E&TC

COLLEGE OF ENGINEERING PUNE

Final Year B. Tech (E and TC)

ET411-5: Fiber Optic Communication (Elective-I)

End Semester Examination

Day and Date: **Tuesday, 27/11/2012** Semester: **VII**

Duration: **3 Hrs** Maximum Marks: **50**

Instruction to the candidate:

i. All questions are compulsory.

ii. Assume suitable data if necessary.

Q 1 i. An optical signal at specific wavelength has lost 55 % of its power after traversing 7 Km. what is attenuation in dB/km for this fiber? **10**

ii. Find the core radius necessary for single mode operation at 1320 nm of a step index fiber with n_1=1.480 and n_2=1.478.

iii. A ruby laser contains a crystal of length 4 cm with a refractive index of 1.78. The peak emission wavelength from the device is 0.55μm. Determine the number of longitudinal modes and their frequency separation.

iv. What are direct band gap and indirect band gap type of semiconductors? Give one example of each type.

v. What do you mean by the terms internal and external quantum efficiencies of a LED source?

Q2 A What are the desirable properties of sources for optical communication? **4**

B With the suitable schematic explain the working of Fabry-Perot resonator. Derive the threshold condition for lasing action. Sketch Power Vs Current characteristics of ILD. **4**

C What is the advantage of using Double hetero junction structure for LED? **2**

Q3 A An InGaAs p-i-n photodiode is operating at room temperature (300 ^{O}K) at a wavelength of 1.3 μm. Its quantum efficiency is 70% and the incident optical power is 500 nW. Assume that the primary dark current I_D of the device is 5 nA, R_L is 1 kΩ, and the effective bandwidth is 25MHz. Calculate **6**

i. The rms values of shot noise current, dark current and thermal current.

ii. S/N at the input end of an amplifier of the receiver.

B With neat diagram explain the construction and working of APD. **4**

Q4 A An intensity-modulated analog fiber-optic link employs a laser transmitter which couples a mean optical power of 0 dBm into a multimode optical fiber cable. The cable exhibits an attenuation of 3.0dB/km with splice losses estimated at 0.5dB/km. There are two connectors one at transmitter and other at receiver end. The connector loss is of 1dB/connector. The p-i-n photodiode receiver has a sensitivity of -25 dBm. A safety margin of 6 dB is required. The rise times of the ILD and p-i-n diode are 1 ns and 5 ns, respectively, and the inter modal and intra modal rise times of the fiber cable are 9 ns/km and 2 ns/km, respectively. **6**

i. What is the maximum possible link length without repeaters?
ii. What is the maximum permitted 3-dB bandwidth of the system?

B A 90-Mb/s NRZ data transmission system that sends two DS3 (45-Mb/s) channels uses a GaAlAs laser diode that has a 1-nm spectral width. The rise time of the laser transmitter output is 2 ns. The transmission distance is 7 km over a graded-index fiber that has an 800MHz-km bandwidth-distance product. If the receiver bandwidth is 90 MHz and mode-mixing factor q=0.7 what is the system rise time? Does this rise time meet the NRZ data requirement of a pulse width? (Given: D_{mat}=0.07ns/nm-km) **4**

Q5 A With a suitable block diagram explain a typical WDM network What are the advantages of WDM? What do you mean by the terms DWDM and CWDM? **4**

B What is meant by OTDR? Discuss with the aid of diagram how this method may be used to measure discontinuity/break in fiber? **4**

C What is SONET? What is data rate of SONET level OC-192? **2**

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