

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
BE, PART-IV, 7TH SEMESTER (IT) FINAL EXAMINATION, DECEMBER 2011
BROADBAND COMMUNICATIONS (IT-703)

F.M = 70

Time = 3 Hrs.

Use separate answerscript for each half

First Half

(Answer Q.4 and any **two** questions from the rest)

1. (a) Draw the structure of an optical fiber and explain its characteristics.
(b) Why cladding is required for optical fiber construction?
(c) Would you prefer using graded index fiber over step index fiber for optical propagation? Explain.
(d) What is NA and maximum acceptance angle of a single mode step index fiber?

$$5 + 2 + 2 + 6 = 15$$

2. (a) Derive the expression for intermodal dispersion in multi-mode fiber.
(b) What is the property of a dispersive medium?
(c) Calculate NA for step index fiber having core r.i. = 1.60, cladding r.i. = 1.49.
(b) What is bending loss in a fiber?

$$5 + 2 + 4 + 4 = 15$$

3. (a) Describe basic three types of radiative recombination?
(b) Design a DC driver circuit using LED that operates at 100mA, and 20mV.
(c) What is the electron energy operating at wavelength 820nm?

$$6 + 5 + 4 = 15$$

4. Write short notes (any one)
(a) Population inversion and gain condition in a LASER.
(b) Heterojunction LED.

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Second Half

Answer any THREE questions. The questions are of equal value. Two marks are reserved for neatness and to the point answer.

5. "The most popular frequency band for satellite communication is 6 GHz (C-band) for uplink and 4 GHz for downlink"- What are the advantages offered by this frequency band? Why two different frequencies are used for uplink and downlink? Give reasons explaining why most commercial satellites are geostationary? Which regions of the earth are not covered by an arrangement of

three geostationary satellites? Briefly describe the principal subsystems constituting the satellite segment and the earth station segment in a typical satellite link.

(2+1+2+1+5)

6. a) What are the limitations of conventional mobile telephone system? Draw a basic cellular system and describe briefly the operation of various subsystems.

b) Why does hexagonal shape become a preferable choice over other geometric shapes in cellular system design? What is meant by 'Frequency reuse' and 'hand-off'?

c) Write the expression of Doppler-shift assuming that the receiver is moving with a constant velocity. Write down the salient features of three propagation mechanisms, Reflection, Diffraction and Scattering.

(1+3)+(1+2)+(1+3)

7. a) Define spread spectrum modulation. Briefly explain operation principles of direct sequence spread spectrum (DS-SS) transmission and reception system with proper block diagram. Mention the relative merits and demerits of DS-SS and frequency hopping spread spectrum (FH-SS) system.

b) Derive the expression of probability of bit error using spread spectrum modulation in hostile communication environment with single-tone interference and jamming.

(2+3+3)+3

8. a) Derive the expression of probability of bit error in a K-user communication system (transmitting in same radio frequency f_0) with equal power P_s using CDMA with uncorrelated and distinct spreading codes. What are the critical functional differences in successive interference cancellation (SIC) and parallel interference cancellation (PIC) in multiuser detection? Name two other modified PIC schemes.

b) What is meant by diversity technique? What is its advantage over equalization technique? Briefly explain the operation of different categories of space diversity.

(2+3+1)+(1+1+3)

9. Write short notes on any two:

a) Time division multiplexing with frame synchronization

b) Carrier interferometry codes

c) Time hopping SS

d) Maximum-length sequences

(5.5x2)