Registration No : | | | | | | | | | | |

Total Number of Pages : 02

B.Tech
PCEE4302

6th Semester Back Examination 2018-19
ELECTROMAGNETIC THEORY
BRANCH : ELECTRICAL
Time : 3 Hours
Max Marks : 70
Q.CODE : F386

Answer Question No.1 which is compulsory and any FIVE from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) Find direction cosines of 'Y' with respect to 'r' and 'Θ'.
b) Evaluate gradient of $(x^2 + y^2 + z^2)$ at (1,0,1).
c) Check whether V= rcosϕ satisfies Laplace's equation or not?
d) An electric dipole of 100 $\mathbf{a}_z$pC.m is located at origin. Find V at (0,0,0).
e) The flux density at a given point in space is given by $\vec{\mathbf{B}} = 4x\hat{\mathbf{a}}_x + 2ky\hat{\mathbf{a}}_y + 8\hat{\mathbf{a}}_z$ Wb/m^2. Calculate the value of *k*?
f) For which condition the magnetic field intensity is conservative? Justify!
g) Define motional emf with its mathematical expression.
h) Explain complex permittivity.
i) Write down difference between Poynting theorem and Poynting vector.
j) Write down difference between transmission line and wave guide.

Q2 a) A cylinder aligned on Y-Z plane such that X- axis is center of cylinder. The lower surface at X=0 and upper surface at X=10. Find the value of ϕ at (2,1,2). **(5)**

b) A point charge of 5nC is located at(-3,4,0) , while line y=1,Z=1 carries uniform charge 2nC/m. Evaluate V at A(5,0,1) if V=0V at origin. **(5)**

Q3 a) One man stands at a point, which coordinate is (1, 1) with respect to one particular coordinate system. Suppose all of sudden earth quake takes place and the whole co-ordinate system will get rotated by 450. Find what will be new co-ordinate system with respect to original one. **(5)**

b) If $\vec{R} = \hat{i}x + \hat{j}y + \hat{k}z$, $\vec{\omega} = \hat{i}\omega_1 + \hat{j}\omega_2 + \hat{k}\omega_3$ And $\vec{\tau} = \vec{R} \times \vec{\omega}$ then find $\nabla.\tau$ **(5)**

Q4 a) Derive differential Poynting theorem. Deduce average power over E and H field and also over Time. **(5)**

b) Derive Helmholtz's wave equation for Electric field and find α and β for free space. **(5)**

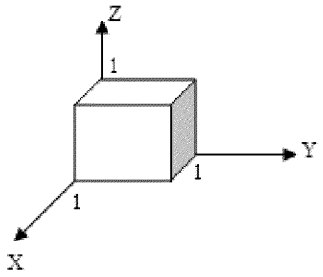
Q5 a) The electric field intensity of a uniform plane wave in free space is given by **(5)**

$$\vec{E} = 94.25\cos(\omega t + 6z)\vec{a_x}\ \text{V/m}.$$

Determine (a) the velocity of propagation, (b) the wave frequency, (c) the wavelength, (d) the magnetic field intensity, and (e) the average power density in the medium.

b) Check the divergence theorem using the function over a unit cuboids as shown in following figure. **(5)**

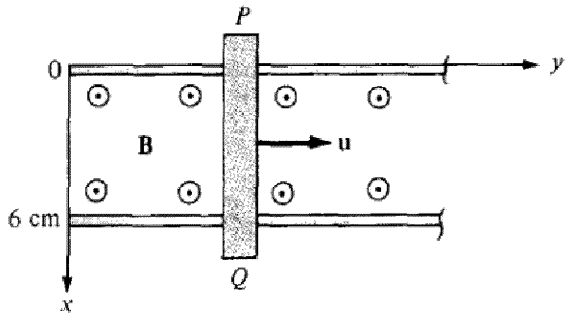
$$\vec{V} = \hat{i}Y^2 + \hat{j}2x(y+1) + \hat{k}(2yz)$$



Q6 Write difference between transmission line and wave guide. Find cutoff frequency of a rectangular wave guide at TE_{01} mode and TM_{11} mode. **(10)**

Q7 A conducting bar can slide freely over two conducting rails, as shown in bellow figure. Calculate the induced voltage in the bar which slides at velocity **(10)**

$$\vec{u} = 20\hat{a}_y \frac{m}{s} \; and \; \vec{B} = 4\cos(10^6 \, t - y)\hat{a}_z \, .$$



Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Biosavat's Law

b) Loss Tangent

c) Maxwell's Time Varying Equations