Enrollment No......................................

Faculty of Engineering

End Sem Examination May-2023

EC3CO14 Fiber Optic Communications

Programme: B.Tech.   Branch/Specialisation: EC

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1   i.   Multimode fibre has core refractive index n1=1.480 and cladding   **1**
            index 1.460 then NA will be _____.
            (a) 0.424   (b) 0.242   (c) 0.121   (d) None of these
      ii.   Second optical window spectrum in wavelength (nm) for an OFC   **1**
            is _____.
            (a)1260   (b) 1310   (c) 1550   (d)1035
      iii. A permanent join in fiber is called-   **1**
            (a) Connector (b) Splice   (c) Butt joint   (d) Tapered sleeve
      iv.   Scattering losses are due to-   **1**
            (a) Compositional fluctuations
            (b) Structural inhomogeneities
            (c) Atomic defects
            (d) All of these
      v.   In a laser structure, the existence of standing waves is possible at   **1**
            frequencies for which the distance between the mirrors is an
            integral number of _____.
            (a) $\lambda / 2$ (b) $\lambda / 4$ (c) $\lambda / 6$ (d) $\lambda / 8$
      vi.   The frequency response of an LED depends on-   **1**
            (a) Doping level in the active region
            (b) Injected carrier lifetime in the recombination region
            (c) Parasitic capacitance of the LED
            (d) All of these

P.T.O.

vii.   _____ is fully depleted by employing electric fields.   **1**
(a) Avalanche photodiode   (b) P-I-N diode
(c) Varactor diode   (d) P-n diode

viii.   The fraction of incident photons generated by photodiode of   **1**
electrons generated collected at detector is known as-
(a) Quantum efficiency   (b) Absorption coefficient
(c) Responsivity   (d) Anger recombination

ix.   WDM is very similar to-   **1**
(a) FDM   (b) TDM   (c) STDM   (d) ATDM

x.   A device which is made of isolators and follows a closed loop   **1**
path is called as a _____.
(a) Circulator   (b) Gyrator   (c) Attenuator   (d) Connector

Q.2   i.   Differentiate between step index and Graded index fiber.   **2**

ii.   A silica optical fiber has a core refractive index of 1.5 and a   **3**
cladding refractive index of 1.47.Determine the Numerical
aperture, acceptance angle and critical angle in air for the fiber.

iii.   What is PREFORM? Explain MCVD method of PREFORM   **5**
Fabrication in brief.

OR   iv.   Calculate the number of modes of an optical fiber having diameter   **5**
of 50µm, n1=1.48 and n2= 1.46 and wavelength 'λ' is 820 nm.

Q.3   i.   Distinguish intrinsic and extrinsic absorption.   **2**

ii.   Explain different type of scattering occur in FOC.   **8**

OR   iii.   Classify dispersion in fiber optic. Derive the expression for   **8**
material dispersion.

Q.4   i.   What is meant by hetero junction? Mention its advantages.   **3**

ii.   A Laser contains a crystal length 4cm with a refractive index of   **7**
1.78. The peak emission wavelength from the device is 0.55 pm.
Determine the number of longitudinal modes & their frequency
separation.

OR   iii.   Derive the expression for cavity model of LASER to calculate   **7**
number of longitudinal modes & their frequency separation.

Q.5   i.   Define any two-photo detector characteristic.   **4**

ii.   Explain the structure & the working of APD with the help of   **6**
suitable diagram' Write advantages & disadvantages of APD over
PIN diode.

OR   iii.   Explain the structure features & working principle of PIN   **6**
photodiode. What is the functional significance of intrinsic Layer
inserted in between the P&N Layer?

Q.6   Attempt any two:

i.   What is WDM? Explain its architecture for fiber optic   **5**
communication.

ii.   What are the components of isolator, how it is work explain with   **5**
diagram.

iii.   Explain optical sensors and its application.   **5**

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Marking Scheme
EC3CO14 Fiber Optic Communications

Q.1 i) b)0.242   **1**

ii) b) 1310   **1**

iii) b) Splice   **1**

iv) d)All of the above   **1**

v) a) $\lambda / 2$ **1**

vi) d) All of the above   **1**

vii) b) P-I-N diode   **1**

viii) a) Quantum efficiency   **1**

ix) a) FDM   **1**

x) a) Circulator   **1**

Q.2 i. Differentiate between step index and Graded index fiber   **2**

ii. A silica optical fiber has a core refractive index of 1.5 and a cladding refractive index of 1.47.Determine the Numerical aperture, acceptance angle and critical angle in air for the fiber.   **1+1+1**

iii. What is PREFORM? Explain MCVD method of preform Fabrication in brief. [1- preform   2 Marks.
Diagram MCVD   2 Marks   **1+4**

OR iv. Calculate the number of modes of an optical fiber having diameter of 50µm , n1=1.48 and n2= 1.46 and wavelength 'λ' is 820 nm
V no –   2 Marks
No of modes – 3 Marks   **2+3**

Q.3 i. Distinguish intrinsic and extrinsic absorption. Minimum 2 key differences   **2**

ii. Explain different type of scattering occur in FOC.   **4+4**

OR iii. Classify dispersion in fiber optic. Derive the expression for material dispersion.
Scattering types 2+2 with diagram
Subtype 2+2 with diagram   **4+4**

Q.4 i. What is meant by hetero junction? Mention its advantages. Definition ,Diagram and advantages .   **1+1+1**

ii. A Laser Contains a crystal Length 4cm with a Refractive Index of 1.78. The peak emission wavelength from the device is 0.55 pm Determine the number of longitudinal modes & their frequency separation?   **4+3**

OR iii. Derive the expression for cavity model of LASER to calculate number of longitudinal modes   4 Marks.
& their frequency separation?   3 Marks.   **4+3**

Q.5 i. Define any two-photo detector characteristic 2 key char with Diagram   **2+2**

ii. Explain the structure   2 Marks.
& the working of APD   2 Marks.
with the help of suitable diagram' Write advantages   0 1 Marks
& disadvantages   0 1 Marks
of APD over PIN diode   **4+2**

OR iii. Explain the structure features   2 Marks.
& working principle   2 Marks.
of PIN photodiode. What is the functional significance of intrinsic Layer inserted in between the P&N Layer? 2 Marks   **4+2**

Q.6 Attempt any two:

i. What is WDM?   1 Marks
Explain it's architecture   2 Marks
for fiber optic communication.
And explanation   2 Marks   **1+4**

ii.	What are the components	1Marks	**1+4**
	of isolator, how it is work explain with diagram 2 Marks.		
	Explanation	2 Marks	
iii.	Explain optical sensors and its application. Definition – 2 Marks		**5**
	Application (any key 3 application)	3 Marks	

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