



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.

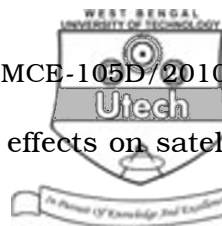
Answer Question No. 1 and any *four* from the rest.

1. Answer any *seven* of the following : $7 \times 2 = 14$

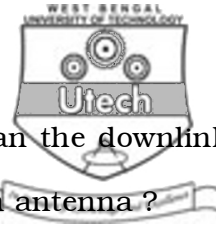
- i) State elements of antenna system. What types of feed is mostly used in antenna ?
- ii) Show the basic block diagram of earth station trans-receiver.
- iii) Calculate the flux density at a distance R from an antenna of peak power P_t and antenna gain G_t . What is Effective Isotropic Radiated Power ?
- 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 $Q (7.07) = 7.8 \times 10^{-11}$. 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

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