

B.Sc. Engineering 4<sup>th</sup> year 2<sup>nd</sup> Term Examination, 2018  
Department of Electronics and Communication Engineering  
KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

ECE 4259  
(Wireless Sensor Networks)

TIME: 3 hours

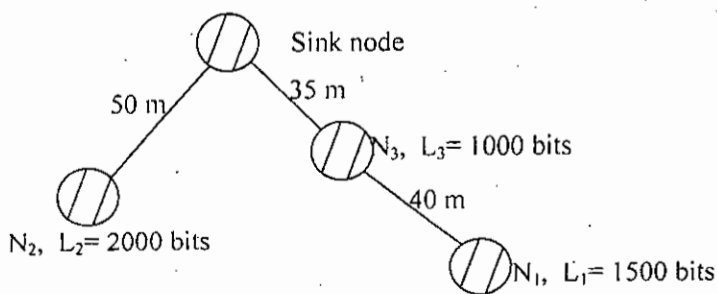
FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.  
ii) Figures in the right margin indicate full marks.

**SECTION A**

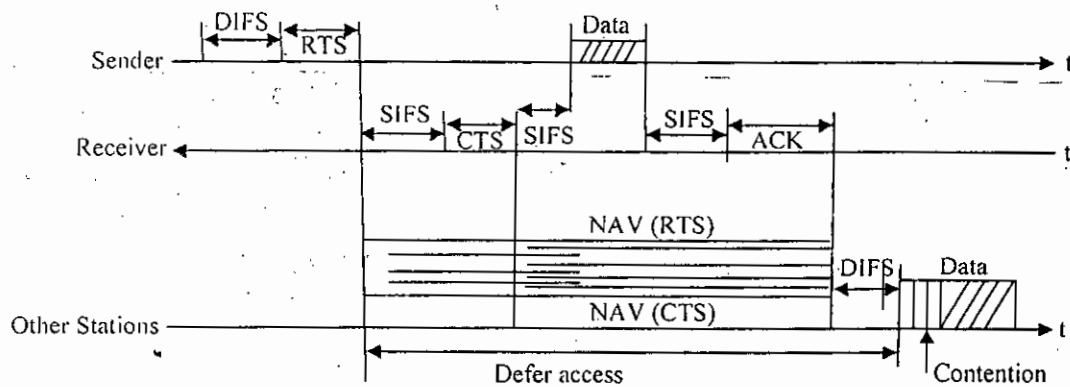
(Answer **ANY THREE** questions from this section in Script A)

1. a) What are the operational challenges of wireless sensor networks? Briefly explain the typical applications of wireless sensor networks. (5+5)  
b) Tabulate the comparisons between traditional networks and wireless sensor networks. (07)  
c) Explain various mobility scenarios of WSN. (08)  
d) What are the advantages and drawbacks of a multi-hop network? What are the QoS parameters of a network? Explain which QoS parameters will be improved due to use of multi-hop network. (10)
  
2. a) What is meant by scalability? Write down the properties that should be considered to deploy a sensor network. Explain the coverage and connectivity issues of wireless sensor network using necessary diagrams. (10)  
b) How can you build a secure wireless sensor network? Illustrate different network congestion avoidance mechanisms. (10)  
c) Explain the importance of FEC and ARQ for ensuring the quality of wireless communication. (06)  
d) Distinguish between data summation and data aggregation. What are the necessities and drawbacks of data aggregation in wireless sensor network? (09)
  
3. a) Draw and explain the energy model diagram of wireless sensor network. In the energy model, if the distance between transmitter and receiver is fixed, What are the factors responsible to increase the energy consumption in wireless sensor networks? (10)  
b) Write down the equation for total energy of a 2-hop routing path. Consider the distance from source node to intermediate node is  $x_1$  and distance from intermediate node to sink node is  $x_2$ , where both the  $x_1$  and  $x_2$  are smaller than the cross over distance. Also assume that the data packets generated in source and intermediate nodes are  $l_1$  and  $l_2$  respectively. (10)  
c) Assume the crossover distance is 42 m,  $E_c=50$  nj/bit,  $e_1=10$  pj/bit and  $e_2=0.0012$  pj/bit. Calculate the total energy required from source to destination of following figure. Also calculate the number of bits received in the sink node. (10)



- d) Explain the principle of LEACH protocol. (05)

