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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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**	**Bloom's Taxonomy Level**	**Domain**
1.	What is an ad hoc wireless network?	BTL 1	Remembering
2.	Mention the challenging issues in ad hoc network maintenance.	BTL 1	Remembering
3.	Classify the security attack in ad hoc wireless networks and specify its features.	BTL 2	Understanding
4.	Summarize the importance of a Gateway in a wireless network.	BTL 3	Applying
5.	List the applications of ad hoc networks	BTL 1	Remembering
6.	Outline the concept of hidden terminal problem.	BTL 4	Analyzing
7.	Point out the issues in ad hoc networks.	BTL 2	Understanding
8.	Broadly Categorize the routing protocols of ad hoc wireless networks.	BTL 4	Analyzing
9.	Differentiate proactive and reactive routing protocols. Write examples for each	BTL 4	Analyzing
10.	Mention the significance of power aware routing in ad hoc wireless networks.	BTL 2	Understanding
11.	Write the classification of routing protocols based on the routing information update mechanism.	BTL 1	Remembering
12.	Examine the method to update the table in table driven routing protocol.	BTL 3	Applying

13.	Identify the advantages and disadvantages of DSDV routing protocols in an ad hoc wireless network.	BTL 2	Understanding
14.	Infer the pros and cons of the proactive routing protocol and reactive routing protocol.	BTL 4	Analyzing
15.	Wireless sensor network and wireless mesh network are part of the ad hoc wireless network- Justify that statement.	BTL 4	Analyzing
16.	How does the table driven protocol work in ad hoc networks?	BTL 3	Applying
17.	Assess the significance of the principle involved in a demand routing protocol.	BTL 3	Applying
18.	Interpret the messages involved in AODV routing protocol employed in a wireless network.	BTL 2	Understanding
19.	Analyze the factor by which AODV performs well compared to DSDV routing protocol.	BTL 4	Analyzing
20.	When does Route Error message get initiated in AODV routing protocol?	BTL 2	Understanding
21.	Define Scalability in ad-hoc networks.	BTL 1	Remembering
22.	What is opportunistic routing?	BTL 1	Remembering
23.	Find the routing technique which utilizes the opportunistic forwarding.	BTL 3	Applying
24.	Write the difference between self-configuration and auto configuration.	BTL 3	Applying

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)	BTL 4	Analyzing
2.	What are the major issues in designing a MAC protocol and explain the concept with necessary diagrams.	(13)	BTL 1	Remembering
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)	BTL 4	Analyzing
4.	Draw the schematic diagram of an ad hoc wireless Internet and discuss the issues to be considered for the successful ad hoc wireless Internet.	(13)	BTL 1	Remembering
5.	Explain about the benefits of the commercial ad hoc wireless networks.	(13)	BTL 2	Understanding
6.	Infer about power management in ad hoc wireless networks.	(13)	BTL 3	Applying
7.	Interpret the concept of Self Organization and quality of service provisioning in an ad hoc wireless networks.	(13)	BTL 2	Understanding
8.	Write about the types of ad hoc network routing protocols based on routing information update mechanism.	(13)	BTL 1	Remembering

9.	How is the loop free property ensured in an on demand routing protocol and in table driven routing protocol.	(13)	BTL 2	Understanding
10.	Explore the issues related to routing protocol for ad hoc wireless networks.	(13)	BTL 3	Applying
11.	Analyze the destination sequenced distance-vector routing protocol with an example.	(13)	BTL 4	Analyzing
12.	(i) List the advantages of hierarchical topology-based protocols over protocols that use the flat topologies. (ii) Explain 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)	BTL 1	Remembering
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)	BTL 3	Applying
14.	Explain how route is established and maintained in an ad hoc network using AODV routing protocol?	(13)	BTL 3	Applying
15.	Describe the topology organization in DSDV and AODV routing protocols with a sample network.	(13)	BTL 4	Analyzing
16.	Examine how does the opportunistic routing support forwarding of packets in adhoc networks?	(13)	BTL 2	Understanding
17.	Analyze the role of self and auto configuration protocols in mobile adhoc networks.	(13)	BTL 4	Analyzing
PART – C				
1.	(i) Explain whether the Table-driven routing protocol is suitable high mobility environment. (ii) Discuss the behavior of the components of an ad hoc wireless network and infer the uniqueness of each component.	(7) (8)	BTL 2	Understanding
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)	BTL 3	Applying
3.	Analyze the issues and challenges in Ad hoc wireless networks.	(15)	BTL 4	Analyzing
4.	Assess the detail in the following table, draw network based on the data available and explain DSDV protocol with the framed network.	(15)	BTL 4	Analyzing

