Code: AE131   **Subject: ADVANCED COMMUNICATION SYSTEMS**

AMIETE – ET (New Scheme)

Time: 3 Hours   **December - 2017**   **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.
- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1   **Choose the correct or the best alternative in the following:**   **(2 × 10)**

   a. A ray of light in a transparent material of refractive index 1.5 is approaching a material with a refractive index of 1.48. At the boundary, the critical angle is _____

   (A) 90^0 **(B)** 9.4^0
   (C) 75.2^0 **(D)** 80.6^0

   b. Step-index single mode fibers are preferred for long distance communication due to :
   (A) Low attenuation due to smaller core diameter
   (B) High Bandwidth
   (C) Very low dispersion
   (D) Low Scattering

   c. Modal dispersion is largest in which type of fiber
   (A) Step-index multimode
   (B) Graded-index multimode
   (C) Step-index single-mode
   (D) Dispersion-shifted single-mode

   d. Communication between a computer and a keyboard involves_____ transmission
   (A) Simplex   **(B)** Half-duplex
   (C) full-duplex   **(D)** automatic

   e. In a _____ topology, if there are n devices in a network, each device has n-1 ports for cables.
   (A) mesh   **(B)** star
   (C) bus   **(D)** ring

f. The _____ layer decides the location of synchronization points.
    (A) transport   (B) session
    (C) presentation   (D) application

g. Mail services and directory services are available to network users through the
    _____ layer.
    (A) data link   (B) session
    (C) transport   (D) application

h. If the data unit is 111111, the divisor 1010, what is the dividend at the
    transmitter?
    (A) 111111000   (B) 1111110000
    (C) 111111   (D) 1111111010

i. The sum of the checksum and data at the receiver is _____ if there are no
    errors
    (A) -0
    (B) +0
    (C) the complement of the checksum
    (D) the complement of the data

j. The address field of a frame in HDLC protocol contains the address of the
    _____ station
    (A) primary   (B) secondary
    (C) tertiary   (D) Both (A) and (B)

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Determine the normalized frequency at 820 nm for a step-index fiber having a
         core radius of 30 μm, n1= 1.48, n2=1.46. Calculate the number of modes
         propagating in the fiber at 820 nm, 1300 nm, and 1550 nm.   **(4)**

     b. Make a power budget for a short-haul system where the required data rate is 20
         Mbps, BER is 1x 10^{-9} errors/bit and it is operating at λ=850 nm. The Si PIN
         photodiode has a receiver sensitivity of about -42 dbm. GaAlAs LED can
         couple 50 μW into multimode fiber with a core diameter of 50 μm. The
         connector loss is 1 dB per connector. Splices will be required at each kilometre
         with 0.5 dB per splicing loss, and fiber attenuation loss for the fiber is 3.5
         dB/km.   **(8)**

     c. Compare the single- mode step-index fiber and Multimode step-index fiber in
         the terms of their advantages and disadvantages.   **(4)**

Q.3 a. If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (i) four cell reuse, (ii) seven-cell reuse and (iii) 12 cell reuse. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equable distribution of control channels and voice channels in each cell for each of three systems. **(6)**

b. Explain the following terms in reference of cellular system: **(4)**
(i) Cell Splitting
(ii) Cell Sectoring

c. Write down the steps for procedure to make a call between mobile to wire line. **(6)**

Q.4 a. Briefly describe about AMPS Control Channels. **(6)**

b. Discuss in brief about the following for CDMA techniques **(10)**
(i) Frequency Hopping & Direct sequence spread spectrum
(ii) CDMA Traffic Channels
(iii) CDMA radiated Power

Q.5 a. Describe the functions of different layer of OSI model in detail with a neat diagram. **(10)**

b. Describe different types of topologies used in data communication network. **(6)**

Q.6 a. Explain Vertical Redundancy Check (VRC) and Longitudinal Redundancy Check (LRC) and also give one example of each. **(10)**

b. Determine the BCS of the following data and CRC generating polynomials:
Data $G(x) = x^7 + x^5 + x^4 + x^2 + x^1 + x^0$, CRC $P(x) = x^5 + x^4 + x^1 + x^0$ **(4)**

c. For a 12 bit data string of 101100010010, determine the number of Hamming bits required, arbitrarily place the hamming bits into data string, determine the logic condition of each hamming bit, assume an arbitrary single-bit transmission error. **(2)**

Q.7 a. What is Character oriented and bit oriented data - link protocols? Also explain XMODEM and High level data link control (HDLC). **(10)**

b. Explain LAN access control methodologies in brief **(6)**

Q.8 a. Complete the following link budget :   **(12)**

Uplink Parameters:
(i) Earth station transmitter output power at saturation, 2000 W
(ii) Earth station Back-off loss, 3dB
(iii) Earth Station total branching and feeder losses, 4dB
(iv) Earth Station transmit antenna gain for a 15-m parabolic dish at 14 GHz, 64dB
(v) Free space path loss at 14 GHz, 206.5 dB
(vi) Additional uplink losses due to earth's atmosphere,0.6 dB
(vii) Satellite receiver G/Te, -5.3 dBK^{-1}
(viii) Satellite branching and feeder loss, 0dB
(ix) Transmission bit rate, 120 Mbps, 8-PSK

Downlink Parameters:
(i) Satellite transmitter output power at saturation(10 W), 10 dBW
(ii) Satellite transmit antenna gain for a 0.37-m parabolic dish at 12 GHz, 30.8 dB
(iii) Satellite Back-off loss, 0.1 dB
(iv) Satellite branching and feeder losses, 0.5 dB
(v) Free space path loss at 12 GHz, 205.6 dB
(vi) Additional downlink losses due to earth's atmosphere,0.4 dB
(vii) Earth station receive antenna gain (15 m, 12 GHZ), 62 dB
(viii) Earth station equivalent noise temperature, 270 K
(ix) Earth Station branching and feeder losses, 0 dB
(x) Earth station G/Te ratio, 37.7 dBK^{-1}
(xi) Transmission bit rate, 120 Mbps, 8-PSK

b. List the advantages and disadvantages of Geosynchronous satellites.   **(4)**

Q.9   Briefly discuss about the following: **(16)**
             (i) Time Division Multiple Access
             (ii) Frequency Division Multiple Access
             (iii) LORAN
             (iv) NAVSTAR GPS