Total No. of Questions : 12]

SEAT No. :

P1145

[Total No. of Pages : 4

[4659] - 505
B.E. (EATC)
Optical and Microwave Communication
(2003 Pattern) (Semester - II)

Time : 3 Hours] *[Maximum Marks : 100*

Instructions to the candidates:

1) ***Solve Q. 1 or Q. 2, Q.3 or Q.4, Q.5 or Q.6 from Section - I and Q.7 or Q.8 , Q.9 or Q.10, Q.11 or Q.12 from Section - II.***

2) ***Figures to the right indicate marks.***

3) ***Use of non programmable calculators is permitted.***

SECTION - I

Q1) a) Define numerical aperture of an optical fiber and derive an expression for the same. **[8]**

b) A graded index fiber has following parameters : **[8]**

i) Radius of core = 42 μM.

ii) Refractive index of core = 1.55.

iii) $\Delta = 0.062$

iv) Power law coefficient (α) = 2

v) Wave length (λ) = 15 μM.

Calculate

1) Number of modes

2) Refractive index of cladding.

OR

Q2) a) Explain stimulated emission as applied to laser diodes. What are advantages of laser diodes over light emitting diodes (LED) when used for light emission over fibers. **[8]**

b) A double hetro junction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and non radiative recombination times of 30 n sec and 100 n sec respectively. The drive current is 40 mA. Determine total recombination life time, internal quantum efficiency and internal power level of the source. **[8]**

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Q3) a) What is dispersion? Explain intramodal and intermodal dispersion. **[8]**

b) When the optical power launched into 10 km length, fiber is 100 μw, the optical power at fiber output is 5 μw calculate **[8]**

i) overall signal attenuation in dB

ii) signal attenuation per Km.

iii) The overall signal attenuation for 12 km optical link using same fiber splices at 1 km interval, each giving attenuation of 0.5 dB

OR

Q4) a) Explain with neat diagrams the working of an OTDR. What are two important performance parameters of an OTDR. **[8]**

b) A multimode graded index fiber exhibits total pulse broadning of 0.1 μ sec over the distance of 12 km Calculate : **[8]**

i) The maximum possible band width on the link assuming no inter symbol interference.

ii) Pulse broadning per unit length.

iii) Band width length product of fiber.

Q5) a) Describe concept of wavelength division multiplexing and state key system features of WDM. **[9]**

b) Explain link power budget with the help of power loss model for point to point link. Give the graphical representation of a link loss budget. **[9]**

OR

Q6) a) Explain with neat diagram basic structure of STS - 1 SONET frame. **[9]**

b) How does photonic switching differ from electro optic switching? Discuss different types of switch used in fiber optical communication systems.**[9]**

SECTION - II

Q7) a) What are wave guides. Explain following terms as applied to waveguides**[9]**

i) Phase velocity

ii) Group velocity

iii) Cutoff wavelength

iv) TE_{Mn} and TM_{Mn} modes

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b) A rectangular cavity resonator has dimensions a = 7.5 cm, b = 4 cm and c = 16 cm, calculate **[9]**

i) Resonance Frequency of dominant mode.

ii) cutoff wave number

iii) Phase constant.

OR

Q8) a) Define 'S' parameters and list different properties of the same along with physical interpretation. **[9]**

b) What is directional coupler? Draw and explain two hole directional coupler. Explain the terms. **[9]**

i) coupling factor.

ii) directivity.

Q9) a) Explain the following : **[8]**

i) Velocity modulation in two cavity klystron.

ii) Negative resistance property of reflex klystron.

b) A Reflex klystron operates under following conditions V_0 = 600 V, L = 1 mm, R_{sh} = 15 Kv, P_r = 96 Hz, $\frac{e}{m} = 1.759 \times 10^{11}$ **[8]**

The table is oscillating at f_r at the peak of n = 2 mode of $1\frac{3}{4}$ mode. Assume that transist time through the gap and beam loading can neglected find

i) Value of repeller voltage "V".

ii) direct current required to give microwave voltage gap of 200 V.

iii) What is electric frequency under this condition.

OR

Q10) a) Explain the working of TWT. State the expressions for the roots of propogation constant and gain of tube used as an amplifier. **[8]**

b) Explain the following : **[8]**

i) Amplifying action in travelling wave tube

ii) Oscillating action in magnetron.

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Q11) a) Explain how tunnel diode can be used as microwave oscillator. **[8]**

b) Compare the negative resistance channel concept of following devices operating in microwave range. **[8]**

i) Tunnel diode

ii) GUNN Diode

iii) IMPATT diode.

OR

Q12) a) Explain in detail the working of TRAPTT diode and draw its performance characteristics. **[8]**

b) What is GUNN effect. Sketch GUNN diode construction and explain its working. **[8]**

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