SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

1906808 - AD HOC AND WIRELESS SENSOR NETWORKS

VIII SEMESTER

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Prepared by

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QUESTION BANK

SUBJECT : 1906808 – Ad hoc and Wireless Sensor Networks

SEM / YEAR : VIII / IV year B.E. (ECE)

UNIT I :- AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS			
Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Classifications of Routing Protocols, Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV), Opportunistic Routing, Self-Configuration and Auto Configuration, Issues in designing a Routing Protocol for Ad Hoc Wireless Networks, Commercial applications of Ad hoc networking.			
PART – A			
Q.No.	**Questions**	**Course Outcome**	**Bloom's Taxonomy Level**
1.	What is an ad hoc wireless network?	CO1	BTL 1
2.	Mention the challenging issues in ad hoc network maintenance.	CO1	BTL 1
3.	Classify the security attack in ad hoc wireless networks and specify its features.	CO1	BTL 2
4.	Summarize the importance of a Gateway in a wireless network.	CO1	BTL 2
5.	List the applications of ad hoc networks	CO1	BTL 1
6.	Outline the concept of hidden terminal problem.	CO1	BTL 2
7.	Point out the issues in ad hoc networks.	CO1	BTL 2
8.	Find the routing protocols of ad hoc wireless networks.	CO1	BTL 1
9.	Define proactive and reactive routing protocols. Write examples for each.	CO1	BTL 1
10.	Mention the significance of power aware routing in ad hoc wireless networks.	CO1	BTL 2
11.	Write the classification of routing protocols based on the routing information update mechanism.	CO1	BTL 1
12.	Explain the method to update the table in table driven routing protocol.	CO1	BTL 2
13.	Identify the advantages and disadvantages of DSDV routing protocols in an ad hoc wireless network.	CO1	BTL 2

14.	Infer the pros and cons of the proactive routing protocol and reactive routing protocol.		CO1	BTL 2
15.	List the applications of ad hoc networks.		CO1	BTL 1
16.	How does the table driven protocol work in ad hoc networks?		CO1	BTL 1
17.	Outline the significance of the principle involved in a demand routing protocol.		CO1	BTL 1
18.	List the messages involved in AODV routing protocol employed in a wireless network.		CO1	BTL 1
19.	Interpret the factor by which AODV performs well compared to DSDV routing protocol.		CO1	BTL 2
20.	When does Route Error message get initiated in AODV routing protocol?		CO1	BTL 2
21.	Define Scalability in ad-hoc networks.		CO1	BTL 1
22.	What is opportunistic routing?		CO1	BTL 1
23.	Find the routing technique which utilizes the opportunistic forwarding.		CO1	BTL 1
24.	What the difference between self-configuration and auto configuration?		CO1	BTL 1
	PART – B			
1.	(i) Differentiate between cellular network and an ad hoc network. (ii) Interpret the major advantages of an ad hoc wireless Internet.	(8) (5)	CO1	BTL 4
2.	Discover are the major issues in designing a MAC protocol and explain the concept with necessary diagrams.	(13)	CO1	BTL 4
3.	(i) Assess the importance of multicasting in an ad hoc wireless network applications. (ii) Summarize the security threats in an adhoc wireless networks.	(7) (6)	CO1	BTL 4
4.	Model the schematic diagram of an ad hoc wireless Internet and discuss the issues to be considered for the successful ad hoc wireless Internet.	(13)	CO1	BTL 3
5.	Examine about the benefits of the commercial ad hoc wireless networks.	(13)	CO1	BTL 4
6.	Infer about power management in ad hoc wireless networks.	(13)	CO1	BTL 3
7.	Construct the concept of Self Organization and quality of service provisioning in an ad hoc wireless network.	(13)	CO1	BTL 3
8.	Classify the types of ad hoc network routing protocols based on routing information update mechanism.	(13)	CO1	BTL 4
9.	Examine how is the loop free property ensured in an on-demand routing protocol and in table driven routing protocol.	(13)	CO1	BTL 4

