SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MEDICAL ELECTRONICS

QUESTION BANK

VII SEMESTER

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UNIT I – INTRODUCTION

Definition, BAN and Healthcare, Pervasive Patient Monitoring using BAN, Technical Challenges-Sensor design, Biocompatibility, Energy Supply, System security and reliability, Context Awareness, Integrated Therapeutic Systems, Ideal BSN Architecture.

PART A

Q.No	Questions	BT Level	Domain
1	What is Body Area Network?	**BTL 1**	**Remembering**
2	Express the operating bandwidth of Wireless Body Area Networks.	**BTL 2**	**Understanding**
3	How does Body area Network work?	**BTL 2**	**Understanding**
4	Classify the examples of body area Network	**BTL 4**	**Analyse**
5	State the definition of Heath by WHO..	**BTL 1**	**Remembering**
6	Discover the challenging task for the WBAN application.	**BTL 3**	**Apply**
7	Point out the issues faced by the analyst on “Bioanalysis”.	**BTL 4**	**Analyse**
8	Define Aptamers.	**BTL 1**	**Remembering**
9	Draw an ideal architecture of BSN.	**BTL 1**	**Remembering**
10	Which factor is most important for a sensor used in WBAN?	**BTL 2**	**Understanding**
11	Difference between nitrogen doping and chemical doping	**BTL 4**	**Analyse**
12	Estimate Biosensors.	**BTL 2**	**Understanding**
13	Sketch the schematic diagram of Biosensor.	**BTL 1**	**Remembering**
14	Quote “Transducer”.	**BTL 1**	**Remembering**
15	Categorize the common approaches used for sterilisation.	**BTL 4**	**Analyse**
16	Employ the two strategies available for providing a better integration of the sensor within the tissue.	**BTL 3**	**Apply**
17	Choose the two crucial elements of the BSN design.	**BTL 3**	**Apply**
18	Classify different types of sensors available for context awareness.	**BTL 2**	**Understanding**
19	Predict the term “photoplethysmography”.	**BTL 2**	**Understanding**
20	Interpret Integrated Therapeutic Systems.	**BTL 3**	**Apply**
21	Analyse Randle’s Model.	**BTL 4**	**Analyse**
22	Defend “biocompatibility”.	**BTL 2**	**Understanding**
23	Modify the other name for Autonomic Nervous System and its use.	**BTL 3**	**Apply**
24	Examine the Early symptoms of atrial fibrillation.	**BTL 4**	**Analyse**

PART B

1	How do you monitor patients with chronic disease? (13)	**BTL 1**	**Remembering**
2	Explain the ideal architecture of body sensor networks. (13)	**BTL 2**	**Understanding**
3	Outline the technical challenges in BAN. (13)	**BTL 1**	**Remembering**
4	Memorize, how do you monitor hospital and elderly patients? (13)	**BTL 1**	**Remembering**

5	Illustrate the conceptual view of pervasive health care model. (13)	**BTL 4**	**Analyse**
6	Apply Nano electrochemical Sensors in BAN. (13)	**BTL 3**	**Apply**
7	Discover Graphene Electrochemical Sensors in BAN. (13)	**BTL 3**	**Apply**
8	Discuss on Biocompatibility and implantable sensors. (13)	**BTL 2**	**Understanding**
9	Summarise the different methods implemented for reducing power size. (13)	**BTL 3**	**Apply**
10	With a neat sketch, elaborate the fabrication steps of vertical nano-wire array integrated nanogenerator. (13)	**BTL 2**	**Understanding**
11	Demonstrate Micro-fuel cells and Biocatalytic fuel cells. (13)	**BTL 3**	**Apply**
12	Paraphrase on security and reliability of Body sensor networks. (13)	**BTL 2**	**Understanding**
13	Examine the several types of sensors developed on Context Awareness. (13)	**BTL 4**	**Analyse**
14	Infer Integrated Therapeutic Systems with an example. (13)	**BTL 2**	**Understanding**
15	Discriminate the Technical challenges faced by designing energy supply. (13)	**BTL 4**	**Analyse**
16	Point out the technical challenges faced by designing biosensors. (13)	**BTL 4**	**Analyse**
17	Describe Implantable sensors, its application, advantages and disadvantages. (13)	**BTL 1**	**Remembering**
PART C			
1	Illustrate the importance of body sensor networks with few applications. (15)	**BTL 3**	**Apply**
2	Enumerate the need for pervasive health monitoring system (15)	**BTL 1**	**Remembering**
3	Describe the drug-delivering therapeutic system with a neat sketch. (15)	**BTL 2**	**Understanding**
4	Discuss the technical challenges faced by body sensor networks. (15)	**BTL 2**	**Understanding**
5	Compare the different challenges faced by Wireless Sensor Networks and Body Sensor Networks. (15)	**BTL 4**	**Analyse**

