CBCS SCHEME

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21EC72

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
Optical and Wireless Communication

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the basic three configurations of optical fibers. **(10 Marks)**

b. Illustrate the relationship between acceptance angle and refractive indices according to Ray theory. **(10 Marks)**

OR

2 a. A continuous 12 km long optical fiber has a loss of 1.5 dB/km.

i) What is the minimum optical power level that must be launched into the fiber to maintain as optical power level of 0.3 μw at the receiving end.

ii) What is the required input power if the fiber has a loss of 2.5 dB/km? **(10 Marks)**

b. Explain bending losses. **(10 Marks)**

Module-2

3 a. What are avalanche photodiodes and briefly explain RAPD (Reach – through avalanche photo diode)? **(10 Marks)**

b. Derive the equations for frequency spacing and wavelength spacing for the laser diode. **(10 Marks)**

OR

4 a. Explain Etalon theory. **(10 Marks)**

b. Explain diffraction grating. **(10 Marks)**

Module-3

5 a. Compare diffraction and scattering. **(10 Marks)**

b. Consider a base-station transmitter operating at 900 MHz carrier frequency. For a mobile moving at a speed of 72 km/h, calculate the received carrier frequency if the mobile is moving.

i) Directly away from the base-station transmitter.

ii) Directly towards the base-station transmitter.

iii) In a direction which is 60° to the direction of arrival of the transmitted signal.

iv) In a direction perpendicular to the direction of arrival of the transmitted signal. **(10 Marks)**

OR

6 a. i) Assume a cellular system of 32 cells with a cell radius of 1.6 km, a total spectrum allocation that supports 336 traffic channels and a sense pattern of 7. Calculate the total service area covered with this configuration, the number of channels per all and a total system capacity. Assume regular hexagonal cellular topology.
ii) Let the size of cell be reduced to the extent that the same area as covered in (i) with 128 cells. Find the radius of the new cell and new system capacity. **(10 Marks)**

b. Illustrate and prove that for a regular hexagonal geometry, the frequency reuse ratio is given by the relationship $q = \sqrt{3K}$ where $k = i^2 + j^2 + 1 \times j$; i and j being the shift parameters. **(10 Marks)**

Module-4

7 a. List out any ten salient features of TDMA technique. **(10 Marks)**

b. What is SDMA? Give some examples of smart antennas and some advantages of smart antennas. **(10 Marks)**

OR

8 a. Illustrate the concept of hybrid TDMA/FDMA technique commonly used in 2G digital cellular systems such as IS 136 and GSM cellular systems. **(10 Marks)**

b. What are the steps involved for landline (PSTN) to mobile (cellular) call in a cellular telephone system? **(10 Marks)**

Module-5

9 a. i) Show that the 3-dB bandwidth for a Gaussian LPF used to produce $B \times T_b = 0.3$ GMSK modulation in GSM standard is 81.3 kHz. The channel data rate is 270.833 kbps.
ii) The channel data rate is 270.833 kbps in GSM standard that is 40% (say) of the theoretical maximum data rate that can be supported in a 200 kHz channel bandwidth. Calculate the corresponding theoretical S/N required. **(10 Marks)**

b. What are GSM traffic channels? Describe the two types of TCH channels. **(10 Marks)**

OR

10 a. Describe GSM hand-OFF procedures briefly. **(10 Marks)**

b. i) What is frequency hopping in GSM?
ii) In Europe, GSM uses the frequency band of 890 to 915 MHz for uplink transmission and the frequency band of 925 to 960 MHz for downlink transmission. Determine the maximum frequency hop from one frame to the next for uplink transmission and downlink transmission. Express it as a percentage of the mean carrier frequency. **(10 Marks)**

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