10.	Explore the issues related to routing protocol for ad hoc wireless networks.	(13)	CO1	BTL 3
11.	Analyze the destination sequenced distance-vector routing protocol with an example.	(13)	CO1	BTL 4
12.	(i) List the advantages of hierarchical topology-based protocols over protocols that use the flat topologies. (ii) Inspect the characteristics that the routing protocol for ad hoc wireless networks should poses for transfer of data from source node to destination node.	(7) (6)	CO1	BTL 4
13.	Illustrate the significance of each field in the table maintained at each node in an ad hoc wireless networks using Table driven protocol.	(13)	CO1	BTL 3
14.	Explain how route is established and maintained in an ad hoc network using AODV routing protocol?	(13)	CO1	BTL 3
15.	Describe the topology organization in DSDV and AODV routing protocols with a sample network.	(13)	CO1	BTL 4
16.	Examine how does the opportunistic routing support forwarding of packets in adhoc networks?	(13)	CO1	BTL 4
17.	Analyze the role of self and auto configuration protocols in mobile adhoc networks.	(13)	CO1	BTL 4

PART – C

1.	(i)	Explain whether the Table-driven routing protocol is suitable high mobility environment.	(7)	CO1	BTL 4
	(ii)	Discuss the behavior of the components of an ad hoc wireless network and infer the uniqueness of each component.	(8)		
2.	Design an ad hoc wireless network with nodes and demonstrate the process of route establishment and route maintenance using the on demand routing protocol.		(15)	CO1	BTL 3
3.	Analyze the issues and challenges in Ad hoc wireless networks.		(15)	CO1	BTL 4
4.	Assess the detail in the following table, draw network based on the data available and explain DSDV protocol with the framed network.		(15)	CO1	BTL 4

Destination	Next hop	Metric	Sequence No.
A	A	0	A-550
B	B	1	B-102

		C	**B**	**3**	**C-588**			
		D	**B**	**4**	**D-312**			
5.	Distinguish a multiple access technology is suitable in a military ad hoc network environment, and a home ad hoc network environment? Devise the methods for different applications of ad hoc wireless network.					(15)	CO1	BTL 4

UNIT II :- SENSOR NETWORK CONCEPTS, ARCHITECTURES AND DESIGN CHALLENGES			
Network Architecture - Sensor Network Scenarios, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, Transceiver Design Considerations, Optimization Goals and Figures of Merit.			
Q.No.	**Question**	**Course Outcome**	**Bloom's Taxonomy Level**
PART – A			
1.	What is a wireless sensor network?	CO2	BTL 1
2.	Identify the characteristic requirements of a wireless sensor network.	CO2	BTL 2
3.	How does address centric network differ from with data centric network.	CO2	BTL 2
4.	Compare active and passive sensors.	CO2	BTL 2
5.	Outline the event detection approaches in WSN.	CO2	BTL 2
6.	Interpret the term energy scavenging in Wireless Sensor Network.	CO2	BTL 2
7.	Summarize the Collaborative processing.	CO2	BTL 2
8.	Name the hardware components of a Wireless sensor network.	CO2	BTL 1
9.	List the challenges in the design of WSN.	CO2	BTL 1
10.	Write the key characteristics of a microcontroller which makes it possible to use in wireless sensor node.	CO2	BTL 1
11.	List the characteristics based on which the transceiver is selected for a wireless sensor node.	CO2	BTL 1
12.	Classify the energy consumption operations in wireless sensor networks.	CO2	BTL 2

13.	Explain the performance metrics of wireless sensor network.		CO2	BTL 2
14.	Name the operational states of transceiver in the sensor node.		CO2	BTL 2
15.	Illustrate the structure of transceiver for WSN.		CO2	BTL 2
16.	Outline the use of low noise amplifier in transceiver.		CO2	BTL 2
17.	Mention the types of mobility of a sensor node in a network.		CO2	BTL 2
18.	Compare Single Hop with Multiple Hop in a wireless network.		CO2	BTL 2
19.	List the features of in-network processing in WSN.		CO2	BTL 1
20.	Classify the modes of operation of a sensor node.		CO2	BTL 2
21.	Explain about dynamic modulation scaling in a transceiver used in wireless sensor node.		CO2	BTL 2
22.	List the generic possibilities for high level QoS in wireless sensor network.		CO2	BTL 1
23.	Outline the optimization goals of sensor network.		CO2	BTL 2
24.	List out the factors affect the performance of event detection application		CO2	BTL 1
PART – B				
1.	Construct the challenges and the required mechanisms of a wireless sensor network.	(13)	CO2	BTL 3
2.	Categorize the various applications of wireless sensor networks and explain any two with an example each.	(13)	CO2	BTL 4
3.	Model the sensor network architecture and describe the components in detail.	(13)	CO2	BTL 3
4.	Model the RF front end of a transceiver and outline the behavior of operational states.	(13)	CO2	BTL 3
5.	Devise the possible sensors and actuators that can be used to design a wireless sensor network.	(13)	CO2	BTL 3
6.	Distinguish sensor networks from the mobile ad hoc network.	(13)	CO2	BTL 4
7.	Summarize the enabling technologies used to improve the performance of the wireless sensor network.	(13)	CO2	BTL 3
8.	Examine the Transceiver characteristics and structure used in the sensor node.	(13)	CO2	BTL 4
9.	Analyze how Energy Scavenging is realized in wireless sensor network.	(13)	CO2	BTL 4
10.	With the supporting equations, write a detailed notes on energy consumption during the transmission and reception of a signal in WSN	(13)	CO2	BTL 3

