SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics & Communication Engineering
B. Tech.7th Semester ECE Major Examination (Odd) 2023-24

Entry No: | | | | | | | | | | Total Number of Pages:[02]

Date: 18th December 2023 Total Number of Questions: [12]

CourseTitle: Optical Fiber Communication Course Code: ECL4170

Time Allowed: 3 Hours **Max Marks: [50]**

Instructions / NOTE

i. **Attempt All Questions.**
ii. **Support your answer with neat freehand sketches/diagrams, wherever appropriate.**
iii. **Assume an appropriate data / information, wherever necessary / missing.**

Section A Q1. All questions 1 Mark each , Q2 . 1 Marks each

Q1. i)Optical fiber works on the phenomenon of _____

ii)The refractive index of the core is uniform throughout and undergoes an abrupt change at the cladding boundary which is known as_____ . **CO 1**

iii)_____ mode fiber have more dispersion when distance of transmission is large. **CO2**

iv) _____may be regarded as the modulation of light through thermal vibrations within the fiber.

v) When there is no optical power incident on the photodetector a small reverse current still flows from the device terminals called_____.

vi) The two main sources of noise in photodiodes without internal gain are _____ and _____. **CO3**

Q2. i) A graded index optical fiber has a parabolic refractive index profile. If the fiber has numerical aperture =0.22. Calculate the total number of guided modes at a wavelength of 1310 nm. **CO2**

ii)The ratio of the stimulated emission rate to the spontaneous emission rate for an incandescent lamp operating at a temperature of 1000 K_____. It may be assumed that the average operating wavelength is 0.5 μm. And h = 6.626 x 10^{-34}, k= 1.31x 10^{-23} **CO3**

iii) A ruby laser contains a crystal of length 4 cm with a refractive index of 1.78. The peak emission wavelength from the device is 0.55 μm. Determine the number of longitudinal modes and their frequency separation. **CO3**

iv) Which feature of an eye-diagram assists in the measurement of additive noise in the signal? **CO4**

a. Eye opening (height, peak to peak)b. Eye overshoot/ undershoot

c. Eye widthd. None of the above

Section B – All questions carry 4 Marks Each

Q3. How are Critical-Angle, Numerical-Aperture, Acceptance-Angle important factors in typical Optical fiber? **CO1**

Q4. Describe the various Elements of an Optical Fiber Transmission Link. **CO1**

Q5. Compare Meritsand Demerits of Fiber Optics over conventional copper wire systems. **CO2**

Q6. Discuss working of Avalanche photo diode as potential component in optical fiber communication. **CO3**

Q7. How are LASERs different then LED while taking into consideration optical fiber communication? **CO3**

Q8. There are several losses that are possible in optical communication. List them and explain any two. **CO2**

Q9. Compare SBS and SRS in communication system. **CO2**

Q10 While designing a basic optical communication system on Optisystem software what are the various points that need to be taken care by designer ? Explain the process. **CO5**

Q11 Write Short notes on following topics :

a) WDM b) EDFA **CO4**

Q12 Describe Prospects for Optical Fiber Communication in growing economy of India. **CO5**

After successful completion of this course students will be able to achieve this Course Outcomes

CO1 To learn the basic concept of optical fiber
CO2 To acquire knowledge about various losses in optical fiber
CO3 To understand basic design concept of optical sources and detectors
CO4 To learn and analyze the design concept of optical fiber networks
CO5 Able to learn design parameters of Optical Fiber Communication System

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1 i) ,ii) 3, 4	10	85
CO2	1 iii) , iv) 2 i) 5,8,9	15	85
CO3	1 v) , vi) , 2 ii), iii) 6,7	12	85
CO4	2 iv) 11	5	85
CO5	10,12	8	85

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics & Communication Engineering
B. Tech.7th Semester ECEMinor-I(Odd) 2023-24

Entry No: | | | | | | | | | | Total Number of Pages:[01]

Date: 27th September 2023 Total Number of Questions: [05]

CourseTitle: Optical Fiber CommunicationCourse Code: ECL4170

Time Allowed:1 HourMax Marks: [20]

Instructions / NOTE :Attempt All Questions.

i. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
ii. Assume an appropriate data / information, wherever necessary / missing.

