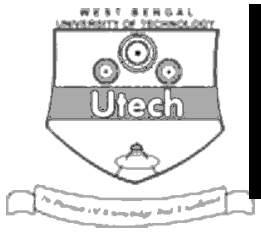
CS/B.TECH(ECE) (SUPPLE)/SEM-8/EC-802/09
ADVANCED COMMUNICATION ENGINEERING (SEMESTER - 8)



1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No.

Roll No. of the Candidate

CS/B.TECH(ECE) (SUPPLE)/SEM-8/EC-802/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JULY – 2009

ADVANCED COMMUNICATION ENGINEERING (SEMESTER - 8)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. 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.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) 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.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. 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.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. 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**.
9. 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

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FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

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

.....
Head-Examiner/Co-Ordinator/Scrutineer

S-53014 (28/07)

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Graph sheet is provided on Page 31.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) The concept of 'frequency reuse' is used in

a) cellular system

b) paging system

c) cordless telephony

d) conventional mobile telephones.

ii) As the height of a satellite gets lower, the speed of the satellite

a) increases

b) decreases

c) remains the same

d) none of these.

iii) Which sub-system of a satellite provides stabilization of the satellite in orbit ?

a) Communication sub-system

b) Propulsion sub-system

c) Antenna sub-system

d) Attitude control sub-system.

iv) In the c-band transponders the uplink and the downlink frequencies are respectively

a) 6 GHz and 4 GHz

b) 4 GHz and 6 GHz

c) 11 GHz and 14 GHz

d) 14 GHz and 11 GHz.

v) The eccentricity of an elliptical orbit with the apogee point at 43,000 km and the perigee point at 7,000 km from the centre of the earth is

a) 0·72

b) 0·16

c) 0·45

d) indeterminate from the given data. ☐

vi) Approximately what is the frequency limit of the fibre ?

a) 20 GHz b) 1 MHz

c) 100 MHz d) 40 MHz. ☐

vii) The large bandwidth available with optical fibre communication is primarily due to

a) its low transmission losses

b) electrical isolation and immunity to interference

c) high optical carrier frequency

d) good quality optical sources. ☐

viii) The maximum limit of BER allowed in optical communication system for faithful digital transmission is

a) 10^{-19} b) 10^{-9}

c) 10^{9} d) 10^{19} . ☐

ix) The material for making an efficient LED should be

a) a metal

b) a direct band gap semiconductor

c) an indirect band gap semiconductor

d) an insulator. ☐

x) Raleigh scattering coefficient τ_R depends on the wavelength λ of the light as

a) $\tau_R \propto \log \lambda$ b) $\tau_R \propto \lambda^4$

c) $\tau_R \propto \lambda$ d) $\tau_R \propto \frac{1}{\lambda^4}$. ☐

xi) The first European digital cellular standard was

a) GSM b) CDMA

c) USDC d) PDC. ☐

xii) In GPRS, the maximum data rate available is

a) 171·2 kbps b) 9·6 kbps

c) 115·1 kbps d) 144 kbps. ☐

xiii) Soft hand-off is used by

a) GSM b) AMPS

c) CDMA d) USDC. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Define acceptance angle and numerical aperture of a fibre. How are they related ? 3 + 2

3. What are shot noise and excess avalanche noise factors ? Give two possible ways of expressing excess avalanche noise factor in analytical terms. 3 + 2

4. a) Define 'Detectivity' of a photo-diode.

b) A silicon *p-i-n* photo-diode incorporated into an optical receiver has a quantum efficiency of 60% when operating at a wavelength of 0.8 μm. The dark current in the device at the operating point is 2 nA and the load resistance is 4 kΩ. The incident optical power at this wavelength is 200 nW and the post-detection bandwidth of the receiver is 5 MHz. Compare the shot noise generated in the photo-diode with the thermal noise in the load resistor at a temperature of 20°. 2 + 3

5. a) What is the difference between Geosynchronous Satellite and Geostationary Satellite ?

   b) What is looking angle ? $2\frac{1}{2} + 2\frac{1}{2}$

6. a) Draw the simplified block diagram of an LO hopping up converter and explain its operation.

   b) What is polarization hopping ? 3 + 2

7. Explain how a call is established when it is originated in a GSM network and terminating onto a PSTN subscriber.

8. What do you understand by the term 'Frequency Reuse' ? Explain how the frequency reuse is achieved by adopting cellular concept in wireless mobile technology. 1 + 4

9. a) What do you mean by CDMA ?

   b) What is the difference between GSM and CDMA ? 2 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

10. a) Illustrate the mechanism of optical loss in an optical fibre. 5

    b) Draw the graph of loss *vs* wavelength and indicate the optical communication windows. Which one is the chosen window for minimum loss ? 3 + 1

    c) What is the inter-modal dispersion ? Deduce the formula for calculating inter-modal dispersion in a step index fibre. 1 + 3

    d) How one can get rid of inter-modal dispersion ? 2

11. a) What is hand-off ? How many types of hand-offs are there ? Discuss. 4 + 3

    b) How is hand-off carried out in practical systems ? 4

    c) If a signal-to-interference ratio of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity of the path loss exponent in (i) $n = 4$, (ii) $n = 2$? Assume that there are five co-channel cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations. 4

12. a) Discuss how population inversion is achieved in semiconductor laser. 3

b) What do you mean by optical gain and loss in lasing medium ? Find out the threshold condition for laser operation. 6

c) How can electrical and optical confinement be achieved in a double hetero-junction LED ? 2

d) A multimode step index fibre has relative refractive index difference of 1% and core refractive index 1·5. Number of modes propagating at a wavelength 1·3 μm is 1100. Find the diameter of fibre core. 4

13. a) Draw and explain GSM system architecture briefly. 5

b) Draw GSM frame structure. 4

c) What are GPRS interfaces and reference points ? 3

d) Explain briefly location management and roaming in GPRS. 3

14. a) Using Two-ray Ground Reflection Model for Radio Wave Propagation show that for grazing incidence the total received E-field varies inversely as square of the distance between transmitter and receiver assuming suitable parameters. 10

b) A mobile is located 5 km away from a base station and uses vertical $\lambda/4$ monopole antenna with a gain of 2.55 dB to receive cellular radio signals. The E-field at 1 km from the transmitter is measured to be 10^{-3} V/m. The carrier frequency used for this system is 900 MHz.

i) Find the length and the effective aperture of the receiving antenna.

ii) Find the received power dB at the mobile using the two-ray ground reflection model assuming the height of transmitting antenna as 50 m and the receiving antenna as 1·5 m above ground. 5

15. a) Deduce the expression for the time period of a satellite. 5

b) Describe with suitable diagrams the communication sub-system of a communication satellite. 5

c) A satellite is orbiting in a geosynchronous orbit of radius 41,500 km. Find the velocity and time period of orbit. What will be the change in velocity if the radius reduces to 36,000 km ? Given Kepler's constant = 398600·5 km^3 s^2 . 5

16. a) Define EIRP and derive its relation with the power received by an antenna (P_r), receiving antanna gain (G_r) and path loss (L_p) for a satellite communication system. 5

b) A satellite located at 42,150 km from the earth operates at frequency of 11·0 GHz and has EIRP of 22·0 dBW. If the receiving antenna gain is 50·5 dB, find the receiver power. 6

c) What is transponder ? With the help of a block diagram explain different sections of a typical single-conversion transponder for the 6/4 GHz band. 4

END