

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

MID SEMESTER EXAMINATION

SUMMER SEMESTER, 2018-2019

DURATION: 1 Hour 30 Minutes

FULL MARKS: 75

CSE 6241: Wireless Sensor Networks

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

1. a) Define *Access Networks* along with an appropriate diagram. 7
- b) Describe inherent characteristics of *Wireless Sensor Networks (WSNs)* in brief. 6
- c) Define *interference range* and *transmission range* of a wireless transmitter. 6
- d) Compare *frequency division multiple access (FDMA)*, and *space division multiple access (SDMA)* with appropriate diagrams. 6
2. a) Briefly discuss few effective approaches that enhance the network lifetime of energy-constrained *WSNs*. 8
- b) How does a wireless station detect its collided transmission? Is there any difference in collision detection mechanism in wired and wireless networks? 5
- c) "Failure to identify the actual cause of packet loss in dense *Wireless Sensor Networks* significantly reduces the network lifetime". Justify the statement with proper argument. 6
- d) 6

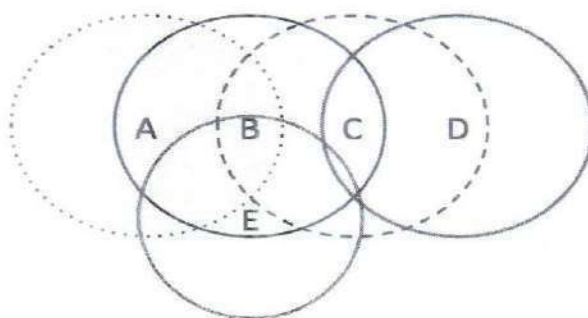


Figure 1: network topology for question 2.d

Consider the topology of a wireless sensor network illustrated in Figure 1. The station A, B, C, and D all have equi-sized transmission ranges, while station E has a smaller transmission range. Assume that, two nodes' transmissions will interfere if and only if they transmit at the same time and their transmission areas overlap. Further, assume that losses only occur due to collisions. Consider the *RTS/CTS* as an enabled mechanism in this scenario.

For the given scenario, find the exposed terminal and hidden terminal stations while the station D communicates with station C. Answer should include appropriate justification.

3. a) Consider a *multi-hop WSN* consists of η number of distributed sensor nodes ($10 < \eta < 15$), where all of the participating nodes share a common channel through a contention based medium access mechanism. Let a station titled *X* has just captured a wireless link and transmitted a frame to a station titled *Y*, which is within its transmission range. Thus this channel capture at link (*X-Y*) restricts few more *neighboring links* (within certain geographical area) to be captured for certain time duration Δt . 6

Considering the above scenario, draw a diagram to correctly identify these restricted neighboring links during Δt period. Assume the network topology and node's individual transmission ranges by yourself.

- b) Mention two fundamental issues of *random access based channel contention* those lead to higher channel wastage. 7
 - c) What is the fundamental idea of *Sensor-MAC (S-MAC)* protocol? 7
 - d) Have a comparative analysis on layered architecture and clustered architecture of WSNs. 5
- 4.
- a) Discuss the steps followed by the participating sensor nodes during the *Setup-Phase* of *Low-Energy Adaptive Clustering Hierarchy (LEACH)* protocol. 9
 - b) Contention-based asynchronous duty cycle MAC protocols transmit long preamble during low power listening (LPL) period. However, such long preamble transmission may occupy the medium for much longer than actual data transmission. Discuss the significant contribution of *Receiver-Initiated MAC (RI-MAC)* protocol in resolving such limitation in asynchronous duty cycled WSN. 9
 - c) Briefly discuss few promising applications for tomorrow's Internet of Things (IoT). 7