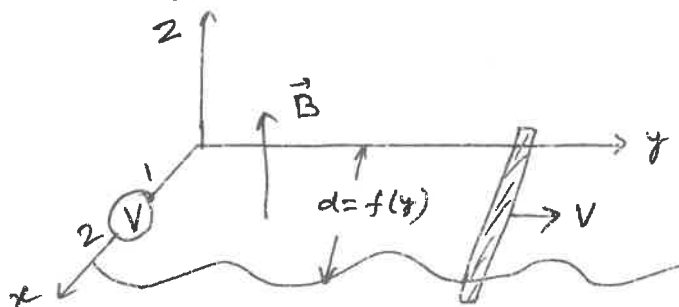
1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Mobiles are not allowed during examination.
5. Non-programmable calculator is allowed.

Q.1 Transform the vector $\mathbf{F} = 20 \rho^{-1} \mathbf{a}_\rho$ in cylindrical coordinate into Cartesian coordinates. 05

Q.2 Prove that $\text{div}(\mathbf{A} \times \mathbf{r}) = 0$ 05

Q.3 How Cartesian coordinates can be transformed into cylindrical coordinates. Determine differential length, differential surface and differential volume of a cylindrical coordinate system. 10

Q.4 The nearer rail in the below figure is replaced by a nonstraight conductor such that the separation is given by $d = f(y)$. The sliding bar is sufficiently long to make contact with both rails. Assuming a uniform field $\mathbf{B} = B_0 \mathbf{a}_z$ T, a constant velocity $\mathbf{v} = v_0 \mathbf{a}_y$ and a location $y = 0$ at $t = 0$, find induced emf $V_{12}(t)$. 10



Q.5 Discuss the boundary conditions for electric field lines propagating through two different dielectric media. Explain the refraction condition of electric field at the boundary. 10

Q.6 In a nonmagnetic medium, $\mathbf{E} = 4 \sin(2\pi \times 10^7 t - 0.8x) \mathbf{a}_z$ V/m. Find ϵ_r , η , and the time-average time power carried by the wave. 10

Q.7	Discuss the plane wave propagation through lossy dielectric media. Determine loss tangent.	10
Q.8	A uniform plane wave in region-1 is incident on the planar boundary separating regions 1 and 2. If $\sigma_1 = \sigma_2 = 0$ and $\mu_{R1} = \mu_{R2} = 1$, find the ratio of $\epsilon_{R2}/\epsilon_{R1}$ if 10 percent of the energy in the incident wave is reflected into region-2.	10
Q.9	Explain plane wave polarization of the wave. How electromagnetic plane wave behaves when it is reflected from the surface at normal incidence.	10