Section – A (1*4 Marks)

Q1. a) The refractive indices of core and cladding of an optical fiber are 1.40 and 1.14 respectively. The value of numerical aperture is 0.818. [1*4] =Marks 4 CO1, CO2, CO1, CO1,

b) In single mode fibers _____ is the most beneficial index profile.

c) MFD is a measure of light intensity in a single mode fiber cross section.

d) -90 dBm = _____ Power in _____.

Section – B (16 Marks) (Answer in points 4 to 5 maximum)

Q2. There was a construction activity going near the road. Due to negligence the optical fiber was damaged and the network was interrupted. What is the role of an engineer to restore the optical network? Marks 4 CO2

Q3. A graded index optical fiber has a parabolic refractive index profile. If the fiber has numerical aperture =0.22. Calculate the total number of guided modes at a wavelength of 1310 nm. a = 25μm Marks 4 CO1

Q4. Which parameter relates wavelength, core radius and refractive index of material ? How this parameter is utilized in deciding modes of propagation? Marks 2,2 CO1

Q5. Determine the cutoff wavelength for a Step Index fiber to exhibit Single mode operation when the core refractive index and radius are 1.46 um and 4.5 um respectively, with the relative index difference being 0.25 percent. Marks 4 CO2

After successful completion of this course students will be able to achieve this

Course Outcomes

CO1 To learn the basic concept of optical fiber
CO2 To acquire knowledge about various losses in optical fiber
CO3 To understand basic design concept of optical sources and detectors
CO4 To learn and analyze the design concept of optical fiber networks
CO5 Able to learn design parameters of Optical Fiber Communication System

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics & Communication Engineering
B. Tech.7th Semester ECEMinor-II(Odd) 2023-24

Entry No: | | | | | | | | | | |

Date: 7th November 2023 Total Number of Pages:[01]

Total Number of Questions: [05]

CourseTitle: Optical Fiber CommunicationCourse Code: ECL4170

Time Allowed:1 Hour Max Marks: [20]

Instructions / NOTE :Attempt All Questions.

i. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

ii. Assume an appropriate data / information, wherever necessary / missing.

	Section – A (1*4 Marks)		
Q1.	a) When the mean optical power launched into an 8 km length of fiber is 120 μW, the mean optical power at the fiber output is 3μW. The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices is _____ b) The scattering created by such inhomogeneities is mainly in the forward direction and is called_____ scattering. c)Stimulated Raman scattering (SRS) is similar to SBS except that a high-frequency _____phonon rather than an _____phonon is generated in the scattering process d) The external quantum efficiency may be defined as the ratio of the _____ emitted from the device to the _____ internally generated.	[1*4] =Marks 4	CO2, CO2, CO2, CO3,
	Section – B (16 Marks) (Answer in points 4 to 5 maximum)		
Q2.	The radiative and nonradiative recombination lifetimes of the minority carriers in the active region of a double-heterojunction LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40 mA.	4	CO3
Q3.	Compare Rayleigh and Mie Scattering in optical communication.	4	CO2
Q4.	A multimode graded index fiber exhibits total pulse broadening of 0.1 μs over a distance of 15 km. Estimate: (a) the maximum possible bandwidth on the link assuming no intersymbol interference; (b) the pulse dispersion per unit length; (c) the bandwidth–length product for the fiber.	4	CO2
Q5.	Discuss the equation that allows estimation of the rms impulse response of a multimode step index fiber	4	CO2

After successful completion of this course students will be able to achieve this

Course Outcomes

CO1 To learn the basic concept of optical fiber
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CO3 To understand basic design concept of optical sources and detectors
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CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1			

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics & Communication Engineering
B. Tech.7th Semester ECEMinor-II(Odd) 2023-24

Entry No: | | | | | | | | | | | Total Number of Pages:[01]

Date: 7th November 2023 Total Number of Questions: [05]

CourseTitle: Optical Fiber CommunicationCourse Code: ECL4170

Time Allowed:1 Hour Max Marks: [20]

Instructions / NOTE :Attempt All Questions.

i. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

ii. Assume an appropriate data / information, wherever necessary / missing.

