PRESIDENCY UNIVERSITY
BENGALURU
School of Engineering
Mid - Term Examinations - November2024

Semester: VII

Course Code: ECE3061

Course Name: Optical Communication

Program:

Date: 06/11/2024

Time: 11.45am to 01.15pm

Max Marks: 50

Weightage: 25%

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.   **5Qx2M =10M**

1	State and explain snell's law with respect to optical physics?	2 Marks	L1	CO1
2	Total Internal Reflection (TIR) that leads to the propagation of waves within fiber cable medium. TIR can be observed only in materials in which the velocity of light is less than in air. The two conditions necessary for TIR to occur are ?	2 Marks	L2	CO1
3	Imagine a beam of light traveling inside a glass block, heading toward the surface where the glass meets air. At certain angles, the light passes through into the air, but if you increase the angle, something fascinating happens: the light no longer exits but reflects entirely back into the glass.calulate that angle?	2 Marks	L3	CO1
4	Imagine you're working with an optical fiber, trying to guide light efficiently from one point to another. The core of the fiber has a refractive index of 1.5, while the surrounding cladding has a slightly lower refractive index of 1.48. Can you figure out how to calculate the Numerical Aperture (NA) for this fiber,	2 Marks	L3	CO1
5	Consider two different types of optical fibers—step-index and graded-index multimode fibers—both designed to carry multiple light paths (or modes) simultaneously. What do you think are the advantages and challenges of each type of fiber in practical applications?	2 Marks	L2	CO1

Part B

Answer ALL Questions. Each question carries 10 marks.   **4QX10M=40M**

6	6a	A light ray is incident from medium-1 to medium-2. If the refractive indices of medium-1 and medium-2 are 1.5 and 1.36 respectively then determine the angle of refraction for an angle of incidence of 30°?	6 Marks	L3	CO1

	6b	Define the following with respect to optical physics
		
		  i. Acceptance angle
		  ii. V-Number
			4 Marks	L1	CO1

or

7	7a	Total internal reflection (TIR) is the optical phenomenon that allows optical fibers to work, with the aid of the diagram explain how total internal reflection (TIR) phenomenon is achieved in optical fibre?	6 Marks	L2	CO1

	7b	Define the following with respect to optical physics
		
		  i. Critical Angle
		  ii. Numerical aperture
			4 Marks	L1	CO1

8		Determine the maximum core diameter for an optical fibre with refractive index difference of 1.6 % and a core refractive index of 1.48 in order that it may be suitable for single mode operation for an operating wavelength of 0.9 μm. Further estimate the maximum core diameter for a single mode operation when the relative refractive index difference is reduced by a factor of 10.Assume V- number as 2.405.	10Marks	L3	CO1

or

9		A step index multimode fiber with a NA of 0.2 supports approximately 1000 modes at an 850 nm wavelength . Determine the diameter of its core ? How many modes do the fiber supports at 1320nm and at 1550 nm?	10Marks	L3	CO1

10		A silica fiber has a core refractive index of 1.5 and its cladding refractive index is 1.45 Determine
		
		  I. Critical Angle
		  II. the numerical aperture of the fiber
		  III. percentage of light collected by the fibre
			10Marks	L3	CO1

11	Light traveling in air strikes a glass plate at an angle θ1 = 33 degrees, where θ1 is measured between the incoming ray and the glass surface. if the refracted and reflected beams makes an angle of 90 degree with each other, what is the refractive index of the glass? Determine critical angle	10Marks	L3	CO1

12	When a light wave travels from a semiconductor medium with a refractive index of 3.6 to a different semiconductor medium with a refractive index of 3.4 and the angle of incidence is 80 degree will this result in total internal reflection analyze on this result.	10Marks	L4	CO2

or

13	With a neat labelled diagram analyze photonic crystal fibres in optical fibre communication system	10Marks	L4	CO2