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BIEL-006

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B.Tech. IN ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

December, 2012

BIEL-006 : ELECTROMAGNETIC FIELD THEORY

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry **equal** marks. All the questions are to be answerd in English Language only.*

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1. (a) Explain the physical Interpretation of the term 5

(i) Divergence of a vector field.

(ii) Curl of the vector field.

(b) Write down Gradient of any scalar and divergence of any vector $\vec{A}$ in different co-ordinate system. 5

2. (a) (i) Convert point P(1, 3, 5) from cartesian to cylindrical and spherical co-ordinates. 2.5x2=5

(ii) Transform the vector

$$\vec{B} = y\hat{a}_x - x\hat{a}_y + z\hat{a}_z$$

into cylindrical coordinate system.

(b) State and Explain the Coulomb's law. 5

3. (a) Explain what is meant by electric field intensity and Electric displacement density. 5

(b) Discuss the solution of poisson's and Laplace's equation in one dimension. 5

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

(b) Given the magnetic vector potential $\vec{A} = -\rho^2/4\hat{a}_z$ wb/m. Calculate the Total magnetic flux crossing the surface $\phi = \pi/2$, $1 \leq \rho \leq 2$m, $0 \leq z \leq 5$ m 5

5. (a) Discuss the boundary condition for mangetic field. 5

(b) Write the Maxwell's equation in the differential & integral form and explain the physical significance. 5

6. (a) Consider the reflection phenomenon of a plane wave travelling through a medium of permittivity ϵ_1 and permeability μ_1 is incident normally to the surface of a perfect dielectric medium with permittivity ϵ_2 and permeability μ_2. Derive the expression for the reflection and transmission coefficient for the electric and magnetic fields. 5

(b) Determine the attenuation constant α phase constant β, velocity of wave propagation v, propagation constant γ and intrinsic impedance of electromagnetic wave in conducting medium from the following data; 5

$\sigma = 58 \times 10^6$ siemen/m and $\mu_r = 1$ at a frequency of 100 MHz.

7. (a) Derive the relation for poynting theorem and show that this relation can be used to explain the power transmitted. 5

(b) Explain and discuss the distortion-less transmission line. 5

8. (a) Define the terms and obtain expression for the voltage wave standing wave ratio, reflection coefficient & reflection percentage on a loss-free transmission line having mismatch. 5

(b) A transmission line operating at 500 MHz has $Z_o = 80\Omega$, $\alpha = 0.04$ Np/m and $\beta = 1.5$ rad/m Calculate line parameters. 5

9. (a) What are TE, TM and TEM mode waves ? Outline the principle of operation of wave guides. 5

(b) Explain the difference in the mechanism of propagation of electromagnetic energy in waveguide and along a transmission line. 5

10. Write short notes on the following (**any two**) : **5x2=10**

(a) Displacement current.

(b) Guided waves.

(c) Smith chart.