ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **WINTER SEMESTER, 2016-2017**

DURATION: 3 Hours **FULL MARKS: 150**

CSE 4505: Communication Engineering

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

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1. a) Discuss the role of every elements of *generic communication system* proposed by Shannon. 7
   b) Depict the *GSM geographical network structure* with appropriate diagram. 7
   c) Explain why collision is an issue in *random access* protocol but not in *controlled access* or *channelization* protocols. 6
   d) Describe the behavior of the *non-persistent*, and *p-persistent* methods with the aid of appropriate diagrams. 5

2. a) How does the *coding theory* allow a single channel to carry multiple transmissions simultaneously? 9
   b) What is the vulnerable time for *slotted ALOHA* protocol? 5
   c) How does a transmitter station detect the collision in a *CSMA/CD* network? 6
   d) Define the core functionality of *Mobile Service Switching Center (MSC)* and *Home Location Register (HLR)* in GSM Network. 5

3. a) Consider a wireless ad hoc network (*WANET*) consists of three stations (A, B, and C), where each of the stations follows the *CSMA/CA* as multiple access protocol. 13

   Draw a *time line diagram* showing a successful frame transmission from station-A to station-C, after two unsuccessful transmissions of the same frame. The diagram should depict the detail contention procedures (i.e. waiting of binary exponential back-off slot period, DIFS period and the SIFS period) carried out by all the contending stations. Note that, the x-axis of the diagram shows time and y-axis shows one horizontal line for each containing station.

   b) What is the aim of *speech coding*? How does the *segmentation* process work in GSM transmission process? 8
   c) What is meant by *carrier separation*? 4

4. a) What is *frequency re-use distance*? Clarify the relationship between *cellular capacity* and *frequency re-use distance* in mobile telephony system with proper arguments. 7
   b) Define the *time alignment* problem. How can the time alignment problem be solved? 6
   c) Mention the steps involved in *Pulse Code Modulation (PCM)* technique. How can the performance of *PCM* technique be improved? 7
   d) List the merits and demerits of *Cell Splitting* technique. 5

5. a) Describe the call routing flow to establish an incoming call in GSM network. 8
   b) Propose an effective channel coding process to minimize the adverse effect of losing longer sequences of bits in a received message. 9
   c) How does the *Intra BSC Handover* work? 8

6. a) A certain city has an area of 1300 square miles and is covered by a cellular system using a 7-cell reuse pattern. Hence, each cell covers 41.57 sq. miles. Each cell has a radius of 4 miles and the city is allocated 40 MHz of spectrum with a full duplex channel bandwidth of 60 KHz. Assume a GOS of 3% for an Erlang B system is specified. Now compute the following items, 8

i. The number of cells in the service area
ii. The number of channels per cell.
iii. Traffic intensity of each cell
iv. The maximum carried traffic

b) Describe the *space segment* functionality of a *communication satellite system* along with its architecture diagram. 7

c) List the general problems experienced by satellite signals traveling from a satellite to a receiver. 5

d) How can the handoff performance be improved for high speed GSM subscriber? 5

7. a) Describe the significance of *path loss* models in the radio network planning process. 5

b) Have a comparative analysis on *empirical path loss* model and *deterministic path loss* model. 6

c) How secure is a *Bluetooth* network? Mention few limitations of *Bluetooth* technology. 6

d) Generate the *convolutional code* using the *trellis diagram* of Figure-1 for the input bit sequence 10101 assuming the encoder is in state (*00*). 8

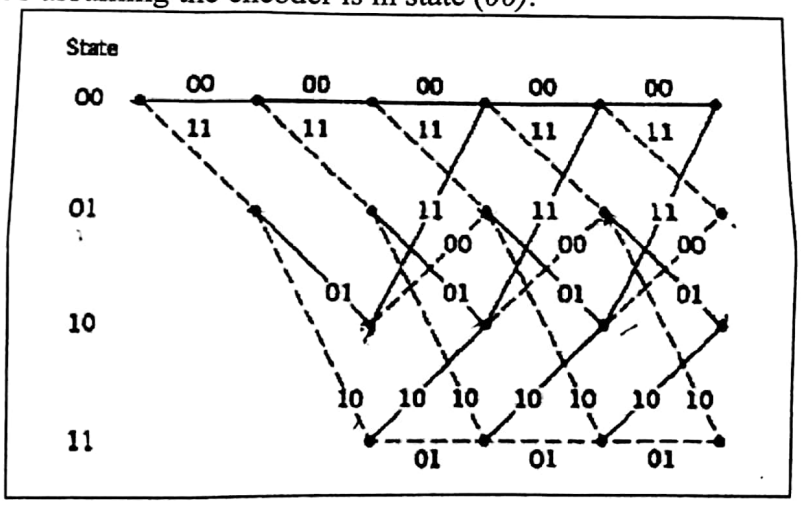

Figure 1: Trellis diagram of a (2, 1, 3) convolutional encoder.

