Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Wired and Wireless Sensor Networks
Program: M.Tech Automation and Robotics Engineering **Semester: II**
Course Code: ECEG7008 **Time 03 hrs.**
Max. Marks: 100

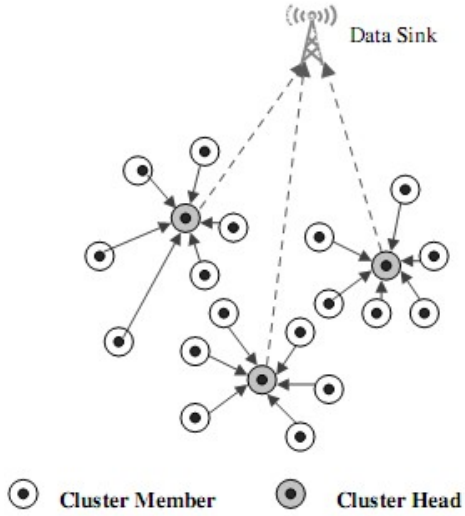
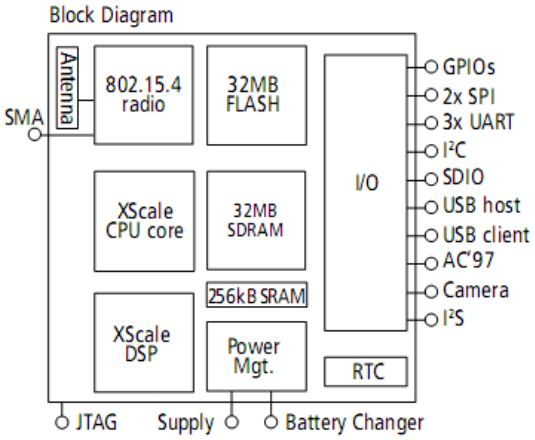
Instructions: Attempt all questions.

SECTION A

S. No.		Marks	CO
Q 1	Define components of a typical sensing node of a WSN with its block diagram.	**5**	**CO2**
Q 2	Discuss all possible advantages and disadvantages of centralized topology of Wireless Networks.	**5**	**CO2**
Q 3	What are the connectivity issues and deployment challenges in implementing WSN in Building Automation (Smart Buildings)?	**5**	**CO4**
Q 4	What are the different types of media that can be used in wired and wireless networks. Elucidate in brief the criteria used to select network media?	**5**	**CO3**

SECTION B

Q 5	Elucidate in brief, Automatic Repeat Request (ARQ) error control mechanism implemented by Transmission Control Protocol (TCP). Discuss all common ARQ retransmission schemes used by TCP (with neat diagrams).	**10**	**CO3**
Q 6	Discuss the features and functions of Sensor Operating Systems (SOS) considering the limited resources of Sensor Nodes.	**10**	**CO4**
Q 7	(A) Explain various operational states/modes of a Transceiver? (B) Calculate efficiency of the power amplifier used by transceiver circuitry, when transmission power P_{tx} = 1 mW and α_{amp} = 174 mW and β_{amp} = 5.0	**10**	**CO3**
Q 8	Suppose a WSN is to be designed for the early Forest fire during summer. Consider the size of forest to be of 100 square Kms. Identify and define the design objectives and technical challenges for such an application.	**10**	**CO4**

	SECTION-C		
Q 9 A	Design a WSN (and a block diagram) that can be used in Structural Health Monitoring (for Buildings, Bridges, etc.). Analyze its features and specifications, including possible wireless standards and network topologies.	**10**	**CO4**
Q 9 B	Refer the routing protocol shown in the figure 1. Routing protocols are designed to achieve special purposes in WSN.  *Figure 1: Routing Protocol for WSN* a) Identify and define the working of the Routing protocol shown in the figure. b) Identify the applications in which the shown Routing protocol can be used. c) What are the routing issues that the shown routing protocol is capable to resolve?	**10**	**CO3**
Q 10 A	A Block diagram of IMote2 sensor node hardware is shown in the figure 2.  *Figure 2: IMote2 Sensor Node Hardware* a) Identify the range of transmission band that can be used by *IMote2* mote. b) What is the size of flash memory for data logging used by *IMote2* mote. c) Identify the transceiver IC and its specifications used by *IMote2* mote. d) Name the WSN OS compatible with the *IMote2* mote.	**10**	**CO4**
Q 10 B	Calculate the life-time of the sensing node running on Four Alkaline AA Batteries of	**10**	**CO1**

	3000 mAh each and consuming the power on the basis of the following: a) Sensing node is running in full-active mode for 10 hours per day and consuming 220 mW power during full-active mode; b) Sensing node is running in idle mode for 10 hours per day and consuming 90 mW power during idle mode; c) Sensing node is running in sleep mode for 4 hours per day and consuming 110 µW power during sleep mode.		

