Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(ECE)/SEM-1/MCE-105D/2010-11

2010-11

MICROWAVE APPLICATIONS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any *four* from the rest.

1. Answer any *seven* of the following : 7 × 2 = 14

   i) State elements of antenna system. What types of feed is mostly used in antenna ?

   ii) Show the basic block diagram of earth station trans-receiver.

   iii) Calculate the flux density at a distance *R* from an antenna of peak power *Pt* and antenna gain *Gt*. What is Effective Isotropic Radiated Power ?

   iv) Explain briefly what is TDMA-SCPC-FDMA.

   v) Why intermodulation products are important in FDMA system ?

vi) What is radar cross-section ?

vii) What is the frequency of operation of K-Band Radar ?

viii) What is Bistatic Radar ?

ix) Why pulsed transmitter is used in a Radar system ?

x) What do you mean by MTI radar ?

xi) What do you mean by Pulse Repetition Frequency (PRF) ?

2. a) Explain with block diagram the telemetry, tracking, command and monitoring (TTC & M) sub-system of a satellite. 5

b) What is the communication sub-system ? Explain with suitable diagram. 3

c) What is the effect of solar eclipse of a satellite ? 3

d) Explain with block diagram, the double conversion transponder for 14/11 GHz Band. 3

3. a) What is the full form of LNBC ? Explain the function with block diagram. 1 + 2

b) Explain atmospheric and ionospheric effects on satellite communication link. 6

c) State the features and application of VSAT. 3

d) An earth station receiver has antenna noise temperature 60° K and receiver noise figure 9 dB. Find the system noise temperature. 2

4. a) Explain mathematically the generation of binary phase shift keying (BPSK) signal. 4

b) Find out the bit error rate equation in terms of C/N ratio for a BPSK signal. 4

c) Explain briefly time division multiple access. 3

d) A satellite link achieves C/N ratio 14 dB, in the receiver under clear sky conditions. The receiver has a RRC filter with noise bandwidth of 1·0 MHz and roll-off factor of 0·3, with ideal correlation detection BPSK demodulator. What are the symbol rate, occupied bandwidth of the link and BER when link is operated with BPSK modulation ? Provided $Q(7{\cdot}07) = 7{\cdot}8 \times 10^{-11}$. 3

5. a) Why the uplink frequency is greater than the downlink frequency ? What is the spot beam of an antenna ? 3 + 2

   b) Explain with suitable diagram the antenna subsystem of a satellite. 5

   c) Find the gain and beam width of a parabolic antenna of diameter 2 m at operating frequency 14 GHz. Antenna aperture is 60%. 4

6. Explain with necessary block diagram, the function of a radar. What is jamming in a radar receiver ? 10 + 4

7. What do you mean by the probability of detection in a radar system ? What is false-alarm in a radar system ? What is radar cross-section in with respect to the field strength of incident wave and scattered wave ? Explain the RCS characteristics of a simple sphere. What do you mean by Fluctuating Target Cross-Section ? 3 + 3 + 2 + 3 + 3

8. Derive the radar equation in terms of maximum radar range. Derive an expression for signal to clutter ratio in a radar receiver. 9 + 5