	Section – A (1*4 Marks)		
Q1.	a) When the mean optical power launched into an 8 km length of fiber is 120 μW, the mean optical power at the fiber output is 3μW. The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices is ____ b) The scattering created by such inhomogeneities is mainly in the forward direction and is called_____ scattering. c)Stimulated Raman scattering (SRS) is similar to SBS except that a high-frequency _____phonon rather than an _____phonon is generated in the scattering process. d) The external quantum efficiency may be defined as the ratio of the _____ emitted from the device to the _____ internally generated.	[1*4] =Marks 4	CO2, C02, CO2, CO3,
	Section – B (16 Marks) (Answer in points 4 to 5 maximum)		
Q2	The radiative and nonradiative recombination lifetimes of the minority carriers in the active region of a double-heterojunction LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40 mA.	4	CO3
Q3.	Compare Rayleigh and Mie Scattering in optical communication.	4	CO2
Q4.	A multimode graded index fiber exhibits total pulse broadening of 0.1 μs over a distance of 15 km. Estimate: (a) the maximum possible bandwidth on the link assuming no intersymbol interference; (b) the pulse dispersion per unit length; (c) the bandwidth–length product for the fiber.	4	CO2
Q5.	Discuss the equation that allows estimation of the rms impulse response of a multimode step index fiber.	4	CO2

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Course Outcomes

CO1 To learn the basic concept of optical fiber
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CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1			
CO2	1 a), b) ,3,4,5	14	87
CO3	1 c) , d) 2	6	87
CO4			
CO5			

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics & Communication Engineering
B. Tech. 7th Semester ECE Minor-I (Odd) 2023-24

Entry No:

Date: 27th September 2023 Total Number of Pages: [01]

Course Title: Optical Fiber Communication Total Number of Questions: [05]

Time Allowed: 1 Hour Course Code: ECL4170 Max Marks: [20]

Instructions / NOTE :Attempt All Questions.

i. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
ii. Assume an appropriate data / information, wherever necessary / missing.

Section – A (1*4 Marks)

Q1. a) The refractive indices of core and cladding of an optical fiber are 1.40 and 1.14 respectively. The value of numerical aperture is _____. [1*4] =Marks 4 CO1,

b) In single mode fibers_____ is the most beneficial index profile. CO2,

c) _____ is a measure of light intensity in a single mode fiber cross section. CO1,

d) -90 dBm =_____ Power in _____. CO1,

Section – B (16 Marks) (Answer in points 4 to 5 maximum)

Q2. There was a construction activity going near the road. Due to negligence the optical fiber was damaged and the network was interrupted. What is the role of an engineer to restore the optical network? Marks 4 CO2

Q3. A graded index optical fiber has a parabolic refractive index profile. If the fiber has numerical aperture =0.22. Calculate the total number of guided modes at a wavelength of 1310 nm. $a = 25\mu m$ Marks 4 CO1

Q4. Which parameter relates wavelength, core radius and refractive index of material ? How this parameter is utilized in deciding modes of propagation? Marks 2,2 CO1

Q5. Determine the cutoff wavelength for a Step Index fiber to exhibit Single mode operation when the core refractive index and radius are 1.46 um and 4.5 um respectively, with the relative index difference being 0.25 percent. Marks 4 CO2

After successful completion of this course students will be able to achieve this

Course Outcomes

CO1 To learn the basic concept of optical fiber
CO2 To acquire knowledge about various losses in optical fiber
CO3 To understand basic design concept of optical sources and detectors
CO4 To learn and analyze the design concept of optical fiber networks
CO5 Able to learn design parameters of Optical Fiber Communication System

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics & Communication Engineering
B. Tech. ECE Major Examination (Odd) 2022-23

Entry No: | | | | | | | | | | | Total Number of Pages: [01]

Date: 28th September 2022 Total Number of Questions: [06]

