

Seventh Semester Examination – 2008

COMMUNICATION SYSTEMS

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory
and any five from the rest.

The figures in the right-hand margin
indicate marks.

1. Answer the following questions : 2×10

- (a) What is the operating wavelength for the third window category of optical fibers ? What is its importance ?
- (b) What is a TE mode ? Give the diagram for wave propagation in an optical fiber.

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- (c) What is a principal disadvantage of multimode fiber ? What is its effect on transmission ?
- (d) Compute the number of modes supported by a fibre of μ_1 (Core) = 1.54 and μ_2 (Cladding) = 1.5 ; Core radius = 20 μm and operating wavelength around the third window.
- (e) What is the fiber loss in an ideal optical fiber ? Justify.
- (f) What is the effect of the barrier potential in a Pn Junction ? How do you overcome its effect ?
- (g) Write two advantages of a geosynchronous satellite.
- (h) How the spectrum of a signal is spread ? What is its effect ?
- (i) Write two disadvantages of a satellite communication system.
- (j) Which modulation scheme is used in a transponder ? Why ?

2. Justify the use of an optical fiber as a wave guide. Hence prove that the field in the core has the form of an oscillatory Bessel function. Start from the fundamental equations. 1+9
3. (a) Explain how modulation of laser diode output is carried out. 5
 (b) Compute the power coupled by a LED to a step-index fiber. 5
4. (a) Explain the physical principles of a photo diode. Hence define responsivity. Draw appropriate diagrams. 5
 (b) A typical photodiode has the following specifications at 1300 nm, $I_D = 4$ nA, $\eta = 0.65$, $R_L = 1$ k Ω . The incident optical power is -35 dBm, the receiver bandwidth being 20 MHz. Compute the various noise terms of the receiver. Assume the surface leakage current to be negligible. 5
5. (a) What is the motivation of a trans-impedance amplifier? Hence discuss one such amplifier. State its advantages and disadvantages. 7
- (b) Compute the responsivity of a detector that has a quantum efficiency of 15% at $0.8 \mu\text{m}$. 3
6. (a) Explain a typical TTC & M subsystem with the help of a neat sketch. 5
 (b) Explain a simplified single conversion transponder. 5
7. A satellite at a distance of 36,000 km from a point on earth's surface radiates a power of 3 W from an antenna with a gain of 20 dB in the direction of the observer. Find the flux density at the receiving point and the power received by an antenna with an effective area of 10 m^2 . Derive the formula used. 10
8. (a) Compare ionospheric and tropospheric propagation effects. 5
 (b) Discuss the direct broadcast satellite TV system. 5