B.TECH SEM – V (2007 COURSE) (ELECTRONICS) : **WINTER - 2017**

SUBJECT: ELECTROMAGENTIC ENGINEERING

Day: **Saturday** Time: **02.30 PM TO 05.30 PM**

Date: **20/01/2018** Max Marks: 80

W-2017-2468

N.B.:

1) Q.No.**1** and **5** are **COMPULSORY**. Out remaining questions, attempt **ANY TWO** questions from each section.
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data, if necessary.
4) Draw neat diagrams **WHEREVER** necessary.
5) Use of non-programmable calculator is **ALLOWED**.

SECTION-I

Q.1 **a)** Given the point C (-3,2,1), find spherical Co-ordinates of C. **(05)**

b) Define divergence theorem. **(05)**

c) State Amperes circuital Law. **(04)**

Q.2 **a)** Transform the following vectors to spherical Co-ordinates at the points **(07)**

i) $10\hat{a}_x$ at P (x = -3, y = 2, z = 4)

ii) $10\hat{a}_z$ at M (r = 4, $\theta = 110°$, $\phi = 120°$)

b) The three vertices of a triangle are located at A (6, -1, 2) , B (-2, 3, -4) and C (-3, 1, 5). Find **(06)**

i) $\overline{R}_{AB}$

ii) $\overline{R}_{AC}$

iii) Vector projection of $\overline{R}_{AB}$ on $\overline{R}_{AC}$

Q.3 **a)** Derive Poisson's and Laplace's equations. **(07)**

b) Calculate $\overline{D}$ in rectangular co-ordinates at point P (2, -3, 6) produced by a point charge Q_A = 55 mC at Q(-2, 3, -6). **(06)**

Q.4 **a)** Derive force on a moving charge and force on a differential current element. **(07)**

b) Find the vector magnetic field intensity $\overline{H}$ at a point P (2.5, 2, 3) caused by a current filament of 12A in $\hat{a}_z$ direction on z-axis extending from 0 to 6. **(06)**

P.T.O.

SECTION-II

Q.5 **a)** Define displacement current. **(05)**

b) Define uniform plane waves. **(05)**

c) Write short note on rectangular waveguides. **(04)**

Q.6 **a)** Let $\mu = 10^{-5} H/m$, $\varepsilon = 4\times10^{-9} F/m$, $\sigma = 0$ and $\rho_v = 0$. Find K for following pair of fields satisfies Maxwell's equation. **(07)**

$\overline{D} = 6\hat{a}_x - 2y\hat{a}_y + 2z\,\hat{a}_z \; nC/m^2$

$\overline{H} = K\hat{a}_x + 10y\hat{a}_y - 25z\,\hat{a}_z \; A/m$

b) Write Maxwell's equations in point form and integral form for static fields. **(06)**

Q.7 A 9.375 GHz uniform plane wave is propagating in polyethylene ($\varepsilon_r = 2.26$). If amplitude of the electric field intensity is 500V/m and material is assumed to be lossless , find **(13)**

i) Phase constant
ii) Wavelength in polyethylene
iii) Velocity of propagation
iv) Intrinsic impedance
v) Amplitude of magnetic field intensity.

Q.8 At an operating radian frequency of 500 Mrad/s, typical circuit values for a certain transmission line are: R= 0.2 Ω/m , $L = 0.25\,\mu H$/m , G= 0.2 μS/m , C= 100 pF/m **(13)**

Find:

i) α
ii) β
iii) λ
iv) V_P
v) Z_0

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