Code: A-17 / T-17   **Subject: TELECOMMUNICATION SYSTEMS**
Time: 3 Hours   **Max. Marks: 100**

NOTE: There are 11 Questions in all.

- **Question 1 is compulsory and carries 16 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Answer any THREE Questions each from Part I and Part II. Each of these questions carries 14 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1   Choose the correct or best alternative in the following: (2x8)

a.   A fully connected network of six nodes needs

   (A) 6 links.   **(B)** 15 links.
   (C) 30 links.   **(D)** 36 links.

b.   The maximum bit rate on a 5 KHz wide channel with a 30 dB SNR is about

   (A) 10 Kbps.   **(B)** 30 Kbps.
   (C) 50 Kbps.   **(D)** 150 Kbps.

c.   In 5B-6B coded transmission, the maximum run length of 0-bits is

   (A) 4.   **(B)** 5.
   (C) 6.   **(D)** 11.

d.   In a busy hour, 300 calls arrive. The average duration of a call is 3 minutes. The offered traffic, in Erlangs, is

   (A) 90.   **(B)** 15.
   (C) 9.   **(D)** 3.

e.   The ideal Grade of Service (GOS) in telephone systems is

   (A) 0.   **(B)** 0.5.
   (C) 1.   **(D)** 100.

f.   The operating state diagrams of a modem has states at coordinates (1, 1),   (1 ,-1), (-1, -1) and (-1, 1). The bit rate corresponding to a 2400 baud modem is

   (A) 9600.   **(B)** 4800.
   (C) 2400.   **(D)** 1200.

g. PSTN stands for

(A) Public Switched Telephone Network.
(B) Private System Transmission Network.
(C) Private Subscriber Telephone Network.
(D) Public Switched Transmission Network.

h. A drawback of Avalanche Photo Diodes (APD's) as optical-to-electrical converters is

(A) not operating in 1300-1550 nm range.
(B) having lower sensitivity.
(C) having no internal amplification.
(D) being temperature sensitive.

PART I
Answer any THREE Questions. Each question carries 14 marks.

Q.2 a. What do you understand by pair-gain systems? Explain and compare concentrators and multiplexers. **(7)**

b. Draw a comparison between single stage and multistage space division switching networks. Give your answer pointwise in a tabular form. **(7)**

Q.3 a. Describe TS switching and find its implementation complexity. **(7)**

b. Find the implementation complexity of a TS switch where the number of TDM lines is 100 and each input line contains a single DS1 signal (32 channels). Assume a one stage matrix for space stage. The number of bits per channel is eight. **(7)**

Q.4 a. Obtain an expression for the grade-of-service in a 'Lost Calls Cleared (LCC)' system with infinite sources. **(7)**

b. A total of 40 subscribers initiate calls in a 20 minute period. The total duration of calls is 4800 sec. Find the load offered to the network and the average subscriber traffic. **(7)**

Q.5 a. A small community with 400 subscribers is to be serviced with a community dial office switch. Assume that the average subscriber originates 0.1 erlang of traffic. Also assume that 20% of the originations are local (intracommunity) calls and that 80% are transit calls to the serving central office. How many erlangs of traffic are offered to the community-dial-office-to-central-office

trunk group? How many trunks are needed for 0.5% blocking of the transit traffic?   **(7)**

   b. Draw a cell structure and allocate frequencies such that there is a separation of at least two cells using the same frequency. Ensure minimum number of frequencies.   **(7)**

Q.6 a. Describe CDMA cellular system and explain channel establishment.   **(7)**

   b. A TASI system has 10 channels and 20 sources connected to it. Find the probability of clipping if the activity factor for each source is 0.4.   **(7)**

PART II
Answer any THREE Questions. Each question carries 14 marks.

Q.7 a. Describe 5B-6B coding scheme and give its salient features.   **(7)**

   b. A graded, multimode fiber exhibits 100 psec/km nm of chromatic dispersion at 850nm. Determine the BDP of a NRZ system using an LED having 40 nm of spectral width.   **(7)**

Q.8 a. Write a short note on data networks.   **(7)**

   b. For a certain EPABX, 180 outgoing calls are initiated every hour. Equal number of calls also come in. Average duration of each call is 200 sec. The required grade-of-service is 0.05. Find the number of lines required between EPABX and the main exchange.   **(7)**

Q.9 Describe ISDN giving benefits / features of B and D channels. Also give basic rate and primary rate access architecture. Describe ISDN DSL Transmitter / receiver with the help of a block diagram.   **(14)**

Q.10 a. Explain circuit switching technique for data transmission and list its merits and shortcomings. Also derive an expression for the total time for a given data transfer.   **(7)**

   b. A 50 Km long circuit switched connection involves 5 nodes, each node taking 2 sec for establishing and 0.2 sec for releasing a connection. Data to be transferred is 30,000 bits long and the rate is 2400 bps. The signal propagation speed is 200 m /μs . Find the total data transfer time.   **(7)**

Q.11 a. Distinguish between hard hand off & soft hand off in cellular systems.   **(4)**

   b. What is the effective signal-to-interference ratio of a single CDMA uplink channel operating at a distance that is twice as far from the base station as 62 other channels? Assume the following:-

   (a) Code length of 64, cross correlations of ± 1, and all transmitters

operate at identical power levels.

(b) Assume all interferers are active.

(c) Assume half the interferers operate with a 25% data rate because of no voice activity.   **(10)**