UNIT II – HARDWARE FOR BAN

Wireless communication - RF communication in Body, Antenna design and testing, Matching Network, Propagation, Materials, Base Station, Power considerations, Wireless communication technologies for wearable systems, Body Area Network – Human Applications.

PART A

Q.No	Questions	BT Level	Domain
1	Differentiate wired and wireless communication.	**BTL 4**	**Analyse**
2	Compare one- and two-way link.	**BTL 4**	**Analyse**
3	List the two ways of communication link.	**BTL 1**	**Remembering**
4	Point out the applications of inductive coupling.	**BTL 4**	**Analyse**
5	Analyse Specific Absorption Rate in BAN.	**BTL 4**	**Analyse**
6	Quote reflection Coefficient..	**BTL 1**	**Remembering**
7	Sketch the schematic diagram of Patch Antenna.	**BTL 1**	**Remembering**
8	Give an expression of radiation resistance of a small and large loop antenna.	**BTL 3**	**Apply**
9	Label Quality factor.	**BTL 1**	**Remembering**

10	Compute the impedance matching of an antenna.	**BTL 3**	**Apply**
11	Point out the efficiency of tuning network.	**BTL 4**	**Analyse**
12	Difference between L and π network.	**BTL 1**	**Remembering**
13	Why is a quarter wave line called as impendence inverter?	**BTL 2**	**Understanding**
14	Analyse the significance of a half wavelength line.	**BTL 4**	**Analyse**
15	Extend the advantages of Graphical User Interface (GUI).	**BTL 2**	**Understanding**
16	Interpret the layer responsible for media access control and why?	**BTL 3**	**Apply**
17	Estimate the role of base station in BAN	**BTL 2**	**Understanding**
18	An antenna is fed with 1000 W power. The radiation efficiency is 80% and radiation intensity is $U(\theta, \phi) = 2 \sin^2(\theta) \sin^2(\phi)$. Calculate the power radiated by an antenna	**BTL 3**	**Apply**
19	A signal travels at 500 MHz. What is its wavelength?	**BTL 3**	**Apply**
20	Interpret radiation pattern in BAN.	**BTL 2**	**Understanding**
21	What do you mean by polarisation?	**BTL 1**	**Remembering**
22	Mention the applications of Transceiver.	**BTL 2**	**Understanding**
23	Predict the base stations located in a transceiver.	**BTL 3**	**Apply**
24	Express Link budget calculation in BAN.	**BTL 2**	**Understanding**
	PART B		
1	Discriminate how impedance is reduced in L and π – L network. (13)	**BTL 4**	**Analyse**
2	Analyse the parasitic effects in a network. (13)	**BTL 4**	**Analyse**
3	Interpret π network of an antenna with a neat sketch. (13)	**BTL 3**	**Apply**
4	Draw and explain the schematic diagram of L network in detail. (13)	**BTL 1**	**Remembering**
5	Analyse the relationship of load resistance and output power of transmitter tuning of a matched network. (13)	**BTL 4**	**Analyse**
6	Recall impedance measurement of a Quarter Wave line. (13)	**BTL 1**	**Remembering**
7	Write short notes on measurement of (i) Antenna Impedance (7) (ii) Radiation Resistance (6)	**BTL 1**	**Remembering**
8	With a neat sketch explain patch antenna in detail. (13)	**BTL 2**	**Understanding**
9	Describe in detail the radiation resistance of small and large loop antenna. (13)	**BTL 1**	**Remembering**
10	Illustrate the working principle of Implanted Transceiver in detail. (13)	**BTL 3**	**Apply**
11	Connect the relation between reflection coefficient and characteristic impedance in detail. (13)	**BTL 4**	**Analyse**
12	Write short notes on (i) Base Station (7) (ii) Propagation (6)	**BTL 2**	**Understanding**
13	Explain the following (i) Materials (4) (ii) Power consideration (4) (iii) External Transceiver (5)	**BTL 2**	**Understanding**
14	Discover Base station antennas used in body area network (13)	**BTL 3**	**Apply**
15	Memorize the following (i) Battery challenges in BAN (7) (ii) Radio Frequency Losses in Components and Layout Issues. (6)	**BTL 1**	**Remembering**
16	Demonstrate the significance of Receiver Tuning with link budget equations. (13)	**BTL 3**	**Apply**
17	Explain multi - resonant network in detail. (13)	**BTL 2**	**Understanding**

