Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80353

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh Semester

Electronics and Communication Engineering

EC 6702 — OPTICAL COMMUNICATION AND NETWORKS

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define numerical aperture.
2. What are the conditions for light to be propagation inside a fiber?
3. What are the causes of absorption?
4. What is polarization mode dispersion?
5. What are the mechanisms behind lasing action?
6. Define external quantum efficiency.
7. Define BER.
8. What is cut back method?
9. How do you ensure that the required system performance is met or not?
10. Name two popular architectures of SONET/SDH network.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Compare the structure and characteristics of step index and graded index fiber. (12)

(ii) A graded index fiber with a core with a parabolic refractive index profile ($\alpha=2$) and diameter of $50\,\mu m$. The fiber has numerical aperture of 0.2. Estimate the number of the guided modes propagating in the fiber when the transmitted light has a wavelength $1\,\mu m$. (4)

Or

(b) (i) Consider a fiber with 25 μm core radius, core index $n1 = 1.48$ and $\Delta = 0.01$. If $\lambda = 1320$ nm, what value of V and how many modes propagate in the fiber. What percent of optical power flows in the cladding? If the core cladding difference is reduced to $\Delta = 0.003$, how many modes does the fiber support and what fraction of the optical power flows in the cladding? (8)

(ii) Explain the functional blocks of an optical communication link with neat block diagram. (8)

12. (a) Discuss about the design optimization of single mode fiber. (16)

Or

(b) What is waveguide dispersion? Derive an expression for time delay produced due to waveguide dispersion. (16)

13. (a) (i) A double heterojunction LED emitting at a peak wavelength of 1310 nm has radiative and non-radiative recombination time of 45 ns and 95 ns respectively The drive current is 35 mA. Determine internal quantum efficiency and internal power level. If the refractive index of the light source material is n = 3.5, find the power emitted from the device. (6)

(ii) What is fiber splicing? Discuss about fusion splicing and mechanical splicing. (10)

Or

(b) Explain the working principle of laser diode and derive its rate equation. (16)

14. (a) Explain the different methods employed in measuring the attenuation in optical fiber with neat block diagram. (16)

Or

(b) What are the performance measures of a digital receiver? Derive an expression for bit error rate of a digital receiver. (16)

15. (a) (i) Draw the generic configuration of SONET and explain the functions of add drop multiplexer in SONET. (8)

(ii) A 90 Mb/s NRZ data transmission system that sends two DS3 channels uses a GaAlAs laser diode that has a spectral width of 1 nm. The rise time of the laser transmitter output is 2 ns. The transmission distance is 7 km over a graded index fiber that has 800 MHz.km bandwidth-distance product. If the receiver bandwidth is 90 MHz and mode mixing factor q = 0.7, what is the system rise time? What is the rise time if there is no mode mixing? (use 0.07 ns/(nm-km)). (8)

Or

(b) Discuss in detail about the effect of noise on system performance.
