2062
B.E. (Electronics and Communication Engineering)
Fourth Semester
EC-408: Electromagnetic Theory

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section. Use of scientific calculator is allowed.*

x-x-x

Q.1 Attempt all questions: -

(a) What is the physical significance of divergence of a vector field? **(2)**

(b) Under what conditions will the field intensity be solenoidal and irrotational? **(2)**

(c) Write a short note on characteristic impedance. **(2)**

(d) What is the inductance per unit length of a long solenoid of N turns and having a length L meters? Assume that its carries a current of I amps. **(2)**

(e) Distinguish between transformer emf and motional emf. **(2)**

Section- A

Q. 2 (a) State Coulomb's law. Four like charges of 30 JIC each are located at the four corners of a square, the diagonal measures 8m. Find the force on a 100 JIC located 3m above the center of the square. **(5)**

(b) Develop the concept of displacement current using Maxwell's equations **(5)**

Q.3 (a) Find conduction & displacement current densities in a material having conductivity of $10-3$ S/m & $\varepsilon r = 2.5$ if the electric field in the material is $E = 5.0 * 10-6 \sin (9.0 * 109 t)$ V/m. **(5)**

(b) Drive an expression for energy stored and energy density in electrostatic field. **(5)**

Q.4 (a) Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6cm diameter. The length of the tube is 60cm and the solenoid is air. **(5)**

(b) Define and explain biot –savart law . **(5)**

Section-B

Q.5 (a) A rectangular waveguide with dimensions of 3 cm × 2 cm operates at 10 GHz. Find (a) Cut-off frequency (fc) (b) Cut-off wavelength (λc) (c) Guided wavelength (λg) (d) Phase constant (βg). **(5)**

(b) What is a waveguide? What is its importance and applications? **(5)**

Q.6 (a) Find the input impedance of the distortion less transmission line at radio frequencies in both open, circuited and short-circuited cases. **(5)**

(b) Discuss the use of UHF lines as circuit elements. **(5)**

Q.7 Derive the expression for attenuation factor for TEM waves between parallel conducting planes. **(10)**

x-x-x