SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code Fiber Optic Communications (18EC0438) **Course & Branch**: B.Tech & ECE

Year &Sem: IV-B.Tech & I-Sem **Regulation:** R18

UNIT –I INTRODUCTION

1.	a) Define the Snell's law	[L1] [CO1]	[2M]
	b) List the elements of Ray optics	[L1] [CO1]	[2M]
	c) show the working principal of Circular Waveguides	[L1] [CO1]	[2M]
	d) Identify any two different between step index & graded index fiber.	[L2] [CO1]	[2M]
	e) List out any two the merits and demerits of optical fiber communication	[L1] [CO1]	[2M]
2.	Explain the Elements of Optical Communication System with neat sketch.	[L2] [CO1]	[10M]
3.	a) Explain detail about the Evolution of optical fiber systems.	[L2] [CO1]	[4M]
	b) Illustrate the Reflection and Refraction with neat sketch.	[L2] [CO1]	[6M]
4.	a) List the applications of optical fiber communication.	[L1] [CO1]	[4M]
	b) A light wave is travelling in a semiconductor medium (GaAs) of refractive index 3.6.It is incident on a different semiconductor medium (AlGaAs) of refractive index 3.4 & angle of incidence is 80°. Calculate numerical aperture & acceptance angle. Will it result in total internal reflection? Comment on the result.	[L3] [CO1]	[6M]
5.	a) Consider multimode fiber that has a core refractive index of 1.488 and core cladding index difference of 2.0%. Evaluate numerical aperture, critical angle and acceptance angle.	[L3] [CO1]	[6M]
	b) List out the merits and demerits of optical fiber communication.	[L1] [CO1]	[4M]
6.	a) Define critical angle and also derive the expression for critical angle.	[L1] [CO1]	[5M]
	b) Describe the single mode step Index fiber with neat sketch.	[L1] [CO1]	[5M]
7.	a) Describe the Multimode Step Index fiber with neat sketch.	[L1] [CO1]	[5M]
	b) Fiber has normalized frequency 26.6 & operating wavelength 1300nm, if the radius of the fiber core is 25μm.Compute the numerical aperture.	[L3] [CO1]	[5M]
8.	a) Compare step index & graded index fiber.	[L2] [CO1]	[5M]
	b) Describe the multimode Graded Index fiber with neat sketch.	[L1] [CO1]	[5M]
9.	a) Define the Mode theory of Circular Waveguides.	[L1] [CO1]	[4M]
	b) Calculate number of modes of an optical fiber having diameter of 50μm & n1 =1.48 & n2=1.46having operating wavelength 0.82μm.	[L3] [CO1]	[6M]
10.	a) Explain about the Snell's law and significance of numerical aperture.	[L2] [CO3]	[5M]
	b) Illustrate on ray optics in detail with neat diagrams.	[L2] [CO1]	[5M]
11.	a) Elaborate the total internal reflection with the help of suitable optical cable setup.	[L3] [CO1]	[4M]
	b) Discuss the Acceptance angle and Numerical aperture.	[L2] [CO1]	[6M]

UNIT –II
TRANSMISSION CHARACTERISTIC OF OPTICAL FIBERS

1.	a) Define Information Capacity.	[L1] [CO2]	**[2M]**
	b) List the various types of losses in optical fiber.	[L1] [CO2]	**[2M]**
	c) what is the prepose of Core and Cladding Losses.	[L1] [CO2]	**[2M]**
	d) What is mean by attenuation?	[L1] [CO2]	**[2M]**
	e) Show the working Principle of OTDR.	[L2] [CO2]	**[2M]**
2.	Demonstrate any two types of Losses in Optical Fiber Communication System.	[L2] [CO2]	**[10M]**
3.	a) Explain the Design Optimization of Single mode fibers.	[L2] [CO2]	**[5M]**
	b) How to minimize the micro bending losses in the fiber?	[L1] [CO2]	**[5M]**
4.	a) How the attenuation is caused by scattering losses & bending losses?	[L1] [CO2]	**[5M]**
	b) Explain in detail about the Mechanisms which cause's Absorption.	[L2] [CO2]	**[5M]**
5.	a) Define linear scattering. Explain about Rayleigh & Mie scattering.	[L1] [CO2]	**[5M]**
	b) Compute the expression for waveguide dispersion.	[L3] [CO2]	**[5M]**
6.	Explain dispersion occurring in multimode fibers in detail with expressions.	[L2] [CO2]	**[10M]**
7.	a) Distinguish between intrinsic & extrinsic Absorption.	[L2] [CO3]	**[5M]**
	b) Determine the theoretical cutoff wavelength for single mode fiber.	[L3] [CO2]	**[5M]**
8.	a) what is attenuation? Explain in detail.	[L1] [CO2]	**[5M]**
	b) Compute the expression for material dispersion.	[L3] [CO3]	**[5M]**
9.	Analyze pulse broadening in graded index waveguides.	[L4] [CO6]	**[10M]**
10.	a) Compute the expression for total dispersion in single mode fiber	[L3] [CO3]	**[5M]**
	b) Explain the refractive index profile optimizes the design in a single mode fiber?	[L2] [CO2]	**[5M]**
11.	a) Illustrate on the two main causes of Intra Modal Dispersion.	[L2] [CO3]	**[5M]**
	b) Explain the phenomenon of Rayleigh scattering in scattering loss.	[L2] [CO3]	**[5M]**

