SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code Fiber Optic Communications (19EC0440) **Course & Branch**: B.Tech & ECE

Year &Sem: IV-B.Tech & I-Sem **Regulation:** R19

UNIT –I
INTRODUCTION

1.	Explain the Elements of Optical Communication System with neat sketch.	[L2] [CO1]	[12M]
2.	a) List the applications of optical fiber communication.	[L1] [CO1]	[6M]
	b) Derive the expression for i) Acceptance angle ii) Snell's law	[L3] [CO1]	[6M]
3.	a) Derive the expression for i) Critical angle. ii) Numerical aperture.	[L3] [CO1]	[6M]
	b) Explain the ray theory transmission with neat sketch.	[L2] [CO1]	[6M]
4.	a) Describe the characteristics of multimode Graded Index fiber with neat sketch.	[L2] [CO1]	[6M]
	b) A light ray is incident from medium-1 to medium-2. If the refractive indices of medium-1 and medium-2 are 1.6 and 1.36 respectively, then evaluate the angle of refraction for an incident angle of $30^{0.}$	[L4] [CO1]	[6M]
5.	a) Consider multimode fiber that has a core refractive index of 1.488 and core cladding index difference of 2.0%. Calculate numerical aperture, critical angle and acceptance angle.	[L4] [CO1]	[6M]
	b) List out the merits and demerits of optical fiber communication.	[L1] [CO1]	[6M]
6.	Describe in detail about (i) Single mode and (ii) Multimode fibers.	[L2] [CO1]	[12M]
7.	a) Illustrate the impact of group delays in optical communication.	[L2] [CO2]	[6M]
	b) What is attenuation? Explain in detail.	[L2] [CO2]	[6M]
8.	a) How the attenuation is caused by absorption losses?	[L1] [CO2]	[6M]
	b) Explain the phenomenon of Rayleigh scattering.	[L2] [CO2]	[6M]
9.	a) What is Dispersion? List the various types of dispersion.	[L2] [CO2]	[6M]
	b) Explain in brief about inter modal dispersion.	[L3] [CO2]	[6M]
10.	a) Deduce the expressions for fiber Core and Cladding losses.	[L4] [CO2]	[6M]
	b) Explain various types of fiber bending losses.	[L3] [CO1]	[6M]

UNIT –II
FIBER OPTICAL SOURCES AND COUPLING

1	a) Explain in brief about direct and indirect band gap materials in detail.	[L2] [CO3]	[6M]
	b) Explain LED Structure with neat sketch.	[L2] [CO3]	[6M]
2	a) Illustrate on light source materials in detail.	[L2] [CO3]	[6M]
	b) A planar LED is fabricated from GaAs which has a refractive index of 3.6.(i) Calculate the optical power emitted into air as a percentage of the internal optical power for the device when the transmission factor at the crystal-air interface is 0.68.(ii) When the optical power generated internally is 60% of the electric power supplied, determine the external power efficiency.	[L3] [CO3]	[6M]
3	a) Explain about the surface emitter LED with neat diagram.	[L2] [CO3]	[6M]
	b) Describe about the modulation of LED in detail.	[L2] [CO3]	[6M]
4	a) Illustrate the working principle of an edge emitter LED with neat diagram.	[L2] [CO3]	[6M]
	b) List the advantages and disadvantages of LED.	[L1] [CO3]	[6M]
5	a) Deduce the expressions of quantum efficiency and LED power.	[L4] [CO3]	[6M]
	b) Illustrate about Injection Laser Diode with suitable diagram.	[L2] [CO3]	[6M]
6	a) Explain about resonant frequencies of LASER Diode.	[L2] [CO3]	[6M]
	b) Calculate the GaAs optical source with a refractive index of 3.6 is coupled to a silica fiber that has a refractive index is 1.48. If the fiber and the source are in close physical contact then find the Fresnel reflection at the interface and power loss in dB.	[L4] [CO3]	[6M]
7	a) Derive the expressions for LASER modes and threshold conditions.	[L3] [CO3]	[6M]
	b) What power is radiated by an LED if its quantum efficiency is 3% and the peak wavelength is 670nm?	[L1] [CO3]	[6M]
8	a) Illustrate about external quantum efficiency of LASER.	[L2] [CO3]	[6M]
	b) Compute the rate equation for LASER diode.	[L3] [CO3]	[6M]
9	a) Explain in detail the various Characteristics of Light Source.	[L2] [CO3]	[6M]
	b) Describe about Temperature effects of Laser characteristics.	[L1] [CO3]	[6M]
10	a) Illustrate the working principle of Distributed feedback LASER diode.	[L2] [CO3]	[6M]
	b) The Radiative and non-radiative recombination life times of minority carriers in the active region of a double heterojunction LED are 60 nsec and 90 nsec respectively. Evaluate the total carrier recombination life time and optical power generated internally if the peak emission wavelength is 870 nm and drift current is 40 mA.	[L4] [CO3]	[6M]