11.	Deduce the expression for energy consumption in a sensor node with an appropriate diagram.	(13)	CO2	BTL 4
12.	Analyze the energy consumption in discrete operational states of an embedded microcontroller in a sensor node.	(13)	CO2	BTL 4
13.	Explain about the mobility management in multiple sources and multiple sinks scenario.	(13)	CO2	BTL 4
14.	Examine the essential aspects of power supply for an untethered wireless sensor node.	(13)	CO2	BTL 4
15.	Categorize the sensor network scenario with diagrams and also explain how mobility can appear in WSN?	(13)	CO2	BTL 4
16.	Discover how networking solutions can be achieved using optimization goals and figure of merits in WSN?	(13)	CO2	BTL 4
17.	Explain the factors used to optimize the wireless sensor network.	(13)	CO2	BTL 3
	PART – C			
1.	Examine the non-radio frequency communication available for communication in a wireless sensor network.	(15)	CO2	BTL 4
2.	Analyze the transceiver tasks and characteristics in a sensor node in a wireless sensor network.	(15)	CO2	BTL 4
3.	Construct a brief note on the performance of hardware elements in sensor node architecture with necessary diagrams.	(15)	CO2	BTL 3
4.	Illustrate the function of microcontroller in a wireless sensor node and discuss about the various microcontrollers that are available in the sensor node.	(15)	CO2	BTL 4
5.	Formulate the advanced radio concepts that are associated with the transceivers of a mote.	(15)	CO2	BTL 3

UNIT III :- WSN NETWORKING PROTOCOLS

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

Q.No.	Question	Course Outcome	Bloom's Taxonomy Level
	PART – A		
1.	What are the performance requirements for a MAC protocol?	CO3	BTL 1
2.	State the concept of wake-up radio.	CO3	BTL 2
3.	List the factors that are essential for PHY design in WSNs.	CO3	BTL 1

4.	Compare the contention-based protocols with schedule-based protocols.	CO3	BTL 2
5.	Find the causes of signaling overhead in WSN.	CO3	BTL 1
6.	Write about the energy efficient routing in WSN.	CO3	BTL 1
7.	Demonstrate a method for duplicate address detection.	CO3	BTL 2
8.	Point out the salient feature of location based routing.	CO3	BTL 2
9.	How does flooding is different from gossiping.	CO3	BTL 1
10.	Compare on-demand protocols with proactive protocols.	CO3	BTL 2
11.	Select the protocols for distributed demand assignment strategy.	CO3	BTL 1
12.	List the important classes of MAC protocols.	CO3	BTL 1
13.	Name the periods used in periodic wakeup scheme.	CO3	BTL 1
14.	Write the significance of S-MAC protocol.	CO3	BTL 2
15.	Outline the pros and cons of scheduled based protocols.	CO3	BTL 2
16.	Summarize the sources of energy waste in MAC protocols.	CO3	BTL 2
17.	Explain the need of dynamic synchronization approaching mediation device protocol.	CO3	BTL 2
18.	Summarize the objective of PAMAS.	CO3	BTL 2
19.	How does the probing protocol determine the length of ongoing packet?	CO3	BTL 2
20.	Interpret the features of IEEE 802.15.4.	CO3	BTL 2
21.	Name the scheduled based protocols.	CO3	BTL 1
22.	How does LEACH protocol differs from other routing protocols used in WSN.	CO3	BTL 1
23.	Distinguish between two types of devices in IEEE 802.15.4 protocol.	CO3	BTL 2
24.	List the challenges and issues in transport layer protocol.	CO3	BTL 1