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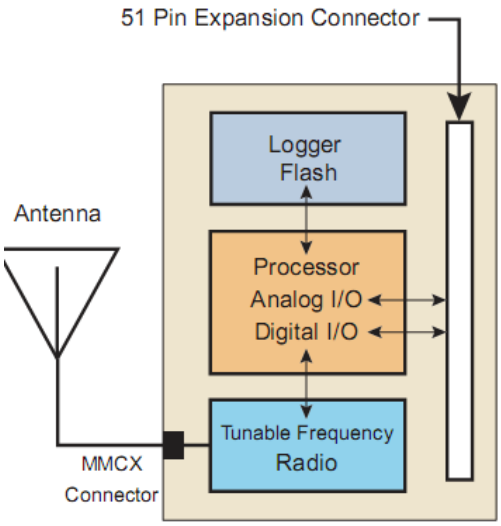
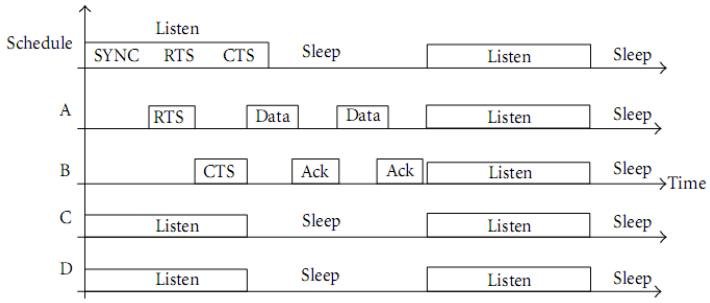
SECTION A

S. No.		Marks	CO
Q 1	Define components of a typical sensing node of a WSN with its block diagram.	**5**	**CO2**
Q 2	Discuss about Multi-hop wireless communication. Why multi-hop wireless communication is required for WSN?	**5**	**CO2**
Q 3	List some ideas on the energy scavenging techniques for sensor nodes.	**5**	**CO3**
Q 4	Examine the concept and implementation of fault tolerance in WSN.	**5**	**CO3**

SECTION B

Q 5	How to estimate range to a node to which no direct radio communications exists? Name and explain any one of such method.	**10**	**CO1**
Q 6	Elucidate in brief, Automatic Repeat Request (ARQ) error control mechanism implemented by Transmission Control Protocol (TCP). Discuss all common ARQ retransmission schemes used by TCP (with neat diagrams).	**10**	**CO3**
Q 7	(A) Explain various operational states/modes of a Transceiver? (B) Calculate efficiency of the power amplifier used by transceiver circuitry, when transmission power P_{tx} = 1 mW and α_{amp} = 174 mW and β_{amp} = 5.0	**10**	**CO3**
Q 8	Suppose a WSN is to be designed for the Patient Monitoring System of a Hospital for about 100 patients under critical observations. Identify the technical issues and challenges for such an application.	**10**	**CO4**

	SECTION-C		
Q 9 A	Design a WSN (block diagram) that can be used in Building Automation (Smart Buildings)? Analyze its features and specifications, including possible wireless standards and network topologies.	**10**	**CO4**
Q 9 B	A Block diagram of MICA2 sensor node hardware is shown in the figure 1.  *Figure 1: MICA2 Sensor Node Hardware* a) Identify the range of transmission band that can be used by MICA2 mote. b) What is the size of flash memory for data logging used by MICA2 mote. c) Identify the transceiver IC and its specifications used by MICA2 mote. d) Name the WSN OS compatible with the MICA2 mote.	**10**	**CO3**
Q 10 A	Assume that nodes A, B and C are within range of each other. Node D is within range of Node C and Node A transmits to Node B. Refer the figure 2 for the MAC protocol that has been designed to facilitate smooth communication in the WSN environment.  *Figure 2: MAC Protocol for WSN* a) Identify and define the working of the MAC protocol shown in figure 2. b) Identify the applications in which the above shown MAC protocol can be used. c) What is the level of synchronization required between nodes for the shown MAC protocol.	**10**	**CO4**

Q 10 B	Calculate the life-time of the sensing node running on Three Alkaline AA Batteries of 3000 mAh each and consuming the power on the basis of the following: d) Sensing node is running in full-active mode for 8 hours per day and consuming 250 mW power during full-active mode; e) Sensing node is running in idle mode for 8 hours per day and consuming 110 mW power during idle mode; f) Sensing node is running in sleep mode for 8 hours per day and consuming 95 µW power during sleep mode.	**10**	**CO1**