Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

Course: Optical Fiber Communication System **Semester: VI**
Program: B.Tech Electronics and Communication Engineering **Time 03 hrs**
Course Code: ECEG 3007 **Max. Marks: 100**

Instructions:

1. Attempt all the questions (Theory, Numerical, Case study etc.) on A4 size blank sheets.
2. Attempt all questions serially as per question paper.
3. Answer should be neat and clean. Draw a free hand sketch for circuits/tables/schematics wherever required.
4. Scan the whole answer script and check the resolution carefully before upload on the blackboard. Note that answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable..
5. It is always expected to be honest about each attempt which you make to progress in life.

SECTION A [40 Marks]

S. No.		Marks	CO
Q.1	(a) What is time division multiplexing? Draw the structure of T1 line. If four T1 lines are multiplexed and in between each line 10 synchronization bits are used, then find the minimum bandwidth required to transmit it. (b) Determine the optical power received in dBm and watts for a 20-km multi-mode step index optical fiber link with the following parameters: Refractive index of core = 1.46 Refractive index of cladding = 1.41 Radius of core = 50 µm Operating wavelength = 1300 nm LED output power of 30 mW Four 5-km sections of optical cable each with a loss of 0.5 dB/km Three cable-to-cable connectors with a loss of 2 dB each No cable splices Light source-to-fiber interface loss of 1.9 dB Fiber-to-light detector loss of 2.1 dB No losses due to cable bends. **Also calculate the total numbers of mode supported by the fib**er.	**20**	**CO4**

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hhrs from the scheduled time (*exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
No Submission will be entertained after 24 Hrs

Q.2	(a) Define the quantum efficiency and the responsivity of a photodetector. Derive an expression for the responsivity of an intrinsic photodetector in terms of the quantum efficiency of the device and the wavelength of the incident radiation. (b) An APD with a multiplication factor of 20 operates at a wavelength of 1.5 μm. Calculate the quantum efficiency and the output photocurrent from the device if its responsivity at this wavelength is $0.6AW^{-1}$ and 10^{10} photons of wavelength, λ=1.5 μm are incident upon it per second.	**20**	**CO3**
SECTION B [60 Marks]			
Q.3	Explain the following splicing techniques of optical fibers with appropriate diagram (a) Fusion splicing (b) Mechanical splicing.	**10**	**CO1**
Q.4	Discuss different types of fiber misalignment and the factors, which causes the losses due to those misalignments. A graded index fiber has a parabolic refractive index profile ($\alpha = 2$) and a core diameter of 50 μm. Estimate the insertion loss due to a 3μm lateral misalignment at a fiber joint when there is index matching and assuming that there is uniform illumination of all guided modes only.	**10**	**CO2**
Q.5	With the aid of suitable diagrams, discuss the principles of operation of the injection laser. Outline the semiconductor materials used for emission over the wavelength range 0.8 to 1.7 μm and give reasons for their choice.	**10**	**CO3**
Q.6	An 8km optical fiber link without repeaters uses multimode graded index fiber which has a bandwidth–length product of 400 MHz-km. Estimate: (a) the total pulse broadening on the link (b) the rms pulse broadening on the link. It may be assumed that a return to zero code is used.	**10**	**CO2**
Q.7	Determine the maximum bit rate for RZ and NRZ encoding for the following pulse-spreading constants and cable lengths: (a) t =10 ns/m, L =100 m (b) t =20 ns/m, L = 1000 m (c) t = 2000 ns/km, L = 2 km	**5**	**CO4**
Q.8	For a single-mode optical cable with 0.25 dB/km loss, determine the optical power 100 km from a 0.1mW light source.	**5**	**CO2**
Q.9	Determine the cutoff wavelength for a step index fiber to exhibit single-mode operation when the core refractive index and radius are 1.46 and 4.5 μm, respectively, with the relative index difference being 0.25%.	**5**	**CO1**
Q.10	Compare the relative advantages and disadvantages of LED and laser diodes.	**5**	**CO3**

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