University of Mansoura   3rd Year Electronics

Faculty of Engineering   Time Allowed: 3 hrs.

Dept. of Electronics & Communics.   Date: 13/6/2012

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Optical Electronics

USE NEAT SKETCHES TO CLARIFY YOUR ANSWERS:

1) A- Explain the advantages of optical fiber communications.

   B- State the main types of optical fibers and compare between them with respect to information carrying capacity.

2) A- Sketch the structure of optical fiber cable, state the function of each element. Give short account onSEA-ME-WE transcontinental cable.

   B- Derive the conditions required to get guided modes in optical fiber and state the condition for single mode case.

   C- Derive an expression for the total number of guided modes in optical fiber in terms of fiber parameters.

3) A- Define the attenuation in optical fiber and sketch the silica fiber attenuation curve $\alpha(\lambda)$ showing the three transmission windows and the All-Wave fiber region.

   B- Explain the sources of extrinsic and intrinsic absorption in silica fiber and compare between them.

   C- A manufacturer wishes to make a silica- core, step-index fiber with V = 50 and numerical aperture 0.25 to be used at 1.55 μm if n_1 = 1.5. What should the core size and the cladding refractive index be ?

4) A- Define signal dispersion in optical fiber and explain its effects on the information capacity of the fiber link.

   B- State the sources of signal dispersion in optical fibers and explain how to minimize their effects in single mode and multimode fibers.

5) A- Explain the advantages of using ternary and quaternary sfmiconductor alloys used in optical sources.

   B- Derive an expression for the threshold gain in laser diode.

6) A- Explain the main requirements of photo detectors used in optical communications.

B- Derive an expression for the quantum efficiency in PIN diode and explain the concept of cut-off wavelength in semiconductor photodetectors.

بالتوفيق

د. محمود الزبائي

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تخلفات قرتم

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5 a) Explain the main performance requirements of fiber optic link   and how they are met

   In F.O.L design.

   b) For F.O.L of the following parameters,

* transmitter has 100 µw and data rate 20 Mb/s
*   the fiber is multimode fiber of $\alpha = 3$ dB/km
   Assuming a proper power margin, find the maximum repeaterless distance of the link if BER
   is 10^{-9}. use receiver sensitivity - 40 dBm.

6.a) A SONET – 48   F.O.L, a laser diode has 3 mw optical power , 0.1 nm spectral width and
25 ps transimitter rise time. The single-mode fiber has 0.3 dB/km and 2 ps/km. nm.   Find the
power received at   the end of 100 km long link.

   b) For the optical link in a), suggest a proper photodetector and prove that the total
   system rise time is in the safe range of OC – 48 channel.of receiver bandwidth 2.5 Ghz.

بالتوفيق مع ١٠. د. حمود الزباني ·