Total No. of Questions: 6 *Total No. of Printed Pages:2*

Enrollment No.....

Faculty of Engineering
End Sem Examination May-2024
EC3CO21 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. Refractive index profile suitable for SI fibers is- **1**
(a) 2 (b) 0 (c) Infinite (d) 1

ii. In fiber optic communication, the refractive index of clad should be- **1**
(a) Higher than core (b) No relation
(c) Less than core (d) Equal to core

iii. Optical signal broadens due to- **1**
(a) Attenuation (b) Absorption
(c) Scattering (d) Dispersion

iv. The power of a signal is reduced to half then the attenuation is (in dB) **1**
(a) 2 (b) -2 (c) -3 (d) 3

v. Emitted Wavelength depends on- **1**
(a) Conduction band (b) Valence band
(c) Band gap energy (d) None of these

vi. Single longitudinal mode operation in LASER is obtained by **1**
(a) Eliminating all transverse mode
(b) Eliminating all longitudinal modes
(c) Increasing the length of cavity
(d) Reducing the length of cavity

vii. Phototransistor operate in **1**
(a) Cutoff region
(b) Saturation region
(c) Reverse saturation region
(d) Active region

viii. The absorption of photons in a photodiode is dependent on: **1**
(a) Absorption coefficient (b) Properties of material
(c) Charge carrier at junction (d) Amount of light

P.T.O.

ix. WDM system key feature include- **1**
(a) Wavelength routing
(b) Capacity upgrade
(c) Transparency
(d) All of these

x. The nonlinear effects in optical fiber occur due to- **1**
(a) Intensity dependence of refractive index of the medium
(b) Due to inelastic-scattering phenomenon
(c) Both (a) and (b)
(d) None of these

Q.2 i. Explain the classification of optical fiber. **4**
ii. Define numerical aperture. Derive the formula for numerical aperture. **6**
OR iii. Explain modified chemical vapor deposition fiber fabrication technique. **6**

Q.3 i. Derive the formula for material dispersion. **4**
ii. Explain the signal attenuation in fibers. **6**
OR iii. Explain the signal dispersion in fibers. **6**

Q.4 i. Explain the direct and indirect bandgap material by E-K diagram. **4**
ii. Explain any one basic LED configurations being used for fiber optics. **6**
OR iii. Explain the three key transition processes involved in laser action. **6**

Q.5 i. Explain optical detection principle with the help of neat diagram. **4**
ii. What is the need of optical amplifier? Explain the working of semiconductor optical amplifier. **6**
OR iii. Explain the PIN photodetector. Also draw energy band diagram for PIN photodiode. **6**

Q.6 Attempt any two:
i. Explain WDM. **5**
ii. Explain nonlinear optical effects. **5**
iii. Explain optical isolators and circulators. **5**

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Scheme of Marking
Fiber Optic Communications (T) - EC3CO21

Q.1 i) Refractive index profile suitable for SI fibers is **1**
(c) Infinite

ii) In fiber optic communication, the refractive index of clad should be **1**
(c) Less than core

iii) Optical signal broadens due to **1**
(d) Dispersion

iv) The power of a signal is reduced to half then the attenuation is (in dB) **1**
(c) -3

v) Emitted Wavelength depends on **1**
(c) Band Gap Energy

vi) Single longitudinal mode operation in LASER is obtained by **1**
(d) Reducing the length of cavity

vii) Phototransistor operate in **1**
(d) Active Region

viii) The absorption of photons in a photodiode is dependent on: **1**
(a) Absorption Coefficient

ix) WDM system key feature include **1**
(d) All of the above

x) The nonlinear effects in optical fiber occur due to **1**
(c) Both A and B

Q.2 i. Explain the classification of optical fiber. **4**
Classification details 4 marks

ii. Define numerical aperture. Derive the formula for numerical aperture. **6**
Definition of NA 1 mark
Diagram 2 marks
Derivation 3 marks

OR iii. Explain modified chemical vapor deposition fiber fabrication technique. **6**
Diagram 3 marks
Explanation 3 marks

Q.3 i. Derive the formula for material dispersion. **4**
Derivation 4 marks

ii. Explain the signal attenuation in fibers. **6**
Types of attenuation 2 marks
Explanation about causes 4 marks

OR iii. Explain the signal dispersion in fibers. **6**
Types of dispersion 2 marks
Explanation about causes 4 marks

Q.4 I Explain the direct and indirect bandgap material by E-K diagram. **4**
Direct BG 2 marks
Indirect BG 2 marks

Ii Explain any one basic LED configurations being used for fiber optics. **6**
SLED or ELED diagram 2 marks
Explanation 4 marks

OR iii Explain the three key transition processes involved in laser action. **6**
Each process 2 marks

Q.5 i Explain optical detection principle with the help of neat diagram. **4**
Diagram 2 marks
Theory 2 marks

Ii What is the need of optical amplifier. Explain the working of semiconductor optical amplifier. **6**
Need of amplifier 2 marks
SOA diagram 2 marks
Theory 2 marks

OR iii Explain the PIN photodetector. Also draw energy band diagram for PIN photodiode. **6**
PIN diagram 2 marks
EB Diagram 2 marks
Theory 2 marks

Q.6 Attempt any two:

I Explain WDM. **5**
Diagram 2.5 marks
Theory 2.5 marks

Ii Explain nonlinear optical effects. **5**
Theory 5 marks

iii Explain optical isolators and circulators. **5**
Isolators 2.5 marks
Circulators 2.5 marks

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