Part B (26 points)

I- Choose only one answer for each of the following questions. A correct answer score is 1 point. Total this part 10 points

1- In digital communication systems, main signal deterioration measure is:
(a) Signal to noise ratio.
(b) Phase and attenuation coefficients.
(c) Bit error rate.
(d) None of the above.

2- Frequencies used to implement the 12-key dual tone multi-frequency (DTMF) keypad are – relative to voice channel-
(a) In-band
(b) Out-of-band
(c) Low frequency
(d) None of the above

3- A tandem exchange can be used to:
(a) Connect local exchanges together.
(b) Connect regional exchanges to national exchanges.
(c) Connect national exchanges together.
(d) All of the above

4- In call set up process, when a subscriber goes off hook, the exchange first:
(a) Identifies the calling party.
(b) Allocates storage for dialed digits.
(c) Receives the dialed digits.
(d) None of the above.

5- In call set-up procedure, the terminating exchange sends an answer message if:
(a) it receives all the information necessary to establish the link.
(b) the continuity check failed
(c) the called subscriber goes off-hock.
(d) the called subscriber goes on-hook.

6- In a noisy telephone channel if the maximum signal to noise ratio is 2000 for an antipodal signal, the maximum bit rate that can be achieved (assuming telephone channel of 3kHz bandwidth) is about :
(a) ≈ 9,900 bps
(b) ≈ 19,800 bps
(c) ≈ 33,000 bps
(d) ≈ 66,000 bps
(e) None of the above.

7- At the end of a telephone call, the calling subscriber circuit turns idle if
(a) the originating exchange receives a clear back (CBK) signal.
(b) the originating exchange receives a clear forward (CLF) signal.
(c) the originating exchange receives a release register (RLG) signal.
(d) None of the above

8- The capacity of a T-switch (number of time slots) is limited by
(a) Memory size.
(b) Memory access time.
(c) Number of control words.
(d) All of the above.

9- To build the most economical local network assuming an established quality of service, the following issues must be considered.
(a) Geographic extension of local area of interest
(b) Number of inhabitants and telephone density
(c) Calling habits
(d) All of the above
(e) Items (a) and (b) above.

10- Among the advantages of GEO satellites:
(a) Simple tracking process.
(b) Short propagation delay.
(c) Good coverage at far northern and southern latitudes.
(d) None of the above
(e) items (a) and (c) above

II Indicate at the left of each statement whether it is true (√) or false (×). A correct answer gets (1) . Total this part: 13 Points.

1. [ ] The maximum time delay in a T-switch is equal to the duration of a single time slot.
2. [ ] In the E1 frame, the first two time slots contain synchronizing bit pattern and some trouble-shooting bit patterns.
3. [ ] The bandwidth required to transmit a base band binary sequence of rate 8000 bps is 16 KHz.
4. [ ] ADSL technology extends the bandwidth of a telephone channel from 4 KHz to nearly 1 MHz and equal download and upload speeds are assumed.
5. [ ] A telephone that is busy 10% of the time represents a load of 0.1 Erlang on that particular line.
6. [ ] Lost calls clear means that a user will immediately reattempt the call on receipt of a congestion signal.

7. [ ] A geostationary orbit is also geosynchronous, but has an equatorial orbit to provide a fixed communications platform with respect to the Earth.
8. [ ] Medium Earth Orbit (MEO) satellites are useful for communications and navigation purposes because of the lower number of satellites required compared to lower altitude satellites
9. [ ] Among the disadvantages of FDMA is the lack of flexibility in case of reconfiguration.
10. [ ] Among the advantages of TDMA is the all stations transmit and receive on the same frequency.
11. [ ] A band-limited waveform can be accurately reconstructed if sampled at a rate *less or equal to* its double bandwidth.
12. [ ] The theoretical limitations on transmission rate over a telephone line are inversely proportional to the bandwidth.
13. [ ] Among the assumption on which Erlang formula are based on is that calls occur individually and collectively at random, i.e., in accordance with Poisson distribution and the inter-arrival time between calls also obeys Poisson distribution.

Traffic Table

TABLE D.1 Maximum Offered Load Versus B and N^a

N/B	0.01	0.05	0.1	0.5	1.0	2	5	10	15	20	30	40
1	.0001	0005	.001	.005	.010	.020	.053	.111	.176	.250	.429	.667
2	.014	.032	.046	.105	.153	.223	.381	.595	.796	1.00	1.45	2.00
3	.087	.152	.194	.340	.455	.602	.899	1.27	1.60	1.93	2.63	3.48
4	.235	.362	.439	.701	.869	1.09	1.62	2.05	2.50	2.95	3.89	5.02
5	.452	.649	.762	1.13	1.36	1.66	2.22	2.88	3.45	4.01	5.10	6.60
6	.728	.996	1.15	1.62	1.91	2.28	2.96	3.76	4.44	5.11	6.51	8.19
7	1.05	1.39	1.58	2.16	2.50	2.94	3.74	4.67	5.46	6.23	7.86	9.80
8	1.42	1.83	2.05	2.73	3.13	3.63	4.54	5.60	6.50	7.37	9.21	11.4
9	1.83	2.30	2.56	3.33	3.78	4.34	5.37	6.55	7.55	8.52	10.6	13.0
10	2.26	2.80	3.09	3.96	4.46	5.08	6.22	7.51	8.62	9.68	12.0	14.7
11	2.72	3.33	3.65	4.61	5.16	5.84	7.08	8.49	9.69	10.9	13.3	16.3
12	3.21	3.88	4.23	5.28	5.88	6.61	7.95	9.47	10.8	12.0	14.7	18.0
13	3.71	4.45	4.83	5.96	6.61	7.40	8.83	10.5	11.9	13.2	16.1	19.6
14	4.24	5.03	5.45	6.66	7.35	8.20	9.73	11.5	13.0	14.4	17.5	21.2
15	4.78	5.63	6.08	7.38	8.11	9.01	10.6	12.5	14.1	15.6	18.9	22.9
16	5.34	6.25	6.72	8.10	8.88	9.83	11.5	13.5	15.2	16.8	20.3	24.5
17	5.91	6.88	7.38	8.83	9.65	10.7	12.5	14.5	16.3	18.0	21.7	26.2
18	6.50	7.52	8.05	9.58	10.4	11.5	13.4	15.5	17.4	19.2	23.1	27.8
19	7.09	8.17	8.72	10.3	11.2	12.3	14.3	16.6	18.5	20.4	24.5	29.5
20	7.70	8.83	9.41	11.1	12.0	13.2	15.2	17.6	19.6	21.6	25.9	31.2

III – Write all equations and make the necessary steps to find the correct answer . You can make use of the given traffic table. (3 Points)

A PBX provides access to outgoing public telephone lines. If there are 60 requests per hour for the public lines with an average holding time of 9 minutes; how much public lines are needed to achieve blocking probability less than 2%?

If the request rate is doubled, find the blocking probability in this new case.