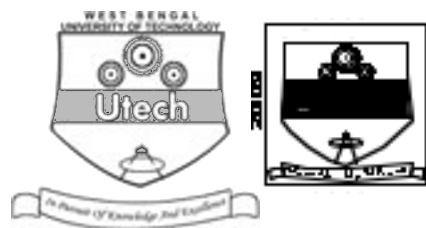


OPTICAL FIBRE COMMUNICATION (SEMESTER - 8)

CS/B.Tech(ECE-OLD)/SEM-8/EC-802(O)/09



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the
Candidate

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CS/B.Tech(ECE-OLD)/SEM-8/EC-802(O)/09

ENGINEERING & MANAGEMENT EXAMINATIONS, APRIL – 2009

OPTICAL FIBRE COMMUNICATION (SEMESTER - 8)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

- This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
- In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
 - For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
- Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
- Read the instructions given inside carefully before answering.
- You should not forget to write the corresponding question numbers while answering.
- Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
- Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
- You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
- Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

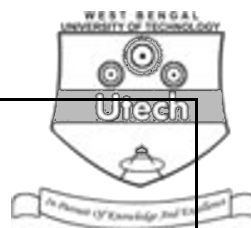
FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

Group – A								Group – B								Group – C								Total Marks	Examiner's Signature
Question Number																									
Marks Obtained																									

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Head-Examiner / Co-Ordinator / Scrutineer

88255(O) (21/04)



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ENGINEERING & MANAGEMENT EXAMINATIONS, APRIL – 2009

OPTICAL FIBRE COMMUNICATION**SEMESTER - 8**

Time : 3 Hours]

[Full Marks : 70

GROUP – A**(Multiple Choice Type Questions)**1. Choose the correct alternatives for the following : 10 × 1 = 10

i) In optical fibre communication link, the coupling efficiency is dependent on

a) modal dispersion

b) numerical aperture

c) V-number

d) core radius.

ii) Optical bandwidth is defined as the frequencies at which output current drops to

a) $\frac{1}{1.414}$ b) $\frac{1}{2}$ c) $\frac{1}{3}$ d) 1.

iii) The cut-off wavelength of GaAs material with optical energy gap of 2.4 eV at 300 K is

a) 885 nm

b) 886 nm

c) 805 nm

d) 785 nm.

iv) What is the maximum limit of BER allowed in optical communication system for faithful digital transmission ?

a) 10^{-19} b) 10^{-9} c) 10^9 d) 10^{19} .



4

v) Rayleigh scattering coefficient T depends on the wavelength λ of the light as

a) $T \propto \log \lambda$

b) $T \propto \lambda^4$

c) $T \propto \lambda$ d)

$T \propto \lambda^{-4}$



vi) Which of the following detectors gives amplified output ?

a) $P-N$ photodiodeb) $P-I-N$ photodiode

c) Avalanche photodiode

d) Photovoltaic detector.

vii) If B be the bandwidth, R_L be the load resistance then thermal noise is given by

a) $\frac{4K_B TB}{R_L}$

b) $\frac{4K_B T}{R_L B}$

c) $\frac{K_B T}{4R_L B}$

d) $\frac{K_B R_L}{4BT}$

viii) A 2×2 Mach-Zehnder Interferometer (MZI) requires

a) one 3 dB 2×2 couplerb) two 3 dB 2×2 couplersc) two 4×4 couplersd) one 3×3 coupler.

ix) The principal cause of linewidth broadening within the semiconductor laser is

a) phase noise

b) white noise

c) quantum noise

d) thermal noise.

x) Gain of Erbium doped fibre amplifier (EDFA) depends on

a) pump power

b) both pump power and fibre length

c) signal power

d) none of these.



5

GROUP – B**(Short Answer Type Questions)**Answer any *three* of the following.

3 × 5 = 15

2. Discuss the implications of the load resistance of both thermal noise and post-detection bandwidth in optical fibre communication receivers. 5
3. Show that the maximum coupling efficiency between a source with Lambertian radiation pattern $I(\theta) = I_0 \cos \theta$ and fibre is given by $\eta_c = (\text{NA})^2$. 5
4. What is modal dispersion ? What is the solution for elimination of this dispersion ? How does chromatic dispersion restrict bit rate in single mode fibre ? 5
5. Describe briefly the propagation of meridional ray, skew ray and evanescent wave. Write the formula of cut-off wavelength in case of single mode fibre having refractive indices $n_{1 \text{ core}}$, $n_{2 \text{ core}}$ and normalized cut-off frequency 2.045. 5
6. State the advantages of T-coupler over star-coupler. How can we change the coupling ratio of 2 × 2 coupler ? 3 + 2

GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following.

3 × 15 = 45

7. a) Outline the major techniques employed to achieve non-synchronous optical ASK and FSK heterodyne detection. Indicate the benefits of these schemes over the corresponding synchronous demodulation schemes. 5
- b) Describe the degradation mechanisms in injection lasers. Comment on these with regard to the CW lifetime of the devices. 5
- c) A Distributed Feedback (DFB) laser has a 3 dB linewidth of 50 MHz. It is connected to a short optical jumper cable such that $\Delta f \cdot \tau = 0.1$. Obtain the average reflectivity for each of the connectors so that the RIN is reduced below a level of -130 dB Hz^{-1} when the frequency f is also 50 MHz. 5



8.
 - a) Discuss the basic principle of operation of an Erbium-doped fibre amplifier. 5
 - b) Discuss briefly on Bragg Grating Filters. 5
 - c) Explain the principle of operation of Mach-Zehnder external Modulator. 5
9.
 - a) Explain the mechanism of amplification in an EDFA with a suitable energy level diagram. 7
 - b) Briefly explain the basic principle of Mach-Zehnder external optical modulator. 4
 - c) Discuss the topology used in FDDI system for high speed data communication. 4
10.
 - a) Discuss the basic principle of IM-DD. 4
 - b) What do you mean by sub-carrier modulation ? 3
 - c) Draw the block diagram of AM / IM and FM / IM scheme. Draw the signal in time and frequency domains. 8
11. Write short notes on any *three* of the following : 3 × 5
 - a) Add/drop multiplexer
 - b) LAN
 - c) Eye diagram
 - d) WAN.

END