PART C			
1	Explain in detail on any two applications of BAN in human body. (15)	**BTL 2**	**Understanding**
2	Determine the radiation resistance of half wave dipole of an antenna. (15)	**BTL 3**	**Apply**
3	Describe the importance of RF communication in Human Body. (15)	**BTL 1**	**Remembering**
4	Discuss on smart wearable sensors and systems with application in rehabilitation. (15)	**BTL 2**	**Understanding**
5	Elaborate the impact of wearable technology in society. (15)	**BTL 4**	**Analyse**

UNIT III – NETWORK TOPOLOGIES, PROTOCOLS AND STANDARDS

Network Topologies - Stand –Alone BAN, Wireless personal Area Network Technologies. Standards - IEEE 802.15.1, IEEE P802.15.13, IEEE 802.15.14, Zigbee, Healthcare system standards.

PART A

Q.No	Questions	BT Level	Domain
1	What do you mean by logical topology of a network?	**BTL 1**	**Remembering**
2	List the common network topologies used in wireless sensor networks.	**BTL 1**	**Remembering**
3	Define point to point network.	**BTL 1**	**Remembering**
4	Sketch cluster tree network.	**BTL 1**	**Remembering**
5	Difference between star and mesh network.	**BTL 4**	**Analyse**
6	Compare Star mesh hybrid and cluster network.	**BTL 4**	**Analyse**
7	Express latency in network topology.	**BTL 2**	**Understanding**
8	Mention stand-alone sensor networks in BAN?	**BTL 1**	**Remembering**
9	Illustrate the characteristics of Pervasive Sensor Networks in BAN.	**BTL 3**	**Apply**
10	Outline frequency hopping technique.	**BTL 2**	**Understanding**
11	Differentiate connection less and connection-oriented services.	**BTL 4**	**Analyse**
12	Infer MAC protocol in network layer.	**BTL 2**	**Understanding**
13	Compare bandwidth and date rate.	**BTL 4**	**Analyse**
14	Discover the different modulation formats supported by IEEE 802.15.4.	**BTL 3**	**Apply**
15	Relate the two main operational modes provided by MAC specification.	**BTL 2**	**Understanding**
16	Predict the use of Zigbee router in BAN.	**BTL 3**	**Apply**
17	Interpret cluster in network topology.	**BTL 2**	**Understanding**
18	Mention the medium access policies provided by IEEE 802.15.6.	**BTL 1**	**Remembering**
19	Associate the use of HBC technique in BAN.	**BTL 2**	**Understanding**
20	Classify sectoring and repeaters.	**BTL 2**	**Understanding**
21	Compare co channel interference and adjacent channel interference.	**BTL 4**	**Analyse**
22	Relate how synchronisation is achieved by means of periodic beacon transmissions.	**BTL 3**	**Apply**
23	Categorize spread spectrum technique and its uses.	**BTL 4**	**Analyse**
24	Interpret the use of Link Manager protocol.	**BTL 3**	**Apply**

