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SEAT No. :

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## TE (E&TC)

## ELECTROMAGNETICS AND TRANSMISSION LINES

## (2012 Pattern)

*Time : 2½ Hour]* *[Max. Marks :70*

***Instructions to the candidates:***

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume Suitable data if necessary.***

***Q1***) a) Derive an expression for potential gradient **[6]**

$(\bar{E} = -\nabla V)$

b) Derive boundary conditions for dielectric dielectric interface. **[7]**

c) State and prove stoke's theorem. **[7]**

OR

***Q2)*** a) Evaluate both sides of divergence theorem for the field $\bar{D} = 2xy\ \bar{a}x + x^2\bar{a}y\ \ c/m^2$ and the rectangular parallelopiped formed by planes x = 0 and 1, y = 0 and 2, z = 0 and 3. **[8]**

b) Derive an expression for capacitance of a spherical capacitor **[6]**

c) State amperis circuital law and derive an expression for magnetic field intensity $\bar{H}$ using Amperis circuital law. **[6]**

***Q3)*** a) Define : i) Conduction current density (Jc) **[8]**

ii) Displacement current density (JD)

and show that $\nabla \times \bar{H} = J_C + J_D$

***P.T.O***

b) Write time harmonic form of maxwell's equations in integral and point form. **[10]**

OR

***Q4)*** a) What are uniform plane waves? Obtain the wave equation in free space in terms of $\bar{E}$ and $\bar{H}$. **[8]**

b) In free space, $\bar{E} = 50\cos(\omega t - \beta z)\bar{a}_x \, v/m$. Find the average power crossing a circular area of radius 2.5m in the plane z = 0. Assume Em = Hm $n_0$ and $n_0 = 120\pi$ **[10]**

***Q5)*** a) A transmission line has characteristic impedance of 50Ω. Find the reflection coefficient, VSWR. if the line is terminated with : **[8]**

i) 50Ω ii) (75 + j75) Ω

iii) 0Ω iv) (75 + j40) Ω

b) Derive an expression for characteristic impedance ($Z_0$) and propagation constant (γ) in terms of primary constants of transmission. **[8]**

OR

***Q6)*** a) Calculate the characteristic impedance, attenuation constant, phase constant of a transmission line, if the following measurments are made on the line. **[8]**

Zoc = 550 L - 60° Ω

Zsc = 500 L - 14° Ω

b) Derive equations for valtages and currents at any point on transmission line. **[8]**

***Q7)*** a) What is standing wave ratio? Derive relationship between SWR and reflection coefficient. **[8]**

b) A lossless transmission line has $Z_0$ = 50Ω. length l = 30m, operating frequency 2MHz. The line is terminated with $Z_L$ = 60 + j40Ω.If velocity is 0.6 × C on the line, where C is velocity of light, find reflection coefficient, VSWR using SMITH CHART. **[8]**

OR

***Q8)*** a) Write a short note on **[8]**

i) Stub matching

ii) i/p impedance of open and short circuited line.

b) The VSWR on a lossless line is found to be 5, and successive voltage minima are 40 cm apart. The first voltage minima is observed to be 15cm from load. The length of a line is 160cm and characteristic impedance is 300Ω. Using SMITH CHART, find load impedance and sending end impedance. **[8]**

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