4. a) Develop sensor network communication architecture. How can you control sensor management protocol (SMP)? (10)
- b) What is CSMA? Explain IEEE 802.11 MAC protocol and its working principle. (08)
- c) Deduce the relationship between number of retransmission and probability of packet error rate. (07)
- d) Following figure shows data communication diagram using 802.11 MAC protocol. Suppose the device does sensing the channel and assumes the channel to be idle and wants to transmit 1500 bytes of data. Assume the transmission rate is 10 Mbps. Calculate the time required to transmit the frame and receive the ACK as function of SIFS and DIFS. Ignore the propagation delay and assume no BER. Both a control frame and a frame without data is 32 bytes. (10)



### SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Explain applications of wireless mesh network. What are the challenges to design a wireless mesh network? (10)
- b) What are the differences between WMN and ad hoc networking in terms of routing and mobility? (10)
- c) What do you mean by scalable multi-channel MAC protocol? Explain the principle of multi-channel multi-transceiver MAC protocol. (15)
  
6. a) Distinguish between DCF and PCF super frame in IEEE 802.11 b. (10)
- b) What do you mean by cross layer design in layered protocol design? How do you classify cross layer design? (10)
- c) Define adaptive TCP. What is the effect of large RTT variations in wireless mesh network? (07)
- d) What are the important features and technological challenges of body area network? (08)
  
7. a) Construct a super frame structure of IEEE 802.11c exploiting CP and CFP. (10)
- b) Compare MSDU and MPDU aggregation. Which type of aggregation is better? (08)
- c) How can you enhance the capacity of WMNs? (08)
- d) Explain the comparisons among multi-radio routing, multi-path routing and hierarchical routing. (09)
  
8. a) How do you overcome the challenges to design underwater sensor network? (08)
- b) Develop a 3D model for deep sea with the help of Urick propagation model. (15)
- c) Explain the network management protocols in WMN. (12)

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ECE 4205  
(Satellite Communication and Radar)

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.  
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**SECTION A**

(Answer **ANY THREE** questions from this section in Script A)

1. a) Draw the functional block diagram of a digital earth station and briefly explain its operation procedure. (10)  
b) Why uplink and downlink frequencies are different in satellite communication? (06)  
c) Why satellite communication is unique? Why upconversion is used after modulation in an earth station? (10)  
d) Define the following terms: (09)  
i) Look angle, ii) Sub-satellite point, and iii) Sun transit outage
2. a) What is slant range? Derive the equation of slant range for a satellite. (10)  
b) What is eclipse? Calculate the maximum daily eclipse duration for a satellite having radius of earth is 6378.155 km, distance of the satellite from earth centre is 42164.2 km and maximum inclination angle is 23.4°. (12)  
c) State Kepler's second law and prove it. (13)
3. a) Draw the block diagram of communication repeater used in satellite communication and describe operation of each component briefly. (10)  
b) Classify satellite in terms of altitude and briefly describe each one. (10)  
c) Derive the expression of equivalent noise temperature of up-converter and high power amplifier connected as a cascade two-port system. (15)
4. a) What is frequency agile down-conversion? Is it essential in satellite communication? Give reason about your answer. (10)  
b) Derive the equation for carrier to noise plus interference ration for a satellite link. From the equation, give your comments about noise dominant link. (10)  
c) Write down the requirements those an earth station antenna must meet. (07)  
d) What is VSAT? Describe VSAT network configurations with necessary diagrams. (08)

## SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Explain the basic principle of operation of radar with suitable block diagram. (08)  
b) What are the limitations of CW radar and how can they be solved? Explain with suitable diagram. (09)  
c) What is thermal noise? Find out the value of object's distance in respect of receiver noise. (3+8)  
d) Calculate the maximum range of a radar system which operates at 3 cm with a peak pulse power of 500 kW, if its maximum receivable power is  $10^{-3}$  W, the capture area of its antenna is  $5 \text{ m}^2$  and the radar cross-sectional area of the target is  $20 \text{ m}^2$ . (07)
6. a) Write down the differences between MTI radar and pulse Doppler radar. What are the applications of Doppler frequency shift? (5+3)  
b) Define radar cross section and describe all the regions of the radar cross section. (3+6)  
c) The average time between false alarm is specified as 30 min and the receiver bandwidth is 0.4 MHz. i) What is the probability of the false alarm? ii) What is the threshold-to-noise power ratio ( $V_T^2/Y_o$ ). (09)  
d) What is flicker effect? What are the functions of range gate and AGC? (09)
7. a) What is monopulse tracker? Why multiple pulses are used for the detection of object in radar tracking system? (3+4)  
b) Draw the block diagram of the two coordinate amplitude comparison monopulse tracking radar. (10)  
c) Write down the characteristics of HF-OTH radar. (08)  
d) A radar system operates at 10 GHz with a common antenna with a gain of 30 dB. The receiver has a bandwidth of 1 kHz and the noise factor is 5 dB. The transmitted power is 1 kW and the target echoing area is  $10 \text{ m}^2$ . Calculate the range for  $S/N=10$ . (10)
8. a) Why is electronically steerable phase array suitable for radar application? (08)  
b) What is noise figure? Describe the noise figure of network for a cascading system. (08)  
c) What types of display are used in radar receiver? Classify the different radar display. (07)  
d) i) What should be the pulse repetition frequency of a radar in order to achieve a maximum unambiguous range of 60 nmi? (12)  
ii) How long does it take for the radar signal to travel out and back when the target is at the maximum unambiguous range?  
iii) If the radar has a pulse width of  $1.5 \mu\text{s}$ , what is the extent (in meters) of the pulse energy in space in the range coordinate?