8. a) Define the physical property of *millimeter waves*. Mention the significance of different *modulation schemes* used for *Broadband Wireless Communication*. 6

b) How is the *QoS (Quality of Service)* supported in *WiMAX MAC-layer* design? Clarify the concept with appropriate examples. 7

c) How does a *Radio Frequency Identification (RFID)* system work? Why is *RFID* better than using *bar codes*? 8

d) Do *Bluetooth* and *Wireless LAN (WLAN)* interfere with each other? 4

Erlang B Traffic Table

No. of Trunks (C)	Traffic (A) in Erlangs for P=															
	0.1%	0.2%	0.5%	1%	1.2%	1.3%	1.5%	2%	3%	5%	7%	10%	15%	20%	30%	40%
80	57.8	59.7	62.7	65.4	66.2	66.5	67.15	68.7	71.1	74.8	78.0	82.2	88.9	95.7	111.2	130.9
81	58.7	60.6	63.6	66.3	67.1	67.5	68.09	69.6	72.1	75.8	79.0	83.3	90.1	97.0	112.6	132.6
82	59.5	61.5	64.5	67.2	68.0	68.4	69.04	70.6	73.0	76.9	80.1	84.4	91.2	98.2	114.1	134.3
83	60.4	62.4	65.4	68.2	69.0	69.4	69.99	71.6	74.0	77.9	81.1	85.5	92.4	99.5	115.5	135.9
84	61.3	63.2	66.3	69.1	69.9	70.3	70.93	72.5	75.0	78.9	82.2	86.6	93.6	100.7	116.9	137.6
85	62.1	64.1	67.2	70.0	70.9	71.2	71.88	73.5	76.0	79.9	83.2	87.7	94.7	102.0	118.3	139.3
86	63.0	65.0	68.1	70.9	71.8	72.2	72.83	74.5	77.0	80.9	84.3	88.8	95.9	103.2	119.8	140.9
87	63.9	65.9	69.0	71.9	72.7	73.1	73.78	75.4	78.0	82.0	85.3	89.9	97.1	104.5	121.2	142.6
88	64.7	66.8	69.9	72.8	73.7	74.1	74.73	76.4	78.9	83.0	86.4	91.0	98.2	105.7	122.6	144.3
89	65.6	67.7	70.8	73.7	74.6	75.0	75.68	77.3	79.9	84.0	87.4	92.1	99.4	106.9	124.0	145.9
90	66.5	68.6	71.8	74.7	75.6	76.0	76.63	78.3	80.9	85.0	88.5	93.1	100.6	108.2	125.5	147.6
91	67.4	69.4	72.7	75.6	76.5	76.9	77.58	79.3	81.9	86.0	89.5	94.2	101.7	109.4	126.9	149.3
92	68.2	70.3	73.6	76.6	77.4	77.8	78.53	80.2	82.9	87.1	90.6	95.3	102.9	110.7	128.3	150.9
93	69.1	71.2	74.5	77.5	78.4	78.8	79.48	81.2	83.9	88.1	91.6	96.4	104.1	111.9	129.7	152.6
94	70.0	72.1	75.4	78.4	79.3	79.7	80.43	82.2	84.9	89.1	92.7	97.5	105.3	113.2	131.2	154.3
95	70.9	73.0	76.3	79.4	80.3	80.7	81.39	83.1	85.8	90.1	93.7	98.6	106.4	114.4	132.6	155.9
96	71.7	73.9	77.2	80.3	81.2	81.6	82.34	84.1	86.8	91.1	94.8	99.7	107.6	115.7	134.0	157.6
97	72.6	74.8	78.2	81.2	82.2	82.6	83.29	85.1	87.8	92.2	95.8	100.8	108.8	116.9	135.5	159.3
98	73.5	75.7	79.1	82.2	83.1	83.5	84.25	86.0	88.8	93.2	96.9	101.9	109.9	118.2	136.9	160.9
99	74.4	76.6	80.0	83.1	84.1	84.5	85.20	87.0	89.8	94.2	97.9	103.0	111.1	119.4	138.3	162.6
100	75.2	77.5	80.9	84.1	85.0	85.4	86.16	88.0	90.8	95.2	99.0	104.1	112.3	120.6	139.7	164.3