UNIT –III
FIBER OPTICAL SOURCE AND COUPLING

1	a) Define direct bandgap materials and indirect bandgap materials	[L1] [CO5]	**[2M]**
	b) What are the advantages of LED.	[L1] [CO5]	**[2M]**
	c) Sketch the emitter LED circuit.	[L3] [CO5]	**[2M]**
	d) Define LASER	[L1] [CO3]	**[2M]**
	e) Show the Temperature effects of Laser	[L2] [CO3]	**[2M]**
2	a) Explain LED Structure with neat sketch.	[L2] [CO3]	**[5M]**
	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 50% of the electric power supplied, determine the external power efficiency.	[L3] [CO3]	**[5M]**
3	a) Illustrate on light source materials in detail.	[L2] [CO2]	**[5M]**
	b) Explain about the surface emitter LED with neat diagram.	[L2] [CO3]	**[5M]**
4	a) Describe about the modulation of LED in detail	[L1] [CO3]	**[5M]**
	b) Illustrate on edge emitter LED with neat diagram.	[L2] [CO3]	**[5M]**
5	a) Explain about quantum efficiency and LED power.	[L2] [CO3]	**[5M]**
	b) Demonstrate on direct and indirect bandgap materials in detail.	[L2] [CO3]	**[5M]**
6	a) Explain about resonant frequencies of LASER Diode	[L2] [CO3]	**[5M]**
	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.	[L3] [CO3]	**[5M]**
7	a) Compute the expression for modes and threshold condition of LASER.	[L3] [CO3]	**[5M]**
	b) Calculate power radiated by an LED if its quantum efficiency is 3% and the peak wavelength is 670nm.	[L4] [CO3]	[5M]
8	a) Illustrate about external quantum efficiency of LASER.	[L2] [CO3]	**[5M]**
	b) Compute the rate equation for LASER diode.	[L3] [CO3]	**[5M]**
9	a) Explain in detail the various Characteristics of Light Source	[L2] [CO3]	**[5M]**
	b) Describe about Temperature effects of Laser	[L1] [CO3]	**[5M]**
10	a) Explain in detail about Quantum laser.	[L2] [CO3]	**[5M]**
	b) Illustrate about source to fiber power launching.	[L2] [CO3]	**[5M]**
11	a) Explain about Distributed feedback LASER.	[L2] [CO3]	**[5M]**
	b) Describe about the resonant frequencies of optical sources.	[L2] [CO3]	**[5M]**

