M.Sc. TE 2nd Semester   28 October 2019

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

SEMESTER FINAL EXAMINATION   **SUMMER SEMESTER, 2018-2019**
DURATION: 3 Hours   **FULL MARKS: 150**

CSE 6297: Wireless Sensor Networks

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) Describe the inherent characteristics of *Wireless Sensor Networks (WSNs)* in brief.   8
   b) List the compulsory and optional components of a wireless sensor node.   4
   c) Have a comparative analysis on following industrial alliances: 9
      i.   Bluetooth
      ii. ZigBee
      iii. Wi-Fi
   d) Define 'Network Lifetime' in *Wireless Sensor Networks* (WSNs).   4

2. a) *CSMA/CA* protocol in any multi-hop *WSNs* employs a *Random Backoff* scheme to avoid   9
      having multiple sensor nodes transmitting simultaneously. Discuss the inefficiency of the
      Random Backoff scheme with appropriate example(s).
   b) With the aid of proper argument and diagram clarify the limitation on immediate collision   9
      detection by respective transmitting node(s) in any wireless sensor networks.
   c) Mention few promising applications of ZigBee industrial alliance.   7

3. a) "Correctly identifying the cause of packet loss in WSNs has a significant contribution in   9
      WSN lifetime enhancement" - Justify the statement.
   b) Reducing the amount of data traffic in WSNs significantly enhance the network energy   8
      efficiency. Mention two effective methodology in reducing the amount of data traffic in
      WSNs.
   c) When using RTS/CTS on a multi-hop wireless sensor networks, how does an exposed   8
      terminal decides it is safe to send?

4. a) "Keeping the nodes in sleep mode as much as possible is one of the prominent approaches to   7
      improve the *WSN* network lifetime. However, such approach triggers few operational
      challenges in boosting network performance" - Justify the statement.
   b) What is the difference between routing and forwarding?   6
   c) Discuss the basics of *Geographic Routing*.   6
   d) Write short note on the network architecture of IEEE 802.15.4.   6

5. a) Define *routing metric* and *routing protocol* with appropriate examples.   5
   b) *Receiver Initiated Multiple Access with Dual Purpose Polling* (RIMA-DP) protocol uses *RTR*   10
      (ready-to-receive packet) and *NTR* (no-transmission-request) to successfully exchange data
      packets. Explain its collision avoidance strategy in different possible scenarios by illustrating
      necessary figures.
   c) Discuss the contribution of *Low-Energy Adaptive Clustering Hierarchy* (LEACH) protocol   10
      in enhancing the network lifetime of a WSN. Mention the role of *code division multiple
      access* (CDMA) in LEACH protocol.

6. a) Discuss the concept of *Wastage Aware Routing Metric* in *Energy-Harvesting Wireless Sensor* 10
Networks (EH-WSNs) with an appropriate example.

   b) With the aid of a network traffic flow diagram clarify the working principle of the *Energy* 9
Neutral Directed Diffusion routing protocol in EH-WSNs.

   c) How does the *Gossiping* routing protocol differ from *Flooding* routing protocol? 6

7. a) How does the communication between *beacon nodes* and *dumb nodes* in any WSN help 9
determining their relative placement?

   b) There are three beacon nodes that can send and receive signals from your dumb sensor node 16
P. Suppose that, in a rectangular coordinate system, the locations of the three beacon nodes
A, B and C are (0,0), (36,0) and (16,32) respectively (1 unit represents 1 km). It is found that
the distance between P and the three beacon nodes A, B and C are 129 km, 25 km and 13 km
respectively. Assume that A, B, C and P lie on the same horizontal plane. Find the coordinates
of the point P.

8. a) Write short note on the followings: 8
   i. TinyOS
   ii. NesC
   iii. TelosB

   b) Draw the system architecture diagram of TinyOS, a low- power embedded operating system. 5

   c) Mention few hardware constraints and software challenges associated with application 8
development for Tiny Sensor nodes.

   d) List the scope of *IEEE 802.15.4* specification. 4