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Department of Electrical Engineering

EEL 716

Telecommunication Switching and Transmission

Major Examination

May 4, 2009

CLOSED BOOK/NOTES

Time : 1 Hour

Max. Marks:40

Note: Attempt as much as you can.

Q1

- (a) Draw the structure of a T-S-S-S-T switch and the associated Lee's graph. (4)
- (b) Code the sequence 1110100000001111 using B6ZS (3)
- (c) Explain various layers in SONET/SDH networks. (4)
- (d) Explain the logic to calculate frame acquisition time for a special case when the framing bits alternate. *Do not calculate the frame acquisition time.* (4)
- (e) Explain GAZPACHO in context of digital termination (4)
- (f) Explain slip conditions in context of clock synchronization. In an E1 carrier system maximum 1 slip in 20 hours is allowed; what must be the clock accuracy? (5)
- (g) In an M/M/N/N system the service rate for each server is μ . Obtain the relation between throughput γ and expected occupancy $E(n)$. (4)

Q2. Let B (= Traffic Lost/Traffic offered) be the grade of service (GOS). Now consider a system which is tandem of two subsystems with GOSs B_1 and B_2 . Let A be the offered traffic at the input of the system.

Obtain an expression for the GOS of the whole system, B , in terms of B_1 , B_2 and A .

Approximate the above expression when $B_1, B_2 \ll 1$. Generalize this expression when number of subsystems is n . Also comment on the traffic related conditions when the approximate expression is not sufficiently accurate. (6)

Q3

Answer 8 questions out of the following 9 questions.

DO NOT answer the question belonging to your term paper.

(8x2=16)

- (a) Why are LEOs attractive for satellite telephony?
- (b) Why delay jitter needs to be bounded in IP telephony?
- (c) Illustrate wavelength modularity in optical cross-connects.

- (d) Illustrate subcarrier multiple access in optical PONs.
 - (e) Why is discrete multitone effective in DSLs?
 - (f) What is the basic difference between SS-7 and earlier non-ISDN signaling?
 - (g) Explain operation of an active switch in all optical networks.
 - (h) How is optical time division switching used in photonic switching fabrics?
 - (i) What are the operational issues in WLLs.
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Notes: (i) Attempt as much as you can. (ii) Notes are not transferable

Q1. In an M/G/1 systems messages arrive at the average rate 3 messages/minute. The message length is uniformly distributed between 1000 and 2000 bits. The output channel rate is 9.6 kbps. Compute the average delay experienced by a message. (10)

Q2. A satellite communication link has following parameters. (20)

Required combined up-down link CNR = 17 dB

UPLINK

Noise temperature at the input of the satellite transponder = 375 deg K

Receive antenna gain at the input of the transponder = 31.7 dB

Uplink frequency = 14 G Hz

Satellite to earth station distance = 40,000 km

Available transmit power for uplinking at the earth station = 3 kW

Signal Bandwidth = 14 MHz

DOWNLINK

Downlink frequency = 11 G Hz

Satellite to earth station distance = 40,000 km

Earth station antenna gain = 46 dB

Transmit power at satellite transponder = 18.0 dBW

Transmit antenna gain at satellite transponder = 31 dB

Antenna pointing and channel absorption losses = 3.8 dB

Noise power at the earth station receiver = -130 dBW

Calculate the diameter of the uplink transmit earth station antenna having 55% efficiency.

You may use Boltzmann's constant = 1.38×10^{-23} J/deg K = -228.6 dBW/deg K/Hz

Q3. Develop an integrated view of modern telecommunication system based on the contents of this course and term papers presented. (10)