Name:

Enrolment No:

UPES
UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Optical Communications
Semester: VIII
Program: B.Tech. EE **Time 03 hrs.**
Course Code: ELEG 421 **Max. Marks: 100**

Instructions: All diagrams are to be drawn by pencil.

SECTION A **5x4 = 20**

S. No.		Marks	CO
1.	A step index fiber has normalized frequency 25 and at 1300 nm wavelength. If the core radius is 25μm, determine the numerical aperture.	4	CO1
2.	Determine the phase change when the light ray gets totally internally reflected with the refractive index n=1.0 and incident angle is 45^0.	4	CO2
3.	Write about connector types.	4	CO3
4.	Explain the heterojunction in optical sources	4	CO4
5.	Write about Semiconductor Optical Amplifiers.	4	CO5
	SECTION B		**4x10= 40**
6.	(a)Determine the maximum possible core radius allowed for a glass fiber having n_1=1.465 and n_2=1.46 if the waveguide is to support only one mode at a wavelength of 1250nm? (b)Write about fiber materials	6+4	CO1
7.	a)Explain different Splicing techniques with neat sketch. b)Draw and explain the output patterns of source to fiber power launching.	5 5	CO3
8.	a) The end faces of core refractive indices of 1.5 and are perfectly aligned. The gap between the faces of fibers are filled with gel of refractive index 1.3, Determine the optical power loss in decibels at the joint. (b)Describe the structure of semiconductor laser amplifier.	5+5	CO3 CO4
9.	a)Describe the structure of Find Erbium Doped Fiber Amplifiers. b)Illustrate the general features of intensity modulated sensors	5+5	CO5
	SECTION-C **Write any two questions**		**2x20=40**

10.	If the "mean optical power" of 120μW is launched into an 8 km length of fiber and the mean optical power at the fiber output is 3μW, Determine the following: i) The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices; ii) The signal attenuation per kilometer for the fiber. iii) The overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals, each giving an attenuation of 1 dB; iv) The numerical input/output power ratio.	**4x5 =20**	**CO2**
11.	(a)Illustrate the SONET architecture. (b)Draw and explain the output patterns of source to fiber power launching. (c)Describe the structure of PIN diode	**10** **5** **5**	**CO5** **CO3**
12.	(a)Glass fiber exhibits material dispersion given by $\lambda(d^2n_1/d\lambda^2)$ of 0.025.Determine material dispersion parameter at a wavelength of 0.85μm and estimate rms pulse broadening/km for good LED source with an RMS spectral width of 20 nm at this wavelength. (b) Differentiate between the photo diode parameters, 'Quantum limit' and 'Dark current'	**12** **8**	**CO4**

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SECTION A **5x4 = 20**

S. No.		Marks	CO
1.	(a)Find the transmission capacity of an optical fiber if the bit rate 20KHz and the repeater is spaced at 100m. (b)Determine the phase change when the light ray is totally internally reflected with the refractive index n=1.5 and incident angle is 30^0.	4	CO1
2.	How Polarization mode dispersion exists in the fibers?	4	CO2
3.	Describe power coupling from light source to optical fiber	4	CO3
4.	Explain Signal distortion in optical fibers due to attenuation and absorption	4	CO4
5.	Write about Semiconductor Optical Amplifiers.	4	CO5

SECTION B **4x10= 40**

6.	(a)Describe the significance of mode field distribution. (b)A multimode step-index fiber has a relative index difference of 2% and a core refractive index of 1.5.The number of modes propagating at a wavelength of 1.3µm is 1000. Calculate the diameter of the fiber core.	3 7	CO1
7.	(a)Explain microbending losses. (b)A step index fiber has normalized frequency 25 and at an 1100 nm wavelength. If the core radius is 25µm, determine the numerical aperture.	6 4	CO2
8.	(a)Draw and explain the output patterns of source to fiber power launching. (b)Describe the structure of Distributed feedback LASER.	5 5	CO3
9.	Explain the operation of Intensity Modulation through Light Interruption in optical	10	CO5

	sensors		
	SECTION-C **Write any two questions**		**2x20=40**
10.	(a)A graded index fiber with parabolic profile support the propagation of 700 guided modes. The fiber has a relative refractive index difference of 2% a core refractive index of 1.45 and a core diameter of 75μm.Calculate the wavelength of light propagating in the fiber .Estimate the maximum diameter of the fiber core which can give single-mode operation at the same wavelength. (b)Describe Generic SONET network.	**12** **8**	**CO1** **CO5**
11.	If the "mean optical power" of 120μW is launched into an 8 km length of fiber and the mean optical power at the fiber output is 3μW, Determine the following: i) The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices; ii) The signal attenuation per kilometer for the fiber. iii) The overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals, each giving an attenuation of 1 dB; iv) The numerical input/output power ratio.	**20**	**CO3**
12.	(a)An optical amplifier has the noise figure 3.6 dB. The input signal has a signal-to-noise ratio of 50dB.Compute the output signal to noise ratio. (b) The quantum efficiency of an InGaAs PIN diode is 80% in the wave length range between 1300nm and 1600nm. Compute the range of responsivity of the PIN diode in the specified wavelength range. (c) Differentiate between the photo diode parameters, 'Quantum limit' and 'Dark current'	**8** **8** **4**	**CO4**