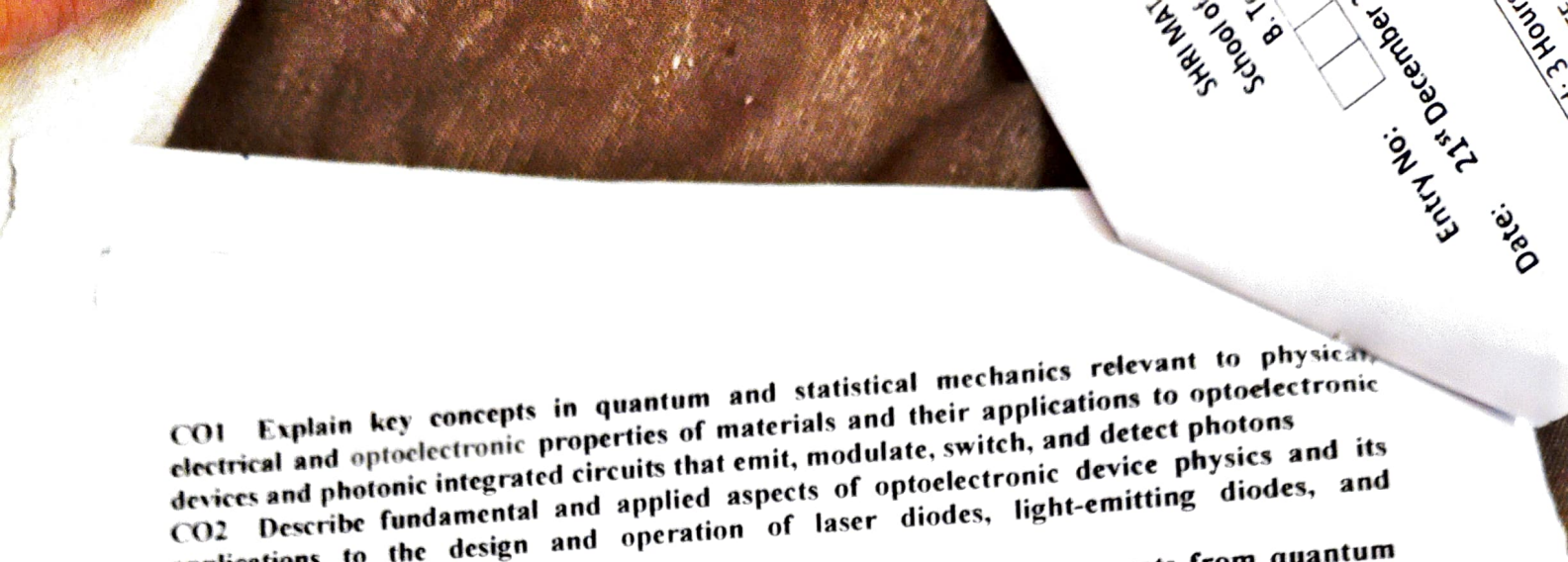
Course Title: Optoelectronic Devices ECE 4171

Time Allowed: 1 Hour 30 Minutes Max Marks: [20]

Instructions / NOTE

i. **Attempt All Questions.**
ii. **Support your answer with neat freehand sketches/diagrams, wherever appropriate.**
iii. **Assume an appropriate data / information, wherever necessary / missing.**