PART – B

1.	Examine the three major classifications of MAC protocols in wireless sensor network.	(13)	CO3	BTL 4
2.	Develop the requirements and design considerations for a MAC protocol in wireless sensor network.	(13)	CO3	BTL
3.	Analyze the requirements and issues in energy efficient routing protocol.	(13)	CO3	BTL 4

4.	Explore the importance of the Mediation device protocols with relevant diagrams in wireless sensor networks.	(13)	CO3	BTL 3
5.	Describe the principles of S-MAC protocol in a network with suitable diagrams.	(13)	CO3	BTL 4
6.	(i) Classify the three different phases of SMAC. (ii) Examine the NAV setting in SMAC with a neat sketch.	(8) (5)	CO3	BTL 4
7.	Discover the issues and challenges in designing low duty cycle protocol.	(13)	CO3	BTL 4
8.	Assess the working principle of CSMA protocol used for medium access in WSN with the help of state diagram.	(13)	CO3	BTL 3
9.	Examine the LEACH routing with the help of neat diagram. Give its advantages and disadvantages.	(13)	CO3	BTL 4
10.	(i) Write short notes on contention based protocols (ii) Explain how does PAMAS protocol minimize the hidden terminal problem.	(5) (8)	CO3	BTL 3
11.	Inspect how the scheduled based MAC protocol differs from the contention-based MAC protocol.	(13)	CO3	BTL 4
12.	(i) List the difference between proactive and reactive routing. (ii) Discover routing that is more suitable for WSN? Explain the reasons.	(7) (6)	CO3	BTL 4
13.	Distinguish the routing technique more suitable for WSN. Narrate the reasons for it.	(13)	CO3	BTL 4
14.	Illustrate how RTS/CTS mechanism is implemented in mediation device protocol.	(13)	CO3	BTL 3
15.	Exhibit the features and network architecture of the IEEE 802.15.4 MAC protocol.	(13)	CO3	BTL 4
16.	Examine the functionality of GTS management and data transfer procedures in WPAN.	(13)	CO3	BTL 4
17.	Analyze the challenges and issues in Transport layer protocol and find the suitable solutions for it.	(13)	CO3	BTL 4
	PART – C			
1.	Evaluate the performance of MAC protocols for Wireless Sensor Networks and estimate the duty cycle.	(15)	CO3	BTL 4
2.	Inspect about the low duty cycle protocols and explain any two protocols with necessary diagrams.	(15)	CO3	BTL 4
3.	Illustrate the importance of scheduled based routing and also explain about the cluster formation in LEACH protocol.	(15)	CO3	BTL 3
4.	Analyze the role of nodes in IEEE802.15.4 network architecture. Also draw the super frame structure used in the 802.15.4 MAC protocol.	(15)	CO3	BTL 4
5.	Identify the important parameters used in Energy efficient routing protocols and estimate the efficiency of the protocol.	(15)	CO3	BTL 3

UNIT IV:- SENSOR NETWORK SECURITY			
Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks			
PART - A			
Q.No	**Questions**	**Course Outcome**	**Bloom's Taxonomy Level**
1.	Define network security.	CO4	BTL 1
2.	List out the requirements of network security.	CO4	BTL 1
3.	Write the importance of data integrity in network security.	CO4	BTL 2
4.	Outline the requirements of data confidentiality in security provisioning.	CO4	BTL 2
5.	Classify the methods to minimize the security attacks.	CO4	BTL 2
6.	Outline the various types of attacks in a wireless sensor network.	CO4	BTL 2
7.	Mention the challenges involved in security provisioning.	CO4	BTL 2
8.	Name the methods to minimize the attacks in WSN.	CO4	BTL 1
9.	Interpret the key idea of security provisioning in WSN?	CO4	BTL 2
10.	Classify the different layer wise attacks in a sensor network.	CO4	BTL 2
11.	Point out the different types of passive attacks	CO4	BTL 2
12.	Compare the characteristics of active and passive attack.	CO4	BTL 2
13.	Write the two types of physical layer attacks in WSN.	CO4	BTL 1
14.	Infer the impact of denial-of-service attacks in sensor networks.	CO4	BTL 2
15.	Mention the significance of link-layer attacks.	CO4	BTL 1
16.	List the possible countermeasures to alleviate the denial-of-service attacks.	CO4	BTL 1
17.	How the link-layer jamming affects the performance of sensor networks.	CO4	BTL 1
18.	Name the network-layer attacks in sensor networks.	CO4	BTL 1
19.	Outline the impact of black hole attack in routing protocols.	CO4	BTL 2
20.	What is meant by tampering?	CO4	BTL 1
21.	Infer how does the Sybil attack affect the performance of sensor network.	CO4	BTL 2

