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. The number of links in a fully connected network of 5 nodes is

(A) 5. **(B)** 10.
(C) 20. **(D)** 32.

b. The maximum data rate on a 3 KHz wide binary channel with a 15 dB SNR is about

(A) 6 Kbps. **(B)** 12 Kbps.
(C) 15 Kbps. **(D)** 45 Kbps.

c. In 6B-8B coding, the maximum number of 8-bit words that can have exactly four 1's is

(A) 16. **(B)** 48.
(C) 64. **(D)** More than 64.

d. During a two-hour busy period, 2400 calls arrive. Each has an average holding time of two minutes. The offered traffic is

(A) 24 E. **(B)** 40 E.
(C) 48 E. **(D)** 80 E.

e. In a certain system, the signal power is 20 mW while the noise power is –0.5 dBm. The SNR is

(A) 10 dB. **(B)** 12.5 dB.
(C) 13.5 dB. **(D)** 19.5 dB.

f. TASI stands for

(A) Time Assignment Speech Interpolation.
(B) Transmission And System Interface.
(C) Transmission And System Interference.
(D) Terminal Aided System Interaction.

g. The width of a B-channel in ISDN is

(A) 4 KHz. **(B)** 16 KHz.
(C) 32 KHz. **(D)** 64 KHz.

h. ADSL stands for

(A) Advanced Digital Subscriber Loop.
(B) Asymmetrical Digital Subscriber Loop.
(C) Advanced Digital Session Layer.
(D) Asynchronous Digital Subscriber Loop.

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

Q.2 a. List all types of transmission impairments and describe any two of these impairments. **(7)**

b. What do you understand by Stored Program Control (SPC)? Explain centralised SPC. **(7)**

Q.3 Consider a three-stage space division switching network with first and third stages having square matrices. Derive expressions for minimum number of switching elements and blocking probability. **(14)**

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

b. A group of 20 servers carry a traffic of 10 E. The average duration of a call is 3 minutes. Find the average number of calls put through a single server and the group as a whole in one hour period. **(7)**

Q.5 a. Consider 20 servers and 100 subscribers. On an average 10 servers are busy. The probability of all servers being busy is 0.2. Find the grade-of-service for
(i) Erlang traffic and (ii) Engest traffic. **(7)**

b. Find the probability of clipping for a TASI system having 50 speech channels supported by 25 speech circuits. The activity factor is 0.4 / user and arrival is Poisson. **(7)**

Q.6 a. Describe cellular telephony, using GSM. Compare it with CDMA cellular systems. **(7)**

b. Explain store-and-forward technique for data transmission giving its classification, merits and

shortcomings. Obtain an expression for transmission delay. **(7)**

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

Q.7 a. Explain wavelength division multiplexing and demultiplexing. **(7)**

b. What do you understand by chromatic dispersion? **(3)**

c. Find the loss limit and chromatic dispersion limit of a single mode fiber optical transmission system operating at 1300 nm, fiber loss 0.35 dB/Km and providing a bandwidth of 417 Mbps. The fiber has a BDP of 250 Gbps-Km. A narrowband source is used giving 42 dB higher power than required at the receiver. Neglect other losses. **(4)**

Q.8 Find the system margin, the dispersion limited repeater spacing and the loss margin for an Fiber Optic Transmission system given

Data rate : 565 Mbps; 5B-6B coding; RZ pulses; $\lambda = 1550$ nm, DFB-LD with 0.4 nm FWHM; -5dBm output; SMF with dispersion coeff 17 ps/Km-nm; 0.2 dB/Km loss; Splice loss 0.2 dB/Km, Receiver sensitivity at 500-600 Mbps is –33 dBm and at 600-700 Mbps, it is –34 dBm. BDP 250 GHz-Km-nm. **(14)**

Q.9 a. What is ISDN? Describe and list features and benefits of B and D channels. **(8)**

b. Find the distance limit imposed by the need to echo E bit in BRI S/T interface. The minimum delay between a terminal transmitting a D bit and receiving it back in the following E bit is 7 bit duration. The data rate is 192 Kbps. The speed of transmission (propagation) is 25% of speed of light in vacuum. Ignore other delays. **(6)**

Q.10 a. Write a note on ATM networks. **(8)**

b. An interactive computer user generates messages at an average rate of 2 messages / mt. Each message is 40 characters long. The line speed is 9600 bps. Find the percentage utilisation of the line. **(6)**

Q.11 a. Find the probability of maximum interference of a 32 channel CDMA system with 32 spreading codes. Also find the signal-to-inference power ratio (SIR). Assume that all channels operate at the same effective power level at the receiver and that all channel codes have a cross-correlation of ± 1 bit. **(10)**

b. Explain briefly SDH. **(4)**