PART B

1	Demonstrate the common network topologies used in wireless sensor networks. (13)	**BTL 3**	**Apply**
2	Compare the pros and cons of different topologies used in sensor networks. (13)	**BTL 4**	**Analyse**
3	Illustrate in detail on Stand-alone sensor networks in BAN. (13)	**BTL 3**	**Apply**
4	Examine Pervasive Sensor Networks in BAN. (13)	**BTL 4**	**Analyse**
5	Interpret the integration of BSN (in tree, mesh and star topologies) with ASN for healthcare applications. (13)	**BTL 3**	**Apply**
6	Discuss the wireless regulatory environment of Body Sensor Networks. (13)	**BTL 2**	**Understanding**
7	Sketch IEEE 802.15.1 (Bluetooth BR/EDR) protocol stack and explain in detail. (13)	**BTL 2**	**Understanding**
8	Explain Medium-Rate Wireless Personal Area Networks. (13)	**BTL 4**	**Analyse**
9	Write short notes on the overview of the IEEE 802.15 family.(13)	**BTL 1**	**Remembering**
10	Show how Bluetooth low energy, Bluetooth LE protocol stack and the Bluetooth LE connection setup is made in BAN. (13)	**BTL 3**	**Apply**
11	Memorize IEEE P802.15.3 High-Rate Wireless Personal Area Networks in detail. (13)	**BTL 1**	**Remembering**
12	Describe IEEE 802.15.4 Low-Rate Wireless Personal Area Networks with a neat sketch. (13)	**BTL 1**	**Remembering**
13	Enumerate MAC and PHY frame formats of IEEE 802.15.4 and explain in detail. (13)	**BTL 1**	**Remembering**
14	Sketch the architecture of Zigbee Stack protocol and define three device types of ZigBee with respect to their networking capabilities. (13)	**BTL 1**	**Remembering**
15	Summarise the device descriptions of a ZigBee Healthcare cluster, accompanied by ID. (13)	**BTL 2**	**Understanding**
16	Infer the three PHY layer specifications of IEEE 802.15.6 in detail. (13)	**BTL 2**	**Understanding**
17	Analyse domain information model of ISO/IEEE 11073-10404 Pulse oximeter in detail. (13)	**BTL 4**	**Analyse**
	PART C		
1	Enumerate the characteristics of wireless communication standards operating at 2.4 GHz. (15)	**BTL 1**	**Remembering**
2	With a neat sketch, explain different healthcare system standards. (15)	**BTL 2**	**Understanding**
3	Illustrate the device descriptions defined by ZigBee Healthcare Profile. (15)	**BTL 3**	**Apply**
4	Interpret the PHY specifications supported by IEEE 802.15.4.(15)	**BTL 3**	**Apply**
5	Describe the characteristics, advantages and disadvantages of various network topologies used in wireless sensor networks with a neat sketch. (15)	**BTL 4**	**Analyse**

UNIT IV – COEXISTENCE ISSUES WITH BAN

Interferences – Intrinsic - Extrinsic, Effect on transmission, Regulatory Issues - Medical Device regulation in Asia, Security and Self-Protection-Bacterial attacks, Virus infection, secured protocols, Self-protection.

