Total No. of printed pages = 4

19/5th Sem/DECE514A

2021

ELECTROMAGNETIC WAVES AND APPLICATIONS

Full Marks – 100

Pass Marks – 30

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Write down the physical significance of divergence and curl. 5

   (b) Write down the properties of cross-product. 3

   (c) What are Position vector and Distance vector ? 2

   (d) Given points P (1, –3, 5), Q (2, 4, 6) and R (0, 3, 8), find : 5+3+2=10

   (i) the position vectors of P and R

   (ii) the distance vector r_{QR}

   (iii) the distance between Q and R.

[Turn over

2. (a) What does orthogonal system mean? 2

(b) How many orthogonal systems are there? Discuss each of them by presenting a vector 'A' in different orthogonal systems. 1+9=10

(c) Given point P (−2, 6, 3) and vector $A = ya_x + (x+z)a_y$, express P in cylindrical and spherical co-ordinates and A at point P in Cartesian co-ordinate system. 3+3+2=8

3. (a) State and explain the Coulomb's law. 3

(b) Find out the expression of electric field at a point (without using Gauss's law) for a uniformly charged sheet and also shows that the electric field does not depend on the distance between the sheet and the observation point. 8+2=10

(c) State and explain Gauss's law in electrostatics. 3

(d) Using Gauss's law derived the expression of electric field for a uniformly charged sheet. 4

4. (a) State and derive the expression of Ampere's circuit law in point form. 2+4=6

(b) Derive the Modified Ampere's circuit law and discuss about the displacement current. 7+3=10

(c) Write down the point form of Maxwell's equations. 4

5. (a) Derive the boundary conditions of electric field and magnetic field. 4+4=8

(b) Derive the expression of wave equation of a medium which contains no free charge. 6

(c) Define and derive the expression of skin depth and loss tangent. 3+3=6

6. (a) What are the line parameters ? 2

(b) What is distortion less line ? What is the condition a transmission line become a distortion less line ? 2+1=3

(c) What is Characteristic Impedance of a transmission line ? 2

(d) An air line has characteristic impedance of 70Ω and phase constant 3rad/m at 100 MHz. Calculate the inductance per meter and the capacitance per meter of the line. 5

(e) What is Smith Chart ? How many different circles are there ? 2+2=4

(f) A lossless 60Ω line is terminated by a $(60+j60)\Omega$ load. 4

Find :

(a) reflection coefficient Γ

(b) Standing wave ratio S.