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.	What kind of 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)	BTL 1	Remembering

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**	**Bloom's Taxonomy Level**	**Domain**
PART – A			
1.	What is a wireless sensor network?	BTL 1	Remembering
2.	Identify the characteristic requirements of a wireless sensor network.	BTL 2	Understanding
3.	Examine how address centric network differ from with data centric network.	BTL 3	Applying
4.	Differentiate between active and passive sensors.	BTL 4	Analyzing
5.	Outline the event detection approaches in WSN.	BTL 2	Understanding
6.	Interpret the term energy scavenging in Wireless Sensor Network.	BTL 2	Understanding
7.	Summarize the Collaborative processing.	BTL 3	Applying
8.	Name the hardware components of a Wireless sensor network.	BTL 1	Remembering
9.	List the challenges in the design of WSN.	BTL 1	Remembering
10.	Write the key characteristics of a microcontroller which makes it possible to use in wireless sensor node.	BTL 1	Remembering
11.	List the characteristics based on which the transceiver is selected for a wireless sensor node.	BTL 1	Remembering

12.	Classify the energy consumption operations in wireless sensor networks.	BTL 4	Analyzing
13.	Exhibit the performance metrics of wireless sensor network.	BTL 3	Applying
14.	Depict the operational states of transceiver in the sensor node.	BTL 2	Understanding
15.	Draw the structure of transceiver for WSN.	BTL 4	Analyzing
16.	Outline the use of low noise amplifier in transceiver.	BTL 2	Understanding
17.	Mention the types of mobility of a sensor node in a network.	BTL 2	Understanding
18.	Compare Single Hop with Multiple Hop in a wireless network.	BTL 4	Analyzing
19.	Explore the features of in-network processing in WSN.	BTL 3	Applying
20.	Classify the modes of operation of a sensor node.	BTL 4	Analyzing
21.	Write about dynamic modulation scaling in a transceiver used in wireless sensor node.	BTL 3	Applying
22.	List the generic possibilities for high level QoS in wireless sensor network.	BTL 1	Remembering
23.	Identify the optimization goals of sensor network.	BTL 3	Applying
24.	Point out the factors affect the performance of event detection application	BTL 4	Analyzing

PART – B

1.	Describe the challenges and the required mechanisms of a wireless sensor network.	(13)	BTL 2	Understanding
2.	What are the various applications of wireless sensor networks and explain any two with an example each.	(13)	BTL 1	Remembering
3.	Draw the sensor network architecture and describe the components in detail.	(13)	BTL 1	Remembering
4.	Sketch the RF front end of a transceiver and outline the behavior of operational states.	(13)	BTL 1	Remembering
5.	Devise the possible sensors and actuators that can be used to design a wireless sensor network.	(13)	BTL 3	Applying
6.	Distinguish sensor networks from the mobile ad hoc network.	(13)	BTL 4	Analyzing
7.	Summarize the enabling technologies used to improve the performance of the wireless sensor network.	(13)	BTL 3	Applying
8.	Interpret the Transceiver characteristics and structure used in the sensor node.	(13)	BTL 2	Understanding
9.	Analyze how Energy Scavenging is realized in wireless sensor network.	(13)	BTL 4	Analyzing