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HUM 4209  
(Industrial Management and Accounting)

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.  
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**SECTION A**

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define Management. (05)  
b) Write down the functions of Management. (10)  
c) Write down the qualities of a Manger. (10)  
d) Explain the concepts of "Centralization and decentralization" (10)
2. a) Define executive development. (06)  
b) Discuss the job methods of executive development. (12)  
c) Define Motivation. (05)  
d) Explain Maslow's need hierarchy theory of motivation. (12)
3. a) What is "Human resources planning (HRP)"? (05)  
b) Describe the special motivational techniques used to motivate the employees. (15)  
c) Which one is the best leadership? Describe the reasons in favor of your opinion. (15)
4. a) Define marketing and marketing mix. (08)  
b) Discuss the process of new product development. (15)  
c) Summarize the characteristics, marketing objectives and required strategies in the maturity stage of product life cycle. (12)

**SECTION B**

(Answer **ANY THREE** questions from this section in Script B)

5. a) What are the parties of Accounting information users? (10)  
b) "Ledger is called the king of all accounts"- Explain the statement. (10)  
c) Describe the various concepts of accounting. (15)
6. a) Sufia Begum opened a law office, Dhaka, Attorney at law, on July 1, 2016, on July 31; the balance sheet showed cash Tk. 44,000, Accounts receivable Tk. 15,000, Supplier Tk. 5,000 office equipment Tk. 50,000, Accounts payable Tk. 42,000 and capital Tk. 72,000. During August the following transactions occurred. 2016  
August 1 Collected Tk. 10,000 of accounts receivable.  
August 2 Paid Tk. 27,000 cash on accounts payable and Tk. 4,000 paid by debtors/ accounts receivable for utility expense.  
August 3 Earned revenue Tk. 75,000 of which Tk. 30,000 is collected in cash and the balance is due in September.  
August 4 Purchased office equipment for Tk. 10,000, paying Tk. 4,000 in cash and the balance on account.  
August 5 Paid salaries Tk. 30,000 rent for August Tk. 9,000 and advertising expenses Tk. 3,500.

- August 6 Withdrew Tk. 5,500 in cash for personal use.  
 August 7 Received Tk, 20,000 from standard chartered Bank-money borrowed on a note payable.  
 August 8 Incurred utility expenses for the month Tk, 2000 on cash.

Instructions (a) Prepare a tabular summary of the August transactions beginning with July 31 balances. The column heading should be as follows: Cash + Accounts Receivable + Supplies + Office Equipment = Notes Payable + Accounts Payable + Sufia Begum, Capital.

b) Journalize above the transactions. (15)

7. a) Define accounting cycle. "Accounting cycle makes interlinking of previous accounting period to current accounting period." Explain the statement. (10)

b) Define trial balance. Write down the purposes of preparing a trial balance. (10)

c) Before preparing financial statement of the Apu advertising agency the following adjustments were noted on December 31, 2017; (15)

- i. Service provided but unbilled on December 31, are Tk. 1,500
- ii. Unpaid salaries on December 31, Tk. 2,000
- iii. Interest income accrued at December 31, Tk. 1,000.
- iv. Depreciation on equipment for the period Tk. 800.
- v. Expired insurance for the month Tk. 1,200
- vi. Two months' rent paid in December 1 @ 5,000 per month.
- vii. Utility expense incurred but not paid prior to December 31, Tk. 5,500.

Instructions: Prepare adjusting journal on December 31, 2017.

8. a) Prepare a statement of comprehensive income, an owner's equity statement and a financial position with consider the following adjustments: (35)

- i) Outstanding office salaries Tk. 900. Advertising Tk. 450 and rent Tk. 500.
- ii) Office supplies consumed were Tk. 1200.
- iii) Unexpired insurance was Tk. 600.
- iv) Depreciation on office equipment for the year @ 10%.
- v) Stock goods at the end Tk. 20,000.