PART A

Q.No	Questions	BT Level	Domain
1	Interpret the key aspects of data transmission and processing in a WBAN?	**BTL 2**	**Understanding**
2	Estimate the different types of interference.	**BTL 2**	**Understanding**
3	Infer the challenges faced by the interference.	**BTL 4**	**Analyse**
4	Employ the services provided by WBAN to access data.	**BTL 3**	**Apply**
5	Define DOS attacks.	**BTL 1**	**Remembering**
6	Compare privacy and security in BAN.	**BTL 4**	**Analyse**
7	What is cypher physical security?	**BTL 1**	**Remembering**
8	Depict QoS regulation in secure body area networks.	**BTL 1**	**Remembering**
9	Label the term spoofing.	**BTL 1**	**Remembering**
10	Illustrate the application of Electronic Patient Record.	**BTL 3**	**Apply**
11	Define packet error rate.	**BTL 1**	**Remembering**
12	Difference between Sinkhole attacks and Sybil attacks.	**BTL 4**	**Analyse**
13	Indicate traffic analysis.	**BTL 2**	**Understanding**
14	Differentiate the cons of Trojan horse.	**BTL 4**	**Analyse**
15	Infer how one can develop energy efficient network.	**BTL 4**	**Analyse**
16	Predict the two main components of Security Protocols for Sensor Networks.	**BTL 3**	**Apply**
17	Defend Inter-Pulse Interval (IPI) in BAN.	**BTL 2**	**Understanding**
18	Paraphrase Innate immune system in BAN.	**BTL 2**	**Understanding**
19	Define Adaptive Immune system.	**BTL 1**	**Remembering**
20	Analyse the ways of Jamming in a network.	**BTL 4**	**Analyse**
21	Manipulate the considerations of context-aware systems.	**BTL 3**	**Apply**
22	Locate the term “buffer overflow” in network topology.	**BTL 2**	**Understanding**
23	Relate the techniques available to avoid collision in a network.	**BTL 3**	**Apply**
24	Depict the use of cryptography.	**BTL 1**	**Remembering**
	PART B		
1	Outline Interference and coexistence in detail. (13)	**BTL 1**	**Remembering**
2	List the salient features of the regulatory strategies in Asia. (13)	**BTL 1**	**Remembering**
3	Illustrate Bacterial attacks that are likely to threaten a BSN's security and privacy. (13)	**BTL 3**	**Apply**
4	Identify seven possible viral infections that could compromise BSN's security and privacy and explain in detail. (13)	**BTL 2**	**Understanding**
5	Memorize the following (i) SNEP (7) (ii) µTesla (6)	**BTL 1**	**Remembering**
6	Demonstrate pairwise key management system in networks. (13)	**BTL 3**	**Apply**
7	Interpret Q-composite key distribution scheme with a neat sketch. (13)	**BTL 3**	**Apply**
8	Identify the similarities and differences between BIS and AIS. (13)	**BTL 4**	**Analyse**
9	Discriminate the advantage of the feature extraction on the frequency domain and time domain. (13)	**BTL 4**	**Analyse**
10	Sketch the basic architecture of human immune system and explain in detail. (13)	**BTL 1**	**Remembering**
11	Draw and discuss the architecture of a BSN immune system. (13)	**BTL 1**	**Remembering**
12	Categorize the mechanisms per BIS layer for developing self-protected BSN. (13)	**BTL 4**	**Analyse**
13	Describe SNEP counter mode encryption and decryption. (13)	**BTL 2**	**Understanding**
14	Discuss the following (i) Jamming (3)	**BTL 2**	**Understanding**

	(ii) Exhaustion and interrogation (3) (iii) Wormholes (3) (iv) Acknowledgement spoofing (4)		
15	Analyse the viral Infections that are likely to compromise the privacy and security of a BSN. (13)	**BTL 4**	**Analyse**
16	Mention the disadvantage of SNEP and how µTesla is used for secure communication. (13)	**BTL 3**	**Apply**
17	Write short notes on (i) Cryptography for ADHOC links (7) (ii) Biometrics based Cryptography (6)	**BTL 1**	**Remembering**
	PART C		
1	Why security in BAN is important? List the various aspects of the BAN which need securing. Why must they be secured? (15)	**BTL 1**	**Remembering**
2	Interpret any of the secure protocols developed by Sensor Networks community. (15)	**BTL 3**	**Apply**
3	Discuss the following (i) Biometric Time Domain (8) (ii) Biometric Frequency Domain (7)	**BTL 2**	**Understanding**
4	Demonstrate the possible bacterial attacks in a BSN. (15)	**BTL 3**	**Apply**
5	Elaborate the extremely effective defence mechanism that is capable of preventing the onset of infection. (15)	**BTL 4**	**Analyse**

UNIT V – APPLICATIONS OF BAN

Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhymias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Smart Garments, Electronic pill.