10.	With the supporting equations, write a detailed notes on energy consumption during the transmission and reception of a signal in WSN	(13)	BTL 3	Applying
11.	Deduce the expression for energy consumption in a sensor node with an appropriate diagram.	(13)	BTL 4	Analyzing
12.	Describe the energy consumption in discrete operational states of an embedded microcontroller in a sensor node.	(13)	BTL 1	Remembering
13.	Explain about the mobility management in multiple sources and multiple sinks scenario.	(13)	BTL 4	Analyzing
14.	Generalize the essential aspects of power supply for an untethered wireless sensor node.	(13)	BTL 2	Understanding
15.	Categorize the sensor network scenario with diagrams and also explain how mobility can appear in WSN?	(13)	BTL 4	Analyzing
16.	Express how networking solutions can be achieved using optimization goals and figure of merits in WSN?	(13)	BTL 2	Understanding
17.	Explain the factors used to optimize the wireless sensor network.	(13)	BTL 3	Applying
PART – C				
1.	Explain the non-radio frequency communication available for communication in a wireless sensor network.	(15)	BTL 2	Understanding
2.	Analyze the transceiver tasks and characteristics in a sensor node in a wireless sensor network.	(15)	BTL 4	Analyzing
3.	Write a brief note on the performance of hardware elements in sensor node architecture with necessary diagrams.	(15)	BTL 1	Remembering
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)	BTL 4	Analyzing
5.	Formulate the advanced radio concepts that are associated with the transceivers of a mote.	(15)	BTL 3	Applying

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	Bloom's Taxonomy Level	Domain
PART – A			
1.	What are the performance requirements for a MAC protocol?	BTL 1	Remembering

2.	State the concept of wake-up radio.	BTL 2	Understanding
3.	List the factors that are essential for PHY design in WSNs.	BTL 1	Remembering
4.	Relate the contention-based protocols with schedule-based protocols.	BTL 4	Analyzing
5.	Find the causes of signaling overhead in WSN.	BTL 4	Analyzing
6.	Write about the energy efficient routing in WSN.	BTL 1	Remembering
7.	Devise a method for duplicate address detection.	BTL 3	Applying
8.	Point out the salient feature of location based routing.	BTL 2	Understanding
9.	Mention how flooding is different from gossiping.	BTL 4	Analyzing
10.	Compare on-demand protocols with proactive protocols.	BTL 4	Analyzing
11.	Identify the protocols for distributed demand assignment strategy.	BTL 3	Applying
12.	List the important classes of MAC protocols.	BTL 1	Remembering
13.	Name the periods used in periodic wakeup scheme.	BTL 1	Remembering
14.	Write the significance of S-MAC protocol.	BTL 2	Understanding
15.	Analyze the pros and cons of scheduled based protocols.	BTL 4	Analyzing
16.	Assess the sources of energy waste in MAC protocols.	BTL 3	Applying
17.	Examine the need of dynamic synchronization approachin mediation device protocol.	BTL 3	Applying
18.	Summarize the objective of PAMAS.	BTL 4	Analyzing
19.	How does the probing protocol determine the length of ongoing packet?	BTL 2	Understanding
20.	Interpret the features of IEEE 802.15.4.	BTL 2	Understanding
21.	Name the scheduled based protocols.	BTL 1	Remembering
22.	Exhibit how LEACH protocol differs from other routing protocols used in WSN.	BTL 3	Applying
23.	Distinguish between two types of devices in IEEE 802.15.4 protocol.	BTL 2	Understanding
24.	Explore the challenges and issues in transport layer protocol.	BTL 3	Applying

PART – B

1.	Explain the three major classifications of MAC protocols in wireless sensor network.	(13)	BTL 2	Understanding

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

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)	BTL 4	Analyzing
5.	Explain the important parameters used in Energy efficient routing protocols and estimate the efficiency of the protocol.	(15)	BTL 1	Remembering

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	Bloom's Taxonomy Level	Domain
1.	Define network security.	BTL 1	Remembering
2.	List out the requirements of network security.	BTL 1	Remembering
3.	Write the importance of data integrity in network security..	BTL 2	Understanding
4.	Outline the requirements of data confidentiality in security provisioning.	BTL 2	Understanding
5.	Formulate the methods to minimize the security attacks.	BTL 4	Analyzing
6.	Categorize the various types of attacks in a wireless sensor network.	BTL 4	Analyzing
7.	Mention the challenges involved in security provisioning.	BTL 2	Understanding
8.	Explore the methods to minimize the attacks in WSN.	BTL 3	Applying
9.	Interpret the key idea of security provisioning in WSN?	BTL 2	Understanding
10.	Exhibit the different layer wise attacks in a sensor network.	BTL 3	Applying
11.	Point out the different types of passive attacks	BTL 2	Understanding
12.	Compare the characteristics of active and passive attack.	BTL 4	Analyzing
13.	Write the two types of physical layer attacks in WSN.	BTL 1	Remembering
14.	Analyze the impact of denial-of-service attacks in sensor networks.	BTL 4	Analyzing
15.	Point out the significance of link-layer attacks.	BTL 1	Remembering
16.	Obtain the possible countermeasures to alleviate the denial-of-service attacks.	BTL 3	Applying

