Code: A-17 / T-17 **Subject: TELECOMMUNICATION SYSTEMS**

December 2005

Time: 3 Hours

Max. Marks: 100

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.**
- **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 best alternative in the following: (2x10)

a. The number of subscribers that can be supported in a bi-directional switching bus with 8000/sec sampling rate and 125 ns PAM sample width is

(A) 1000 **(B)** 500
(C) 250 **(D)** 125

b. A standard noise power of 1pW equals

(A) –120 dBm **(B)** –90 dBm
(C) –30 dBm **(D)** 0 dBm

c. The basic SONET signal STS-1 uses

(A) B3ZS code **(B)** CMI code
(C) AMI code **(D)** DB code

d. In a 4B1C code, the inserted bit after the four-bit data word ‘a b c 0’ will

(A) depend upon the digits a, b and c.
(B) depend upon the digits c only.
(C) be 0 irrespective of the digits a, b and c.
(D) be 1 irrespective of the digits a, b and c.

e. The capacity of a 4 kHz data wide channel with a 30 dB SNR is approximately

(A) 40 kbps. **(B)** 24 kbps.
(C) 20 kbps. **(D)** 12 kbps

f. TSI stands for

(A) Time slot interchange. **(B)** Time slot interference.
(C) Time slot interruption. **(D)** Time slot indication.

g. The first M in the queue nomenclature M/M/1 implies

(A) Mean value **(B)** Median value
(C) Memoryless system. **(D)** Marginal waiting.

h. In the 8-ary QAM system, the eight symbols are distinguished by

(A) phases only.
(B) frequency only.
(C) amplitude only.
(D) combinations of amplitudes and phases.

i. The traffic unit CCS gives

(A) calls completed in 100 sec.
(B) century call seconds.
(C) century of call seconds per hour.
(D) calls completed per second.

j. The data speed in the H11 channel in an ISDN network is

(A) 16 kbps. **(B)** 64 kbps.
(C) 384 kbps. **(D)** 1536 kbps.

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

Q.2 a. Describe a three-stage space division switching network and determine the minimum number of switching elements for the network to be non-blocking. Also determine the switching element advantage ratio. **(8)**

b. A three stage switching structure supports128 inlets and 128 outlets. It is proposed to use 16 first stage and 16 third stage switching matrices. Find the number of switching elements for this arrangement. Also find (i) the minimum number of switching elements if the system is non-blocking and (ii) the switching advantage ratio.
(8)

Q.3 A three stage switching network is designed for 512 inlets and 512 outlets. Each of the first and third stage matrices are of 16 × 16 size. The probability of an inlet being busy is 0.7. Find the blocking probability using (i) Lee's equation and (ii) Jacobaeus equation. Compare the results and comment. **(16)**

Q.4 A central office to PBX trunk contains four circuits. The average call duration is 3 min and the busy hour offered traffic intensity is 2 E. Find the

(i) busy hour calling rate. **(2)**
(ii) probability that two arrivals occur less than one sec apart. **(3)**
(iii) blocking probability, assuming lost calls cleared operation. **(6)**
(iv) amount of lost traffic **(2)**
(v) proportion of time the fourth circuit is in use, assuming fixed order selection. **(3)**

Q.5 a. List and briefly discuss the advantages of cellular structure for a mobile system. **(8)**

b. Show frequency allocation for various cells of a cellular mobile system such that there is a minimum of two-cell separation between cells using the same frequency. Use the minimum number of frequencies. **(8)**

Q.6 a. Explain common channel signalling scheme for ISDN networks, clearly distinguishing between (i) user level signalling and (ii) network level signalling, and explaining these two separately. **(8)**

b. What do you understand by transmission impairments? Explain echo and singing. **(8)**

Q.7 a. An 850 nm, graded-index, multimode 50 Mbps fiber system with 2 dB/km loss in the fiber is to be used for a network. The source delivers –16 dBm power (with 50nm spectral width) and the detector has a sensitivity of –48 dB at 50 Mbps. The BDP of the fiber is 500 Mbps-km. Find how many taps, each with a 0.4 dB loss, can be inserted per kilometre without affecting the distance between the transmitter and the receiver. Also find the maximum distance that can be covered, without the taps, if the data rate is reduced to 10 Mbps. **(6+6)**

b. What will be the required SNR if the CCITT standard 2048 kpbs PCM is to be carried on a 50kHz channel. **(4)**

Q.8 Write notes on:

(i) ISDN services.
(ii) 2W/4W transmission system. **(2 × 8=16)**

Q.9 A network offers both circuit and packet switching facilities. Let

T_q = processing and queueing delay in each node for packets.
T_s = circuit set up time per station.
p = number of data bits in a packet.
d = overhead bits in each packet.
R = data rates in bps over all links
K = number of hops or links for a connection in both circuit and packet switched modes.

a. Compare the delay in sending a message of M bits in circuit and packet switching modes. Under what conditions, will the packet switching mode have a lower delay? **(10)**

b. Calculate the circuit and packet switching delays if the circuit set up time per station is 2.0s, p = 200 bits, d = 20 bits, R = 1200 bps, M = 1000 bits and the queueing and processing delay in each node is 0.02 s. **(6)**