UNIT –III
FIBER OPTICAL RECEIVERS

1	a) Explain the principle behind the operation of an PIN photo diode.	[L2] [CO3]	[6M]
	b) A photo diode has a quantum efficiency of 66% when photons of energy of 1.6 x 10-19 J are incident upon it. (i) Find the operating wavelength of the photodiode (ii) Calculate the incident optical power required to obtain a photo current of 2.6nA when the photodiode is operating as described above.	[L4] [CO3]	[6M]
2	a) Explain in detail the operation of Avalanche Photo Diode using suitable diagram.	[L2] [CO3]	[6M]
	b) In GaAs Photodetector a pulse of 86ns emits $6*10^6$ photons at 1300 nm wavelength. Average e-h pair generated are $6.4*10^6$. Calculate the quantum efficiency of the detector.	[L3] [CO3]	[6M]
3	a) Explain about avalanche multiplication noise in APD diode.	[L2] [CO3]	[6M]
	b) Summarize the comparisons of photo detectors.	[L2] [CO3]	[6M]
4	a) Explain the characteristics of fundamental optical receiver operation.	[L2] [CO3]	[6M]
	b) Explain the energy band diagram for a PIN photodiode with neat diagram.	[L2] [CO3]	[6M]
5	a) Illustrate how noises are entered into photo detector.	[L2] [CO3]	[6M]
	b) Analyze photo detector receiver with simple model and equivalent circuit.	[L4] [CO3]	[6M]
6	a) Deduce the equation for S/N ratio of an optical fiber.	[L4] [CO3]	[6M]
	b) Compute the Bandwidth of a photo detector having the parameters as follows: Photo diode capacitance 3pf, amplifier capacitance 4 pf, load resistance 60 Ω and amplifier input resistance is 1MΩ.	[L3] [CO3]	[6M]
7	a) Compute the expression for response time of a photodiode.	[L3] [CO3]	[6M]
	b) Explain the working of depletion layer photo diode with diagram.	[L2] [CO3]	[6M]
8	a) Explain the digital signal transmission for an optical receiver.	[L2] [CO3]	[6M]
	b) Construct the optical receiver configuration.	[L3] [CO3]	[6M]
9	a) What is a preamplifier? Classify them.	[L4] [CO3]	[6M]
	b) A given silicon avalanche photodiode has a quantum efficiency of 66% at a wavelength of 900nm.Suppose 0.6μW of optical power produces a multiplied photocurrent of 10μA. Calculate the multiplication M.	[L3] [CO3]	[6M]
10	a) Explain the mechanism of error sources and disturbance in the optical pulse detection with diagram.	[L2] [CO3]	[6M]
	b) Explain in detail about any one type of Preamplifier in detail.	[L2] [CO3]	[6M]

UNIT –IV
OPTICAL FIBER SYSTEM DESIGN & TECHNLOGY

1	a) List the types of budget in optical communication system.	[L1] [CO4]	[6M]
	b) List the applications of Optical amplifier.	[L2] [CO4]	[6M]
2	a) Explain Optical Fiber System Design Specification.	[L2] [CO4]	[6M]
	b) Explain the Rise Time Budget analysis with basic elements.	[L2] [CO4]	[6M]
3	a) What is bandwidth budget?	[L1] [CO4]	[6M]
	b) Describe about power budget with examples.	[L2] [CO4]	[6M]
4	. a) Describe about link budget calculations.	[L2] [CO4]	[6M]
	b) 2*2 biconical fiber coupler has an optical input power level of P0=400µw, the output power at the other 3 ports are P1=180µw, P2=170µw, P3=12.6nw. evaluate performance parameters.	[L4] [CO4]	[6M]
5	a) Summarize on system performance using rise time budget of digital systems.	[L2] [CO4]	[6M]
	b) Explain the significance of system consideration in point-to-point fiber links.	[L2] [CO4]	[6M]
6	a) Illustrate in detail about Link power budget.	[L2] [CO4]	[6M]
	b) Analyze the system performance using link power budget of digital systems.	[L4] [CO4]	[6M]
7	a) Explain the optical multiplexing and de-multiplexing techniques.	[L2] [CO5]	[6M]
	b) Explain in detail about Optical amplifier with an example.	[L2] [CO5]	[6M]
8	a) Explain about bandwidth budget.	[L2] [CO4]	[6M]
	b) An optical transmission system is constrained to have 600 GHZ channel spacing. How many wavelength channels can be utilized in the 1636 to 1666 nm spectral band?	[L2] [CO5]	[6M]
9	a) Sketch the optical multiplexing and explain each block.	[L3] [CO5]	[6M]
	b) LED spectral width of 40nm has rise time of 16ns, t_{mat} is 21ns, t_{rx} is 14ns and t_{mod} is 3.9ns. Find total system rise time.	[L3] [CO5]	[6M]
10	Explain in detail about Receiver Sensitivity.	[L2][CO5]	[12M]

UNIT –V
OPTICAL NETWORKS

1	a) What is optical Network? Explain the elements of optical network	[L2] [CO5]	[6M]
	b) List the advantages of optical networks.	[L1] [CO5]	[6M]
2	Explain in detail about Optical network topologies	[L2] [CO5]	[12M]
3	a) Illustrate about basic optical networks	[L2] [CO5]	[6M]
	b) What are the advantages of WDM Networks?	[L1] [CO5]	[6M]
4	a) Discuss about broadcast and select single hop network.	[L2] [CO5]	[6M]
	b) Discuss about broadcast and select multi hop network.	[L2] [CO5]	[6M]
5	Explain in detail about wave length routed networks.	[L2] [CO5]	[12M]
6	a) List the advantages of EDFA.	[L1] [CO6]	[4M]
	b) Explain the Performance of WDM+EDFA systems in optical networks	[L2] [CO6]	[6M]
7	a) Discuss the basic concept of optical CDMA.	[L2] [CO6]	[6M]
	b) What are the advantages of optical CDMA?	[L1] [CO6]	[6M]
8	Illustrate about ultra-high capacity networks in detail.	[L2] [CO6]	[10M]
9	a) Explain in brief about the working principle of WDM.	[L2] [CO6]	[6M]
	b) What are the characteristics of WDM?	[L1] [CO6]	[6M]
10	a) Why we need optical networks? Explain its significance.	[L4] [CO6]	[6M]
	b) Describe about the optical CDMA network using coded sequence pulse.	[L2] [CO6]	[6M]

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