17.	How the link-layer jamming affects the performance of sensor networks.	BTL 3	Applying
18.	Name the network-layer attacks in sensor networks.	BTL 1	Remembering
19.	Assess the impact of black hole attack in routing protocols.	BTL 4	Analyzing
20.	What is meant by tampering?	BTL 1	Remembering
21.	Analyze how does the Sybil attack affect the performance of sensor network.	BTL 4	Analyzing
22.	How does misdirection affect the routing in sensor networks?	BTL 3	Applying
23.	Identify the importance of flooding attack in secure routing.	BTL 2	Understanding
24.	Outline the concept of homing attack.	BTL 3	Applying

PART – B

1.	Analyze the different types of security attacks with suitable parameters.	(13)	BTL 4	Analyzing
2.	(i) Explain how the security can be improved by minimizing the attacks in sensor networks. (ii) Discuss the challenges in security provisioning.	(8) (5)	BTL 2	Understanding
3.	Summarize about the issues, challenges and various security constraints of sensor networks.	(13)	BTL 2	Understanding
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)	BTL 1	Remembering
5.	Compile the various issues in security provisioning in WSN and also write about the solutions to avoid it.	(13)	BTL 3	Applying
6.	Identify the layer wise attacks in wireless sensor networks and explain its impact on networks.	(13)	BTL 3	Applying
7.	Explain about jamming and write the possible solutions for jamming in WSN.	(13)	BTL 1	Remembering
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)	BTL 4	Analyzing
9.	List the different types of transport layer attacks and explain about its impacts on security provisioning.	(13)	BTL 1	Remembering
10.	Examine how does IP spoofing, hijacking and sinkhole attacks affect the network-layer functionality.	(13)	BTL 2	Understanding
11.	Define tampering attack. Describe how it recovers cryptographic keys used for ciphering in sensor networks.	(13)	BTL 1	Remembering
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)	BTL 3	Applying

13.	Write short notes on (i) SNEP protocol (ii) TESLA protocol	(6) (7)	BTL 2	Understanding
14.	Explain about the application layer attacks and its countermeasures in wireless sensor networks in detail.	(13)	BTL 4	Analyzing
15.	Assess how the SPIN protocol provides authenticated broadcast for resource-constrained environments.	(13)	BTL 3	Applying
16.	Determine the impact of the following security threats in WSN : (i) Black hole attack (ii) wormhole attack	(6) (7)	BTL 4	Analyzing
17.	Illustrate the reliability requirements of secure routing protocol.	(13)	BTL 4	Analyzing
	PART-C			
1.	Generalize the Active and passive attacks with suitable examples. Also explain how these attacks differ from each other.	(15)	BTL 4	Analyzing
2.	Analyze how the jamming and tampering affects the functional characteristics of wireless sensor networks in real time environment.	(15)	BTL 4	Analyzing
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)	BTL 2	Understanding
4.	Describe the different types of network-layer attacks in routing protocols with necessary diagrams.	(15)	BTL 1	Remembering
5.	Explain the importance of security protocols for sensor networks. also explain about the building blocks of SPINS protocols in security provisioning	(15)	BTL 3	Applying

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**	**Bloom's Taxonomy Level**	**Competence**
1.	List the challenges of sensor network programming.	BTL 1	Remembering

