

JK LakshmiPat University, Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), May 2019

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

Roll No.....

ECE403: Electromagnetic Field Theory

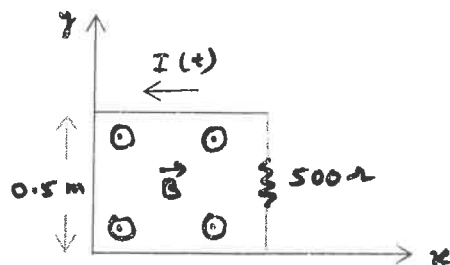
Time: 3 hours

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 Prove that $\nabla (\ln r) = \frac{\vec{r}}{r^2}$ where $\vec{r} = \hat{i}x + \hat{j}y + \hat{k}z$ 05
- Q.2 If ϕ is a scalar function and $\vec{A}$ is a vector function then prove that 05
 $\nabla \cdot (\phi \vec{A}) = \phi (\nabla \cdot \vec{A}) + \vec{A} \cdot (\nabla \phi)$
- Q.3 If a vector $\vec{A} = -\hat{i}y + \hat{j}x$ exist in X-Y plane then determine the line integral of the 05
vector $\vec{A}$ for a closed loop $x^2 + y^2 = r^2$ along $z = 0$. Prove Stoke's theorem for it.
[Given $|\vec{A}| = r$]
- Q.4 Express the field $\vec{F} = 2xyza_x - 5(x + y + z)a_z$ in Cylindrical coordinate and find 05
Field $\vec{F}$ at the point P ($\rho = 2, \phi = 60^\circ, z = 3$).
- Q.5 Discuss the boundary conditions for magnetic field lines propagating through 10
two different media. Explain the refraction condition of magnetic field at the
boundary.
- Q.6 A perfectly conducting filament containing a small 500Ω resistor is formed into a 10
square, as shown in figure. Find current flowing through the loop, $I(t)$ if
magnetic flux density $\vec{B} = 0.2 \cos 120 \pi t a_z$ Tesla.



- Q.7 Discuss the plane wave propagation through lossless dielectric media. Determine loss tangent, and intrinsic impedance of the media. 10
- Q.8 A lossy dielectric is characterized by $\epsilon_R = 1.5$, $\mu_R = 1$ and $\frac{\sigma}{\omega\epsilon} = 2.5 \times 10^{-4}$. At a frequency of 200 MHz, how far can a uniform plane wave propagate in the material before it undergoes an attenuation of 1 Np. 10
- Q.9 A plane interface between two perfect dielectrics is located at $z=0$. A 4 GHz uniform plane wave travelling in the a_z direction is incident from region 1, $z < 0$, onto region 2, $z > 0$. The wavelengths in the dielectrics are $\lambda_1 = 6$ cm and $\lambda_2 = 4$ cm. Both the materials are nonmagnetic. What percentage of energy incident on the boundary is reflected? 10
- Q.10 Discuss why electromagnetic interference (EMI) is affecting performance of the electronic devices and how EMI can be suppressed to improve device performance? 10