	Section - A		
Q1.	I. Name the compound semiconductor used for following applications : Fluorescent materials =_____LightDetectors=_____ ii) . The distance *d* between two adjacent planes labeled (*hkl*) is given in terms of the lattice constant, *a*, as_____ iii) In many compound semiconductors, atoms are arranged in a basic diamond structure,but are differenton alternating sites. This is called a - _____ structure and is typical of the III–V compounds. iv)n If the conduction band electron and the hole are created by the excitation of a valence band electron to the conduction band, they are called an _____ v) The curvature at the minimum of the conduction band is directly related to what? a. The effective momentum of an electron. b. The effective band gap of the semiconductor. c. The effective mobility of the semiconductor. d . The effective mass of an electron near the minimum the conduction.	[1*5] =Marks 5	CO1
	Section - B		
Q2.	Discuss the concept of intrinsic and extrinsic semiconductor with band diagrams.	**Marks 3**	CO1
Q3.	How direct band gap semiconductors are different from indirect bandgap semiconductors ?	**Marks 3**	CO1
Q4.	Discuss Schematic band diagram, density of states, Fermi–Dirac distribution, and the carrier concentrations for (a) intrinsic, (b) n-type, and (c) p-type semiconductors at thermal equilibrium	**Marks 3**	CO1
Q5.	How the variation of direct and indirect conduction bands in AlGaAs as a function of composition ?	**Marks 3**	CO1
Q6.	Find the (E, **k**) relationship for a free electron and relate it to the electron mass.	**Marks 3**	CO1



CO1 Explain key concepts in quantum and statistical mechanics relevant to physical, electrical and optoelectronic properties of materials and their applications to optoelectronic devices and photonic integrated circuits that emit, modulate, switch, and detect photons

CO2 Describe fundamental and applied aspects of optoelectronic device physics and its applications to the design and operation of laser diodes, light-emitting diodes, and photodetectors

CO3 Analyze optoelectronic device characteristics in detail using concepts from quantum mechanics and solid state physics

CO4 Describe techniques to improve the operation of optoelectronic devices and device characteristics that have to be optimized for new applications by employing their understanding of optoelectronic device physics

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1	20	45

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics & Communication Engineering
B. Tech. ECE Major Examination (Odd) 2022-23

Entry No: | | | | | | | | | |

Total Number of Pages: [01]

Date: 21st December 2022

Total Number of Questions: [09]

Course Title: Optoelectronic Devices ECE 4171

Time Allowed: 3 Hours

Max Marks: [50]

Instructions / NOTE

ii. Attempt All Questions. Support your answer with neat freehand sketches/diagrams, wherever appropriate. Assume an appropriate data / information, wherever necessary / missing.

Section – A (Question 1 (1 Marks each) Question 2 (2 Marks each) (15 Marks)

Q1. i) If a beam of photons with hv < E_g falls on a semiconductor, there will be _____ absorption.
ii) The solar cell converts_____ into _____.
iii) The bandgap of Silicon is _____ while that of Germanium is _____
iv) The optical switch is used for_____
v)Photodetector is used for_____ CO1, CO2

Q2. i) One example each for Direct and Indirect semiconductor?
ii)Photoluminescence is _____.
iii) solar Cells can be classified as _____,_____ and _____.
iv) Einstein relationship is used to find_____.
v) Optical storage device examples are _____. CO3, CO4

Section – B (Marks 5 each) (35 Marks)

Q3.	Optical modulators and switches can be of great utility in present era of high speed data transfer. Explain.	5	CO4
Q4.	Laser is a great invention for humanity. Explain about laser action and application ?	5	CO3
Q5.	How optical absorption experiment can be used for the determination of bandgap of materials ?	5	CO2
Q6.	How alloy composition variation leads to change in properties of materials ?	5	CO1
Q7.	Crystal lattices and semiconductor properties are related. Explain.	5	CO1
Q8.	What are heterojunctions ? How they have revolutionized the field of semiconductors ?	5	CO3
Q9.	Discuss principle and operation of solar cell.	5	CO4

CO1 Explain key concepts in quantum and statistical mechanics relevant to physical, electrical and optoelectronic properties of materials and their applications to optoelectronic devices and photonic integrated circuits that emit, modulate, switch, and detect photons

CO2 Describe fundamental and applied aspects of optoelectronic device physics and its applications to the design and operation of laser diodes, light-emitting diodes, and photodetectors

CO3 Analyze optoelectronic device characteristics in detail using concepts from quantum mechanics and solid state physics

CO4 Describe techniques to improve the operation of optoelectronic devices and device characteristics that have to be optimized for new applications by employing their understanding of optoelectronic device physics

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1,6,7	15	38
CO2	1,5	8	38
CO3	2,4,8	14	38
CO4	3,9	13	38