M.E. (ETC) 1ST SEM. FINAL EXAM, 2012
MICROWAVE APPLICATIONS (ETC 934)

Time: 3 hrs. Full Marks: 70

Answer any **five** questions

1. a) Describe briefly Microwave Relay System with the help of suitable block diagram. What feature of the above system makes it attractive for providing telephone trunk circuit? How many repeater stages will be required in a 600 km. route?

   b) Part of a microwave link can be approximated by free space conditions. The antenna gains are each 40 dB, the frequency is 60 GHz. and the path length is 80 Km. Calculate the followings:
   (i) Transmission Path Loss
   (ii) Received Power for a Transmitted Power of 10W. 10+4

2. a) Why must a radio repeater station not retransmit on the same frequency on which it receives?

   b) How is the critical frequency for an ionized layer related to the plasma frequency? Discuss briefly Secant Law and Maximum Usable Frequency (MUF)? What is Optimum Working Frequency?

   c) Calculate the transmission path distance for an ionospheric transmission that utilizes a layer of virtual height of 200 K.M. The angle of elevation of antenna beam is 20 degree. Consider flat earth approximation. 2+10+2

3. a) What is coherence Time and coherence bandwidth? Discuss Hata model for mobile radio propagation.

   b) Demonstrate Small Scale Fading effects of signal propagating through a mobile radio channel on the basis of (i) multi path time delay spread and (ii) Doppler spread. 6+8

4. a) What are the important considerations in design of satellite link? Briefly describe importance of each of them. Using basic transformation theories deduce the received power expression in satellite link design.

   b) A satellite at a distance of 40,000 Km from a point on earth's surface radiates a power of 2 W from an antenna with a gain of 17 dB in the direction of observer. Find flux density at the receiving point, and the power received by an antenna with an effective area of 10 m^2. 4+8+2

5. a) Why noise temperature is important in satellite communication? Explain the effect of equivalent noise temperature on carrier to noise ratio.

b) Explain the operation of satellite transponder. 6+8

6. a) Explain basic radar system with the help of block diagram and timing diagram of an elementary pulse radar. How do you define double range echoes? How it can be mitigated?

b) Describe briefly with the help of suitable mathematical interpretation the radar performance factors in the light of i) radar range equations ii) factors influencing maximum range iii) effect of noise . 4+10

7. a) What is clutter ? List various types of clutters as found in radar system.

b) How radar range equation describing the detection of a target in surface clutter is different from the standard radar equation limited by receiver noise? Explain briefly with suitable illustration considering grazing angle, incidence and depression angles and various surfaces.

c) What will be the attenuation due to rain uniformly distributed throughout the radar coverage and what will be the radar cross section of rain at a range of 20 km. for a radar pointing at a low elevation angle with a 2 degree by 4 degree beam width and a 2 micro second pulse width at frequencies of 3, 10, and 35 GHz? The rain falls at a rate of 4 mm/h. 2+8+4

8. Write short notes on any two of the following- 2 X 7

a) Satellite Subsystems
b) Wireless Application Protocol
c) Synthetic Aperture Radar
d) Environmental/External Noise of Radar Receiver