UNIT –IV
Fiber Optical Receivers

1	a) Define avalanche multiplication noise in APD diode	[L1] [CO4]	**[2M]**
	b) List the operating parameters of Si, Ge, In GaAs for PIN diode	[L1] [CO4]	**[2M]**
	c) Sketch the schematic representation of a PIN photodiode circuit	[L3] [CO4]	**[2M]**
	d) State the signal transmission for an optical receiver.	[L1] [CO4]	**[2M]**
	e) List out the quantum limit in optical receiver.	[L1] [CO4]	**[2M]**
2	a) Explain in detail the operation of Avalanche Photo Diode with its structure.	[L2] [CO4]	**[5M]**
	b) A photo diode has a quantum efficiency of 65% when photons of energy of 1.5 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 2.5nA when the photodiode is operating as described above.	[L3] [CO3]	**[5M]**
3	a) Explain about avalanche multiplication noise in APD diode.	[L2] [CO4]	**[5M]**
	b) Summarize the comparisons of photo *detectors.*	[L2] [CO4]	**[5M]**
4	a) Explain the principle behind the operation of an PIN photo diode.	[L2] [CO4]	**[5M]**
	b) Explain the simple energy band diagram for a PIN photodiode with neat diagram.	[L2] [CO4]	**[5M]**
5	a) Illustrate how noises are entered into photo detector.	[L2] [CO4]	**[5M]**
	b) Analyze photo detector receiver with simple model and equivalent circuit.	[L4] [CO6]	**[5M]**
6	a) Describe the equation for S/N ratio of an optical fiber.	[L2] [CO2]	**[5M]**
	b) List the operating parameters of Si, Ge, In GasAs for avalanche photo diode.	[L1] [CO2]	**[5M]**
7	a) Compute the expression for response time of a photodiode.	[L3] [CO4]	**[5M]**
	b) Explain the working of depletion layer photocurrent with diagram.	[L2] [CO4]	**[5M]**
8	a) Explain the digital signal transmission for an optical receiver?	[L2] [CO4]	**[5M]**
	b) Design any one type of receiver configuration works in optical receiver.	[L3] [CO4]	[5M]
9	a) List the operating parameters of Si, Ge, In GaAs for PIN diode.	[L1] [CO4]	**[5M]**
	b) A given silicon avalanche photodiode has a quantum efficiency of 65% at a wavelength of 900nm.Suppose 0.5μW of optical power produces a multiplied photocurrent of 10μA. Calculate the multiplication M.	[L3] [CO4]	**[5M]**
10	a) Explain the mechanism of error sources and disturbance in the optical pulse detection with diagram.	[L3] [CO4]	**[5M]**
	b) Demonstrate any one type of Preamplifier in detail.	[L3] [CO4]	**[5M]**
11	a) Explain about the probability of error in detail.	[L2] [CO4]	**[5M]**
	b) Illustrate on the quantum limit in optical receiver	[L2] [CO4]	**[5M]**

UNIT –V
OPTICAL FIBER SYSTEM DESIGN &TECHNLOGY

1	a) List the types of budget in optic	[L1] [CO5]	**[2M]**
	b) Identify what are the applications of Optical amplifier	[L2] [CO5]	**[2M]**
	c)List the differs between the optical multiplexing and de-multiplexing techniques	[L1] [CO5]	**[2M]**
	*d)*Define the link budget calculations	[L1] [CO5]	**[2M]**
	e) Draw the diagram of the optic de-multiplexing technique.	[L2] [CO5]	**[2M]**
2	a) Explain Optical Fiber System Design Specification.	[L2] [CO5]	**[6M]**
	b) Explain the Rise Time Budget analysis with basic elements.	[L2] [CO5]	**[4M]**
3	a) Describe the bandwidth budget.	[L1] [CO5]	**[6M]**
	b) Describe about power budget with examples	[L1] [CO5]	**[4M]**
4	. a) Describe about link budget calculations	[L1] [CO5]	[5M]
	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. Find performance parameters**.**	[L3] [CO5]	**[5M]**
5	a) Summarize on system performance using rise time budget of digital systems.	[L3] [CO5]	**[5M]**
	b) Explain the significance of system consideration in point-to-point fiber links**.**	[L2] [CO5]	**[5M]**
6	a) Illustrate on line coding with neat diagrams.	[L2] [CO5]	**[3M]**
	b) Analyze the system performance using link power budget of digital systems.	[L4] [CO6]	**[7M]**
7	a) Explain the optical multiplexing and de-multiplexing techniques	[L2] [CO5]	**[3M]**
	b) Explain about Optical amplifier and applications	[L2] [CO5]	**[7M]**
8	a) Explain about bandwidth budget.	[L2] [CO5]	**[5M]**
	b) An optical transmission system is constrained to have 600 GHZ channel spacing. How many wavelength channels can be utilized in the1536 to 1556 nm spectral band?	[L2] [CO5]	**[5M]**
9	a) Draw the diagram of optical multiplexing explain each block	[L2] [CO5]	**[5M]**
	b) LED spectral width of 40nm has rise time of 15ns, t_{mat} is 21ns, $t_{rx}$is 14ns and t_{mod} is 3.9ns. Find total system rise time.	[L3] [CO5]	**[5M]**
10	Explain optical amplifier and its applications.	[L2] [CO5]	**[10M]**

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