Registration No. :

Sixth Semester Back Examination – 2015

ELECTROMAGNETIC THEORY

BRANCH : ELECTRICAL

QUESTION CODE : M-178

Full Marks – 70

Time : 3 Hours

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

1. Answer the following questions :   2 × 10

    (a)   Mention the importance of a unit vector.

    (b)   What is a waveguide ? What is its importance and applications ?

    (c)   Define electric field intensity and electric flux density.

    (d)   State uniqueness theorem.

    (e)   What is the condition for the field to be realizable as static magnetic field ?

    (f)   What do you mean by TEM waves ?

    (g)   Define Reflection coefficient.

    (h)   Define Poynting vector.

    (i)   What do you mean by surface impedance of a conductor ?

    (j)   Define intrinsic impedance and give its physical significance.

P.T.O.

2. (a) A uniform plane electromagnetic wave propagating in air is given by

$$E = i_1 x \, Cos[wt - 2(\pi/\lambda)y]$$

Derive by using the Maxwell's equations, the expression for the vector magnetic field. 5

(b) A sphere of radius 2 cm having volume charge density of e_u given by $r_u = cos^2q$. Find the total charge Q contained in the sphere. 5

3. What are guided waves ? Write down some of its applications, Derive the field component present in the TE_{10} mode of propagation in guided wave. 10

4. (a) Prove that in a travelling plane electromagnetic wave, there is a definite ratio between the amplitudes of E and H and find this ratio. 5

(b) Is Gauss's Law useful in finding the electric field vector of a finite line charge ? Explain. 5

5. (a) State and explain Ampere's circuital Law in integral form. 4

(b) An ideal lossless transmission line of Z0 = 60 ohms is connected to unknown Z_L. If SWR = 4, find Z_L, reflection coefficient and transmission coefficient. 6

6. (a) Starting with Maxwell's equations derive the wave equation for E and H in free space. 5

(b) State and prove Laplace's equation for a simple medium in vector notation. 5

7. (a) State and prove continuity equation. 5

(b) What is boundary condition for electrostatics potential at an interface between two different dielectric media ? 5

8. (a) Derive the expression for attenuation factor for TEM waves between parallel conducting planes. 5

(b) The transmission line of characteristic impedance of 50 ohms is terminated with a load of 100 + j 100 ohms. Find the reflection coefficient and SWR. 5