22.	How does misdirection affect the routing in sensor networks?		CO4	BTL 1
23.	Identify the importance of flooding attack in secure routing.		CO4	BTL 2
24.	Outline the concept of homing attack.		CO4	BTL 2
	PART – B			
1.	Analyze the different types of security attacks with suitable parameters.	(13)	CO4	BTL 4
2.	(i) Identify how the security can be improved by minimizing the attacks in sensor networks. (ii) Discuss the challenges in security provisioning.	(8) (5)	CO4	BTL 3
3.	Discover about the issues, challenges and various security constraints of sensor networks.	(13)	CO4	BTL 4
4.	List the possible solutions to mitigate the denial-of-service attacks in sensor networks and explain how it improves the performance of the system.	(13)	CO4	BTL 4
5.	Compile the various issues in security provisioning in WSN and also write about the solutions to avoid it.	(13)	CO4	BTL 3
6.	Identify the layer wise attacks in wireless sensor networks and explain its impact on networks.	(13)	CO4	BTL 3
7.	Examine about jamming and write the possible solutions for jamming in WSN.	(13)	CO4	BTL 4
8.	Examine the impacts of physical-layer jamming attacks on radio communication. How it distorts the signals in the sensor network's frequency band.	(13)	CO4	BTL 4
9.	List the different types of transport layer attacks and explain about its impacts on security provisioning.	(13)	CO4	BTL 4
10.	Analyze how does IP spoofing, hijacking and sinkhole attacks affect the network-layer functionality.	(13)	CO4	BTL 4
11.	Examine tampering attack. Describe how it recovers cryptographic keys used for ciphering in sensor networks.	(13)	CO4	BTL 4
12.	Identify the Key management schemes in Wireless Sensor Networks. Illustrate the key distribution and management mechanism required for secure communication in sensor networks.	(13)	CO4	BTL 3
13.	Construct short notes on (i) SNEP protocol (ii) TESLA protocol	 (6) (7)	CO4	BTL 3
14.	Explain about the application layer attacks and its countermeasures in wireless sensor networks in detail.	(13)	CO4	BTL 4
15.	Assess how the SPIN protocol provides authenticated broadcast for resource-constrained environments.	(13)	CO4	BTL 3

16.	Determine the impact of the following security threats in WSN : (i) Black hole attack (ii) wormhole attack	(6) (7)	CO4	BTL 4
17.	Illustrate the reliability requirements of secure routing protocol.	(13)	CO4	BTL 4
	PART-C			
1.	Generalize the Active and passive attacks with suitable examples. Also explain how these attacks differ from each other.	(15)	CO4	BTL 4
2.	Analyze how the jamming and tampering affects the functional characteristics of wireless sensor networks in real time environment.	(15)	CO4	BTL 4
3.	Identify the reliability requirements in sensor networks in order to achieve an end-to-end communication and also discuss about the reliability bottleneck of the network.	(15)	CO4	BTL 3
4.	Classify the different types of network-layer attacks in routing protocols with necessary diagrams.	(15)	CO4	BTL 4
5.	Explain the importance of security protocols for sensor networks. also explain about the building blocks of SPINS protocols in security provisioning	(15)	CO4	BTL 3

UNIT V :- APPLICATIONS OF SENSOR NETWORK AND TOOLS

Real time applications of WSN, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual node.

PART A

Q.No	Questions	Course Outcome	Bloom's Taxonomy Level
1.	List the challenges of sensor network programming.	CO5	BTL 1
2.	Write the three categories of sensor node hardware.	CO5	BTL 1
3.	Name the real time applications of WSN.	CO5	BTL 1
4	What is Node level simulation?	CO5	BTL 1
5.	Outline the transmission characteristics of WSN.	CO5	BTL 2
6.	Summarize the features of Node-Level Software Platforms	CO5	BTL 1
7.	Name two representative examples of node-level programming tools	CO5	BTL 1