2.	Write the three categories of sensor node hardware.	BTL 1	Remembering
3.	Name the real time applications of WSN.	BTL 1	Remembering
4	What is Node level simulation?	BTL 1	Remembering
5.	Outline the transmission characteristics of WSN.	BTL 2	Understanding
6.	Summarize the features of Node-Level Software Platforms	BTL 1	Remembering
7.	Write the two representative examples of node-level programming tools	BTL 3	Applying
8.	How does TinyOS support Berkeley mote?	BTL 3	Applying
9.	Interpret the application example of TinyOS.	BTL 3	Applying
10.	Express the need for nesC.language for sensor network programming	BTL 2	Understanding
11.	Interpret the component interfaces of nesC.	BTL 2	Understanding
12.	Classify the components of nesC based on the implementation level.	BTL 4	Analyzing
13.	The language nesC directly reflects the TinyOS execution model-Justify	BTL 4	Analyzing
14.	Compare the TinyGALS with TinyOS.	BTL 4	Analyzing
15.	Assess the importance of TinyGUYS mechanism in sensor network programming.	BTL 4	Analyzing
16.	Identify the components of node-level simulator.	BTL 3	Applying
17.	Distinguish between cycle driven and discrete event simulation.	BTL 4	Analyzing
18.	Illustrate the functionalities of NS-2 in the simulation of sensor network	BTL 2	Understanding
19.	Point out the use of TOSSIM simulator in modelling wireless network.	BTL 3	Applying
20.	Examine the role of state centric programming model in sensor network applications.	BTL 3	Applying
21.	What is the use of COOJA?	BTL 1	Remembering
22.	How does TOSSIM works?	BTL 2	Understanding
23.	Analyze the scripts used in NS-2.	BTL 4	Analyzing
24.	Write about Cycle driven simulation.	BTL 2	Understanding
Part B			
1.	Define sensor node hardware and explain in detail about three categories of sensor node hardware with examples. (13)	BTL 1	Remembering
2.	Summarize about the characteristics of embedded sensor nodes family with the help of MICA note architecture. (13)	BTL 2	Understanding

3.	(i) List the drawbacks of traditional programming technologies in sensor network design. (ii) What are the challenges of sensor network programming?	(5) (8)	BTL 1	Remembering
4.	(i) Write short notes on node-centric programming. (ii) Explain about the node level programming tools with examples.	(5) (8)	BTL 1	Remembering
5.	Interpret how the TinyOS operating system supports resource constrained hardware platforms. Discuss in detail.	(13)	BTL 3	Applying
6.	(i) Discuss about the interface and configuration of nesC language. (ii) Justify that nesC supports the components and applications of TinyOS.	(6) (7)	BTL 2	Understanding
7.	Explain the components and implementation models of Timer functions in nesC.	(13)	BTL 4	Analyzing
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)	BTL 3	Applying
9.	Analyze the characteristics and components of node-level simulator with necessary functions.	(13)	BTL 4	Analyzing
10.	Examine how an open-source network simulator can be used to simulate wireless/mobile networks and sensor networks.	(13)	BTL 4	Analyzing
11.	(i) Name a dedicated simulator for TinyOS applications and explain. (ii) Point out the components of node centric programming models.	(5) (8)	BTL 2	Understanding
12.	Describe the following simulators used in wireless sensor networks: (i) NS-2 simulator (ii) TOSSIM simulator	 (6) (7)	BTL 1	Remembering
13.	Outline the design methodologies and frameworks supported by state-centric programming tools.	(13)	BTL 3	Applying
14.	Determine the role of collaboration groups and its abstractions in the design of state-centric programming tools.	(13)	BTL 4	Analyzing
15.	Explain about the programming beyond individual nodes in Sensor-Actuator scenario.	(13)	BTL 3	Applying
16.	How TOSSIM works as an emulator of actual hardware through mapping hardware interrupts to discrete events.	(13)	BTL 2	Understanding
17.	Analyze the NS-2 support for TCP simulation with suitable procedures.	(13)	BTL 4	Analyzing
	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)	BTL 4	Analyzing

2.	Write 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)	BTL 1	Remembering
3.	Describe about the execution models of Node-Level Simulators. Formulate the characteristics of cycle-driven and discrete-event simulators In terms of timing behaviour.	(15)	BTL 2	Understanding
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)	BTL 4	Analyzing
5.	Explain the real time applications of WSN with suitable examples.	(15)	BTL 3	Applying