ANNA UNIVERSITY – CHENNAI

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2011

FIFTH SEMESTER

Electronics and Communication Engineering

EC 2305 – TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

(Common to PTEC 2305 Transmission Lines and Wave guides for B.E. (Part-Time) Electronics and Communication Engineering – Fourth Semester – **Regulation 2009)**

Time: Three hours **Maximum: 100 marks**

Answer all questions.

Part – A (10 × 2 = 20 Marks)

1. For a symmetrical network, define propagation constant and characteristic impedance.
2. What are the advantages of m-derived filters?
3. How can distortion be reduced in a transmission line?
4. A transmission line has $Z_o = 745 \angle -12° \Omega$ and is terminated as $Z_R = 100\ \Omega$. Calculate the reflection loss in dB.
5. Express standing wave ratio in terms of a reflection coefficient.
6. Mention the application of quarter wave line.
7. The electric field in free space is given by $E = 50 \cos[10^8 t + \beta x]\ a_y\ v/m$. Find the direction of wave propagation and β.
8. Define skin depth.
9. Compare transmission line and wave guide.
10. An air filled resonant cavity with dimensions a = 5 cm, b = 4 cm and c = 10 cm is made of copper. Find the resonant frequency for lowest order mode.

PART B — (5 × 16 = 80 marks)

11. (a) Derive the relevant equations of *m*-derived low pass filter and design *m*-derived T-type low pass filter to work into load of 500 Ω with cut off frequency at 4 kHz and Peak attenuation at 4.15 KHz.

[OR]

(b) Explain the structure and application of crystal filter. Design a low pass filter

infinite attenuation at 2850 Hz.

12. (a) Derive the equation of attenuation constant and phase constants of transmission lines in terms of line constants R, L, C and G and explain the significance of reflection coefficient and insertion loss.

[OR]

(b) A generator of 1V, 1 kHz supplies power to a 100 km open wire line terminated in 200Ω resistance. The line parameter are R = 10Ω/km, L = 3.8 mH/km, G = 1×10^{-6} mho/km, C = 0.0085 μF/*km*. Calculate the impedance, reflection coefficient, power and transmission efficiency.

13. (a) Explain the technique of single stub matching and discuss operation of quarter wave transformer.

[OR]

(b) Explain the applications of smith chart. A 30 m long lossless transmission line with Z_0 = 50Ω operating at 2 MHz is terminated with a load $Z_L = 60 + j40\ \Omega$. If U = 0.6 C on the line, find the reflection coefficient Γ, the standing wave ratio s and the input impedance.

14. (a) Explain the concept of displacement current, in free space $E = 20 \cos [\omega t - 50\ x]\ a_y\ v/m$. Calculate displacement current density, magnetic field strength and angular frequency.

[OR]

(b) Discuss in detail guided waves between parallel planes with neat diagram.

15. (a) A rectangular wave guide with dimensions a = 2.5 cm, b =1 cm is to operate below 15 GHz. How many TE and TM modes can the waveguide transmit if the guide is filled with a medium characterized by $\sigma = 0$, $\varepsilon = 4\ \varepsilon_0$, $\mu_r = 1$? Calculate the cutoff frequencies of the modes.

[OR]

(b) Explain in detail:

(i) Excitation of wave guides (8)

(ii) Resonant cavities. (8)