8.	How does TinyOS support Berkeley mote?		CO5	BTL 1
9.	Interpret the application example of TinyOS.		CO5	BTL 2
10.	Express the need for nesC language for sensor network programming		CO5	BTL 2
11.	Interpret the component interfaces of nesC.		CO5	BTL 2
12.	Classify the components of nesC based on the implementation level.		CO5	BTL 2
13.	How does the language nesC directly reflects the TinyOS execution model.		CO5	BTL 1
14.	Compare the TinyGALS with TinyOS.		CO5	BTL 2
15.	List the importance of TinyGUYS mechanism in sensor network programming.		CO5	BTL 1
16.	Outline the components of node-level simulator.		CO5	BTL 2
17.	Compare cycle driven and discrete event simulation.		CO5	BTL 2
18.	Illustrate the functionalities of NS-2 in the simulation of sensor network		CO5	BTL 2
19.	Label the use of TOSSIM simulator in modelling wireless network.		CO5	BTL 1
20.	Demonstrate the role of state centric programming model in sensor network applications.		CO5	BTL 2
21.	What is the use of COOJA?		CO5	BTL 1
22.	How does TOSSIM works?		CO5	BTL 2
23.	Explain the scripts used in NS-2.		CO5	BTL 2
24.	Write about Cycle driven simulation.		CO5	BTL 2
	Part B			
1.	Examine sensor node hardware and explain in detail about three categories of sensor node hardware with examples.	(13)	CO5	BTL 4
2.	Make use of MICA note architecture and Examine the characteristics of embedded sensor nodes family.	(13)	CO5	BTL 3
3.	(i) List the drawbacks of traditional programming technologies in sensor network design. (ii) Discover the challenges of sensor network programming?	(5) (8)	CO5	BTL 4
4.	(i) Simplify the notes on node-centric programming. (ii) Examine about the node level programming tools with examples.	(5) (8)	CO5	BTL 4
5.	Interpret how the TinyOS operating system supports resource constrained hardware platforms. Discuss in detail.	(13)	CO5	BTL 3
6.	(i) Inference about the interface and configuration of nesC language. (ii) Justify that nesC supports the components and applications of TinyOS.	(6) (7)	CO5	BTL 4

7.	Explain the components and implementation models of Timer functions in nesC.	(13)	CO5	BTL 4
8.	(i) Identify the characteristics of Dataflow-Style Language. (ii) Illustrate the component interfaces and module implementations of TinyGALS programming model with necessary diagrams.	(5) (8)	CO5	BTL 3
9.	Analyze the characteristics and components of node-level simulator with necessary functions.	(13)	CO5	BTL 4
10.	Examine how an open-source network simulator can be used to simulate wireless/mobile networks and sensor networks.	(13)	CO5	BTL 4
11.	(i) List a dedicated simulator for TinyOS applications and explain. (ii) Distingush the components of node centric programming models.	(5) (8)	CO5	BTL 4
12.	Construct the following simulators used in wireless sensor networks: (i) NS-2 simulator (ii) TOSSIM simulator	(6) (7)	CO5	BTL 3
13.	Outline the design methodologies and frameworks supported by state-centric programming tools.	(13)	CO5	BTL 3
14.	Determine the role of collaboration groups and its abstractions in the design of state-centric programming tools.	(13)	CO5	BTL 4
15.	Explain about the programming beyond individual nodes in Sensor-Actuator scenario.	(13)	CO5	BTL 3
16.	Examine how TOSSIM works as an emulator of actual hardware through mapping hardware interrupts to discrete events.	(13)	CO5	BTL 4
17.	Analyze the NS-2 support for TCP simulation with suitable procedures.	(13)	CO5	BTL 4
	PART-C			
1.	Formulate the traditional embedded system programming interface with neat diagram and also explain the characteristics of sensor network programming with its challenges.	(15)	CO5	BTL 4
2.	Inference about the layers of operating system TinyOS that supports sensor network applications on Berkeley motes hardware platforms and Explain its Field Monitor application for sensing and sending measurements.	(15)	CO5	BTL 4
3.	Organise the execution models of Node-Level Simulators. Formulate the characteristics of cycle-driven and discrete-event simulators In terms of timing behaviour.	(15)	CO5	BTL 3
4.	Analyze the issues to be addressed using abstractions during the design of sensor network to ensure the correctness and efficiency of the system.	(15)	CO5	BTL 4
5.	Explain the real time applications of WSN with suitable examples.	(15)	CO5	BTL 3