The following is the unadjusted trial balance of Hanif Brothers as on June 30, 2016:

**HANIF BROTHERS (Trial balance as on June 30, 2016)**

Account Titles	Debit (Tk.)	Credit (Tk.)
Stock Goods (01/07/2015) -----	5,000	
Purchases -----	1,60,000	
Sales -----		1,83,000
Return -----	2,600	2,500
Accounts Receivable-----	27,600	
Accounts Payable -----		18,000
Hanif Capital -----		40,500
Office Equipment -----	20,000	
Cash -----	15,000	
Notes payable -----		3,000
Prepaid Insurance -----	1,800	
Office Supplies -----	1,400	
Rent Expense -----	2,600	
Salaries -----	3,200	
Hanif, Drawing -----	900	
Advertising Expense -----	1,200	
Delivery Expense -----	3,500	
Transportation in -----	2,200	
Tk.	2,47,000	2,47,000

B.Sc. Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Term Examination, 2018  
Department of Electronics and Communication Engineering  
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ECE 4203  
(Telecommunication Engineering)

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.  
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**SECTION A**

(Answer **ANY THREE** questions from this section in Script A)

1. a) Describe in brief the different elements of a switching system. Also draw the switching network configurations. (10)  
b) Describe the basic signaling tones in automatic exchanges with necessary diagrams. Differentiate between Strowger and crossbar switching systems. (12)  
c) Explain the following terms: (06)  
i) Tandem exchange, ii) Cost capacity index.  
d) Draw the functional block diagram of a common control switching system. (07)
2. a) Write down the differences between time-multiplexed time switching (TMTS) and time-multiplexed space switching (TMSS). (10)  
b) Design a touch tone dialing scheme with required tone frequencies. Describe briefly the protection schemes against "talk-off". (11)  
c) Discuss in brief the synchronous duplex mode of dual processor based switching systems. (05)  
d) Prove that the unavailability of dual processor system is given by  $U_D = \frac{2(MTTR)^2}{(MTBF)^2}$ , (09)  
where the symbols have their usual meanings.
3. a) Briefly explain synchronous optical network (SONET). (07)  
b) Draw the block diagram of two-stage space division switching and discuss about the total number of switching elements (s) and the blocking probability ( $P_B$ ) with proper mathematical background. (11)  
c) Using Lee's graph, show that the blocking probability of a three stage switch is given by  $P_B = [1 - (1 - \alpha/k)]^s$ , where the symbols have their usual meanings. (09)  
d) A three stage switching structures supports 128 inlets and 128 outlets. It is proposed to use 16 first stage and third stage matrices. (08)  
i) What is the number of switching elements in the switch if it is non-blocking?  
ii) At peak periods, the occupancy rate of an inlet is 10%. If the number of switching elements required for non-blocking operation is reduced by a factor of 3, what is the blocking probability of the switch?
4. a) Define the following terms of switching system. (06)  
i) Full availability, ii) Blocking switch, iii) Folded network.  
b) Briefly explain the ISDN protocol architecture. (10)  
c) Calculate the number of trunks that can be supported on a time multiplexed space switch, given that (06)  
i) 32 channels are multiplexed in each stream.  
ii) Control memory access time is 100 ns.  
iii) Bus switching and transfer time is 100 ns per transfer.  
d) Determine the switch advantage ratio of a three stage switch with N inlets and N outlets for the cases when i) N=128 and ii) N=8192. (08)  
e) Sketch and explain the frequency spectrum of ADSL. (05)

## SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) What is the significance of side tone? Explain the mechanism of for handling this side tone with proper circuit diagram. (10)
- b) Compare the feature of local battery and central battery exchanges in telephone networks. (08)
- c) Draw the functional block diagram of a standard telephone set and explain it briefly. (10)
- d) Briefly describe dial pulsing. Calculate the minimum time to dial pulse out the seven-digit telephone number 987-12344. (07)
6. a) Interpret the following hex code for a caller ID message (Start and Stop bits are not mentioned in the hex code): (10)
- ▶ 04 09 30 39 33 30 31 32 33 34 50
- b) What is crosstalk? Describe various types of cross talk. (08)
- c) Explain the following terms: (i)  $\mu$ -law companding (ii) echo suppressor (iii) vocoders (09)
- d) Write down the differences between inchannel and common channel signaling. (08)
7. a) Briefly explain the protocol architecture of SS7. What is the relationship between SS7 and ISO seven layer models? (13)
- b) Describe the cable hierarchy for subscriber loop system. (06)
- c) A group of 20 trunks provides a grade of service of 0.01 when offered 12 E of traffic. (10)
- (i) How much is the grade of service improved if one extra trunk is added to the group? (ii) How much does the grade of service deteriorate if one trunk is out of service?
- d) Briefly explain pure chance traffic and statistical equilibrium. (06)
8. a) On average, one call arrives every 5 seconds. During a period of 10 seconds, what is the probability that: (i) No call arrive? (ii) One call arrives? (iii) Two calls arrive? (iv) More than two calls arrive? (08)
- b) For a lost call system, deduce the expression for the first Erlang distribution and hence the grade of service. (12)
- c) For queuing systems, show that  $P(x) = \frac{N^N}{N!} \left(\frac{A}{N}\right)^x P(0)$ , Where symbols have their own meanings for telecommunication traffic theory. (10)
- d) A group of 20 trunks provides a grade of service of 0.01 when offered 12E of traffic (05)
- (i) How much is the grade of service improved if one extra trunk is added to the group? (ii) How much does the grade of service deteriorate if one trunk is out of service?



B.Sc. Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Term Examination, 2018  
Department of Electronics and Communication Engineering  
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ECE 4227  
(Biomedical Engineering)

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.  
ii) Figures in the right margin indicate full marks.

**SECTION A**

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define Biomedical Engineering. How can you contribute in Biomedical Engineering and healthcare sector as a student/graduate of Electronics and Communication Engineering? (08)  
b) Write down the differences between action potential and resting potential. Explain the generation process of action potential using necessary diagram. (12)  
c) What is ECG? Explain the electrical happenings through the cardiac conduction system during a cardiac cycle. (10)  
d) Calculate the equilibrium resting potential at 37° C temperature considering the following data: (05)
- | Species         | Permeability (cm/s) | Intracellular (millimoles/litre) | Extracellular (millimoles/litre) |
|-----------------|---------------------|----------------------------------|----------------------------------|
| Na <sup>+</sup> | $2 \times 10^{-8}$  | 12                               | 145                              |
| K <sup>+</sup>  | $2 \times 10^{-6}$  | 155                              | 4                                |
| Cl <sup>-</sup> | $4 \times 10^{-6}$  | 4                                | 120                              |
2. a) Why is driven right leg circuit necessary in ECG acquisition? Explain the working principle of driven right leg circuit using necessary diagram. (11)  
b) Write down the basic requirements of a biopotential amplifier. (07)  
c) Define EEG. Explain different components of EEG considering signal characteristics, electrode positions and mental status. (10)  
d) Briefly explain a typical EMG estimation system using necessary diagram. (07)
3. a) Define and classify biopotential electrode. Also describe the working principle of Ag/AgCl electrode. (10)  
b) Briefly explain the interaction between light and tissue and mention their significance in medical diagnosis. (08)  
c) Define biotelemetry. Describe the operation of a multichannel radio-telemetry system using necessary diagrams. (11)  
d) Write down the applications of LASER in healthcare. (06)
4. a) What is the frequency range of medical ultrasound? Describe the working principle of ultrasound imaging system using necessary diagrams. (13)  
b) Explain the basic principle of magnetic resonance imaging (MRI) technique. (14)  
c) Write down the procedural steps involved in the development of prosthetic devices. (08)

## SECTION B

(Answer ANY THREE questions from this section in Script B)

5.
  - a) How many types patient monitoring system? Draw the block diagram of total patient monitoring system. (10)
  - b) Write down three important ICU. What are the main functions of ECG in patient monitoring system? (10)
  - c) What is pulse oximeter? Draw the block diagram of SpO<sub>2</sub> and explain its operation. (15)
  
6.
  - a) Briefly explain prosthesis and prosthetic devices. Classify them. Mention their applications. (10)
  - b) How body temperature and blood pressure of a human body is measured? Briefly describe them. (15)
  - c) Define and classify biosensor. Also describe the performance specifications of biosensors. (10)
  
7.
  - a) What is surgical diathermy? Describe the surgical tissue effect on electrosurgical machine. (12)
  - b) Describe the electrode that used in surgical diathermy. (10)
  - c) What is leakage current? Explain the different type of leakage current flow into medical device. (13)
  
8.
  - a) What are the differences between defibrillator and pacemaker? Draw the block diagram of a clinical defibrillator and explain its working principle. (12)
  - b) Write short notes on: i) CCU and ii) Ventilators. (10)
  - c) Discuss on the shock hazards in biomedical equipments and suggest possible grounding process to avoid shock hazards. (13)