PART A

Q.No	Questions	BT Level	Domain
1	What is Diabetes mellitus?	**BTL 1**	**Remembering**
2	How can atrial fibrillation be prevented while monitoring patients with chronic disease?	**BTL 2**	**Understanding**
3	Paraphrase arrhythmias.	**BTL 2**	**Understanding**
4	Interpret the use of ear-worn activity recognition (e-AR) sensor.	**BTL 3**	**Apply**
5	Give the physiological and biochemical parameter for the rheumatoid arthritis.	**BTL 1**	**Remembering**
6	Illustrate the physiological and biochemical parameter for the vascular disease.	**BTL 3**	**Apply**
7	Draw the ECG signal waveform.	**BTL 1**	**Remembering**
8	Differentiate ECG and optical heart rate monitors.	**BTL 4**	**Analyse**
9	Express noise in patient monitoring system.	**BTL 2**	**Understanding**
10	Infer why Gait analysis is important in-patient monitoring system.	**BTL 4**	**Analyse**
11	Define Magneto resistive sensors.	**BTL 1**	**Remembering**
12	Indicate how can the neural spikes be measured.	**BTL 2**	**Understanding**
13	Analyse the role of neuron in nervous system.	**BTL 4**	**Analyse**
14	What do you mean by depolarisation?	**BTL 1**	**Remembering**
15	Identify the conceptual diagrams of the conventional system and the proposed system for high-density neural recording.	**BTL 3**	**Apply**
16	Examine the use of Gait analysis.	**BTL 2**	**Understanding**
17	Analyse the use of Gyroscope.	**BTL 4**	**Analyse**

18	State the principle of Faraday's law of magnetic induction.	**BTL 4**	**Analyse**
19	Outline electromyography in BAN.	**BTL 2**	**Understanding**
20	Relate the best method for the detection of heart abnormalities and why.	**BTL 3**	**Apply**
21	Interpret technology-aware ECG monitoring systems.	**BTL 3**	**Apply**
22	Prioritize why blood pressure is being measured in patient monitoring system.	**BTL 4**	**Analyse**
23	Quote electrode.	**BTL 1**	**Remembering**
24	Define sensor technology.	**BTL 1**	**Remembering**
	PART B		
1	Illustrate in detail, how can you keep track of chronic disease patients. (13)	**BTL 3**	**Apply**
2	Contrast the disease processes and the parameters commonly used to monitor these diseases in detail. (13)	**BTL 4**	**Analyse**
3	Discriminate how do you monitor elderly patients using BSN in detail. (13)	**BTL 4**	**Analyse**
4	Discover how do you monitor hospital patients using BSN. (13)	**BTL 3**	**Apply**
5	Discuss the signal characteristics of ECG. (13)	**BTL 2**	**Understanding**
6	Estimate the factors that causes cardiac arrhythmia in detail. (13)	**BTL 2**	**Understanding**
7	What is AD8232 ECG Sensor? Discuss the working and its applications. (13)	**BTL 2**	**Understanding**
8	Sketch the overall architecture of electrocardiogram (ECG) monitoring systems and discuss in detail. (13)	**BTL 1**	**Remembering**
9	Draw the flowchart of blood pressure data acquisition and explain each block in detail. (13)	**BTL 1**	**Remembering**
10	Explain the design of blood pressure data acquisition process.(13)	**BTL 2**	**Understanding**
11	Demonstrate the block diagram of different multi-channel neural recording architectures and the function of each block. (13)	**BTL 2**	**Understanding**
12	Interpret the following neural amplifiers (i) Conventional capacitive-feedback network (CFN) topology. (7) (ii) CFN amplifier using T-capacitor feedback network topology. (6)	**BTL 3**	**Apply**
13	Relate open loop network (OLN) topology and Miller compensated CFN (MCCFN) topology. (13)	**BTL 3**	**Apply**
14	Sketch the Block diagram of the neural recording system with adaptive electrode selection and discuss in detail. (13)	**BTL 1**	**Remembering**
15	Analyse the basic principles and features of motion sensors and systems. (13)	**BTL 4**	**Analyse**
16	Discriminate the features of smart clothing for physiological monitoring process. (13)	**BTL 4**	**Analyse**
17	Tabulate the various applications of electronic pill. (13)	**BTL 1**	**Remembering**
	PART C		
1	Demonstrate a generic ECG layered monitoring architecture developed to capture the key elements and structural components of ECG monitoring systems. (15)	**BTL 3**	**Apply**
2	Illustrate Multi patient monitoring systems based on wireless embedded internet. (15)	**BTL 3**	**Apply**
3	Categorize the methods used for the data compression to decrease the output data rate and power consumption in multichannel neural recording. (15)	**BTL 4**	**Analyse**

4	Explain how a wearable GRF sensor system is constructed using five small triaxial force sensors. (15)	**BTL 2**	**Understanding**
5	Describe the following (i) Smart Garments (8) (ii) Electronic Pill (7)	**BTL 1**	**Remembering**