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Question Paper Code : X 10393

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Third/Seventh Semester
Electrical and Electronics Engineering
EE 8391 – ELECTROMAGNETIC THEORY
(Common to Electronics and Instrumentation Engineering / Instrumentation and control Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State the properties of Divergence of Vector Field.
2. A charge is distributed on x axis of Cartesian system having a line charge density of $3x^2\mu C/m$. Find the total charge over a length of 10m.
3. A point charge Q = 0.4 nC is located at the origin. Obtain the absolute potential at A (2, 2, 3).
4. Find the Polarization in dielectric material with $\in_r = 2.8$ if $D = 3\times10^{-7} C/m^2$.
5. What is energy density in magnetic field and write its expression.
6. Write the Laplace's equation for scalar magnetic potential.
7. State Maxwell's Third equation.
8. State point form of Ohm's law.
9. Mention the properties of uniform plane wave.
10. Define intrinsic impedance or characteristic impedance of a medium.

PART – B **(5×13=65 Marks)**

11. a) i) Find the divergence of curl of the following function : $\overline{A} = 2xy\bar{a}_x + x^2z\bar{a}_y + z^3\bar{a}_z$. **(5)**

ii) Express the field $\overline{E} = \frac{A}{r^2}\bar{a}_r$ in rectangular components and cylindrical components. **(8)**

(OR)

b) i) Three point charges each 10μC are placed in free space at the points (1, 0, 0), (–1, 0, 0) and (0, –1, 0) m respectively. Determine the force on a point charge of 30μC located at (0, 0, 1) m. **(7)**

ii) A sphere of radius 2 cm is having volume charge density of ρ_v given by $\rho_v = \cos^2\theta$. Find the total charge Q contained in the sphere. **(6)**

12. a) A total charge of 10^{-8}C is distributed uniformly along a ring of radius 5 m. Calculate the potential on the axis of the ring at a point 5 m from the centre of the ring. If the same charge is uniformly distributed on the disc of 5 m radius, what will be the potential on its axis at 5 m from the centre ?

(OR)

b) Derive the Boundary conditions between conductor and free space of electric field intensity and electric flux density.

13. a) Find the magnetic field intensity $\bar{H}$ due to straight Conductor of finite length carrying current of 'I' amperes.

(OR)

b) Find out the magnetic vector potential in the vicinity of a very long straight wire carrying 'I' amperes. Hence find the magnetic flux density and magnetic field strength.

14. a) i) If the magnetic field $\bar{H} = [3x\cos\beta + 6y\sin\alpha]\bar{a}_z$ A/m, find current density $\bar{J}$ if fields are invariant with time. **(5)**

ii) An area of 0.65m^2 in the plane z = 0 encloses a filamentary conductor.

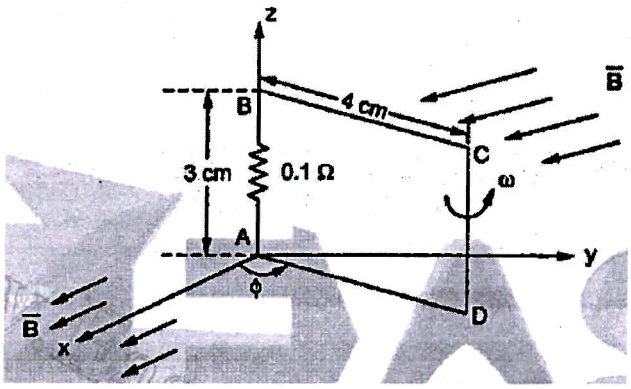
Find the induced voltage if, $\bar{B} = 0.05\cos 10^3 t\left\langle\frac{\bar{a}_y + \bar{a}_z}{\sqrt{2}}\right\rangle$ Tesla. **(8)**

(OR)

b) A loop shown in the figure is inside a Uniform magnetic field $B = 50\,\bar{a}_x$ mWb/m^2. If side DC of the loop cuts flux lines at frequency of 50 Hz and the loop lies in the y-z plane at t = 0, find

i) The induced e.m.f. at t = 1 ms. **(7)**

ii) The induced current at t = 3 ms. **(6)**



15. a) Derive and summarize the equations which describe propagation of uniform plane waves in free space.

(OR)

b) Derive and summarize the equations which describe propagation of uniform plane waves in lossy dielectric medium.

PART – C **(1×15=15 Marks)**

16. a) An electrostatic field is given by, $\overline{E} = -8xy\bar{a}_x - 4x^2\bar{a}_y + \bar{a}_z$ V/m. A charge of 6C is to be moved from B (1, 8, 5) to A (2, 18, 6). Find the work done in each of the following cases :

i) The path selected is $y = 3x^2 + z$, $z = x + 4$. **(5)**

ii) The straight line from B to A. **(5)**

iii) Show that the work done remains the same and is independent of the path selected. **(5)**

(OR)

b) Do the fields $\overline{E} = E_m \sin x \sin t \bar{a}_y$ and $\overline{H} = \frac{E_m}{\mu_0} \cos x \cos t \bar{a}_z$ satisfy Maxwell's equations ?

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