

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 6241: 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 <i>Wireless Sensor Networks (WSNs)</i> 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 ' <i>Network Lifetime</i> ' in <i>Wireless Sensor Networks (WSNs)</i> . | 4 |
| 2. a) | <i>CSMA/CA</i> protocol in any multi-hop <i>WSNs</i> employs a <i>Random Backoff</i> scheme to avoid having multiple sensor nodes transmitting simultaneously. Discuss the inefficiency of the <i>Random Backoff</i> scheme with appropriate example(s). | 9 |
| b) | With the aid of proper argument and diagram clarify the limitation on immediate collision detection by respective transmitting node(s) in any wireless sensor networks. | 9 |
| c) | Mention few promising applications of ZigBee industrial alliance. | 7 |
| 3. a) | "Correctly identifying the cause of packet loss in <i>WSNs</i> has a significant contribution in <i>WSN</i> lifetime enhancement" - Justify the statement. | 9 |
| b) | Reducing the amount of data traffic in <i>WSNs</i> significantly enhance the network energy efficiency. Mention two effective methodology in reducing the amount of data traffic in <i>WSNs</i> . | 8 |
| c) | When using RTS/CTS on a multi-hop wireless sensor networks, how does an exposed terminal decides it is safe to send? | 8 |
| 4. a) | "Keeping the nodes in sleep mode as much as possible is one of the prominent approaches to improve the <i>WSN</i> network lifetime. However, such approach triggers few operational challenges in boosting network performance" - Justify the statement. | 7 |
| b) | What is the difference between routing and forwarding? | 6 |
| c) | Discuss the basics of <i>Geographic Routing</i> . | 6 |
| d) | Write short note on the network architecture of IEEE 802.15.4. | 6 |
| 5. a) | Define <i>routing metric</i> and <i>routing protocol</i> with appropriate examples. | 5 |
| b) | <i>Receiver Initiated Multiple Access with Dual Purpose Polling (RIMA-DP)</i> protocol uses <i>RTR</i> (ready-to-receive packet) and <i>NTR</i> (no-transmission-request) to successfully exchange data packets. Explain its collision avoidance strategy in different possible scenarios by illustrating necessary figures. | 10 |
| c) | Discuss the contribution of <i>Low-Energy Adaptive Clustering Hierarchy (LEACH)</i> protocol in enhancing the network lifetime of a <i>WSN</i> . Mention the role of <i>code division multiple access (CDMA)</i> in <i>LEACH</i> protocol. | 10 |

6. a) Discuss the concept of *Wastage Aware Routing Metric* in *Energy-Harvesting Wireless Sensor Networks* (EH-WSNs) with an appropriate example. 10
- b) With the aid of a network traffic flow diagram clarify the working principle of the *Energy Neutral Directed Diffusion* routing protocol in EH-WSNs. 9
- 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 determining their relative placement? 9
- b) There are three beacon nodes that can send and receive signals from your dumb sensor node *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*. 16
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 development for Tiny Sensor nodes. 8
- d) List the scope of *IEEE 802.15.4* specification. 4