Dept. of Communications & Electronics
Final Exam, First Semester: 2003/2004

Course Title: Optical Communications	**Date: 24/1/2004**
Course No: (610535)	**Time Allowed: 2 Hours**
Lecturer: Dr. A.K. Qawasmi	**No. of Pages: 2**

Question 1:   *(10 Marks)*

Choose The Correct Answer:

1- **The loss applies whenever a wave travels through a medium having a scattering objects smaller than a wave length is:**
a- Rayleigh absorption
b- Rayleigh geometric effects
c- Rayleigh scattering
d- Geometric effects.

2- **The loss in (dB/km) is:**
a- The ratio of two power measurements (in decibels) divided by the weight of the fiber.
b- The ratio of the two power measurements (in decibels) divided by the length of the fiber (in kilometers).
c- The ratio of the two power measurements (in joules) divided by the length of the fiber (in meters).
d- The ratio of one power measurement (in decibels) divided by fixed length (in kilometers).

3- **Graded Index Fiber is:**
a- A fiber, which has a core material whose refractive index decreases continuously with distance from the fiber axis.
b- A fiber with step refractive index.
c- A fiber whose refractive index increases continuously with distance from cladding.
d- A fiber, which has a cladding with variable refractive index.

4- **TE (transverse electric) mode in SI fibers means (see figure 1):**
a- An electric field pointing in the y direction corresponds to the perpendicular polarization
b- The magnetic field points in the x direction.
c- The electric field pointing in the x direction corresponds to the parallel polarization.
d- An electric field pointing in the x direction corresponds to the perpendicular polarization
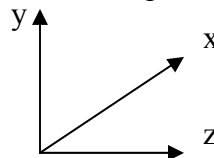
5- The optic power generated by an LED is:
a- Nonlinearly proportional to the forward driving current.
b- Linearly proportional to the rise time of the photo detector .
c- Linearly proportional to the refractive index of multimode fiber.
d- Linearly proportional to the forward driving current.

Question 2: (15 Mark)

a- Write 3 differences between LED and LD. *[3 marks]*

b- Using sketches, equations and writing to explain the Lighting-Emitting Diode Operating Characteristics.(Optic power, Modulation, Carrier life time, f_{3-dB},…) *[6 mark])*

c-1- Determine the current and the optic modulation factors using the figure below. *[3 marks]*

2- Calculate the carrier life time τ if the frequency $f \le 1$ GHz. *[3 marks]*

Driving Curent

Resulting output Power
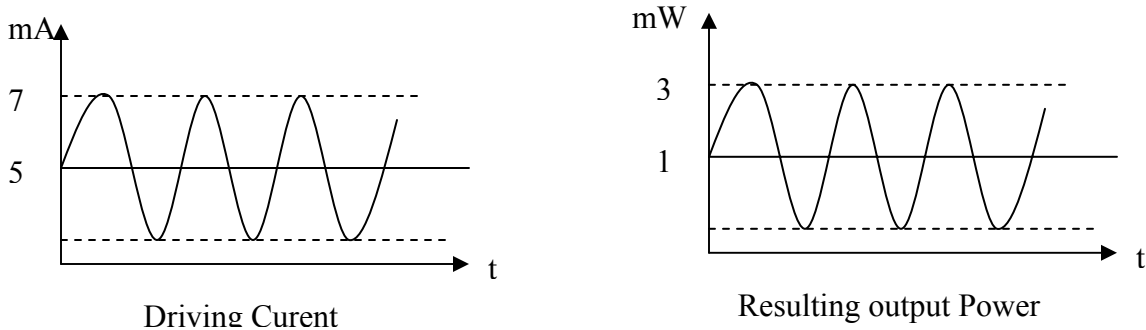
Question 3: (15 Marks)

a- Find the current generated by avalanche Photodiode with gain M=250 , if the optic power= 2 mW and quantum efficiency = 50%. *[4 marks]*

b- What is the Responsivity of APD if the wavelength= .82 µm. *[3 marks]*

c- Give two differences between internal and external photo electronic effects. *[4 marks]*

d- Compute the Lateral Misalignment in connection shown in the figure below. *[4 marks]*

d=0.3 µm

a=0.8 µm
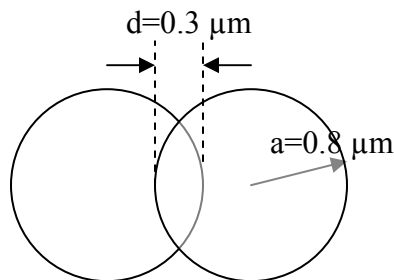
Question 4: (10 Mark)

a- Compute the Allowed SI fiber length to design an optical communication system based on the Bandwidth Budget, if you know: *[6 marks]*

1- Light Source: LED, P_{dc}=1 mW at wavelength λ=.85 µm, rise time=12 ns, spectral width =35 ns and emitting surface has a diameter < 50 µm.

2- Multimode GRIN fiber: NA=0.24, bandwidth f_{3-dB}=500 MHz X km, loss= 5 dB/km and 50-µm core diameter.

3- The system will operate with signal bandwidth= 6 MHz and load resistance R_L=4000 ohms.

4- Photo detector: PIN diode, Capacitance= 6 pF.

b- Briefly, Explain the work of optical amplifiers. *[4 marks]*