



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION	May 2012	DATE OF EXAM	18/05/2011
SEMESTER & PROGRAM	IV B.TECH (ELECTRONICS & TELECOMMUNICATION)	TIME	1.30 P.M -4.30 P.M
TIME ALLOWED	3 HRS.	MARKS	100
COURSE (Course Code):	ELECTROMAGNETIC WAVE THEORY (ET 0205)		

- Q.1 (a) Express the given vector in Cartesian and Cylindrical coordinates. Find  $B(-3,4,0)$  and  $B(5, \pi/2, -2)$ , 10  
Where  $B = \frac{10}{r} a_r + r \cos \theta a_\theta + a_\phi$
- (b) Verify Stokes theorem for the vector field  $A = (2x-y)a_x - 2yz^2 a_y - 2zy^2 a_z$  on the upper half -surface  $x^2 + y^2 + z^2 = 4$  (above the x-y plane), where the contour C is its boundary (rim of the surface in the x-y plane). 10
- Q.2 (a) State and prove Gauss's law. Using Gauss' law, find an expression for flux density due to an infinite uniform surface charge. 10
- (b) Derive general wave equations for E and H fields. Give solution to the wave equation in perfect dielectric for a wave travelling in Z-direction which has only X-component of E-fields. 10
- OR**
- (c) Explain significance of Maxwell's equation. Also explain the concept of displacement current or current density. 10
- Q.3 (a) A uniform plane wave propagating in a medium has  $E = 2e^{-\alpha z} \sin(10^8 t - \beta z) a_y$  V/m. If the medium is characterized by  $\epsilon_r = 1, \mu_r = 20$  and  $\sigma = 3$  S/m. Find  $\alpha, \beta$  and H. 10
- (b) Define Poynting vector. Obtain the integral form of Poynting theorem and explain each of the terms. 10

P.T.O.

- Q.4 (a) (1) Write short notes on skin depth (Depth of penetration) . 05  
(2) State and explain Ampere circuital law. 05  
(b) Explain briefly the oblique incidence of wave on perfect conductors. 10

- Q.5 (a) Derive the expression for attenuation factor for TEM waves between 10  
Parallel conducting planes.  
(b) A certain transmission line 2 m long operating at  $\omega = 10^6$  rad/sec has  $\alpha = 8$  dB/m, 10  
 $\beta = 1$  rad/m, and  $Z_0 = 60 + j40 \Omega$  .If the line is connected to a source of  $10 \angle 0$  V,  
 $Z_g = 40 \Omega$  and terminated by a load of  $20 + j50 \Omega$  ,determine  
(i) The input impedance  
(ii) The sending -end current  
(iii) The current at the middle of the line

OR

- (b) For a rectangular waveguide with dimensions  $a = 3$ cm,  $b = 1.5$ cm,  $\epsilon_r = 2.25$ , 10  
Calculate cutoff frequency for TE<sub>10</sub>, TE<sub>20</sub> and TM<sub>11</sub> modes.

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