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## ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E /B. Tech /B. Arch (Full Time/Part Time) - END SEMESTER EXAMINATIONS, NOV/DEC 2023

B.E BIOMEDICAL ENGINEERING

VII Semester

BM5017 WEARABLE SYSTEMS

(Regulation 2019)

Time: 3hrs

Max.Marks: 100

CO 1	Comprehend and appreciate the significance and role of this course in the present contemporary world
CO 2	Choose appropriate sensors and signal processing techniques for wearable systems
CO 3	Assess the energy requirement for a wearable system and analyse and experiment energy harvesting techniques for wearable systems
CO 4	Appreciate the need for BAN and the challenges involved in the design of BAN
CO 5	Design basic wearable systems for medical applications

**BL – Bloom's Taxonomy Levels**

(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

**PART- A (10 x 2 = 20 Marks)**

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	With simple illustration classify wearables.	2	1	2
2	List a few technical challenges in the adaptation of wearables.	2	2	1
3	List the technical challenges involved in sensor placement.	2	2	2
4	What are all the advantages of low power signal processing in wearables.	2	2	2
5	Which device is commonly used for the measurement of energy expenditure? Mention its principle.	2	3	1
6	Give the importance of vibration based energy harvest devices.	2	3	1
7	Why are body area networks (BANs) designed to be wireless?	2	4	2
8	List the different safety categories for medical devices in BANs	2	4	1
9	What is neural recording?	2	5	2
10	Point out the need of smart textiles in wearable systems	2	5	1

**PART- B (5 x 13 = 65 Marks)**

(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks	CO	BL
11 (a)	Discuss in detail about wearable sweat biosensors are used to measure the physiological parameters.	13	1	3
OR				
11 (b)	Explain about E-Textiles and Bio suit with its associated tools.	13	1	3

12 (a)	Draw the structure of signal processing flow of wireless BSN.	13	2	3
OR				
12 (b)	With detail expression explain how filters are used to remove noises from bio signals.	13	2	3
OR				
13 (a)	Elaborate the importance of Hybrid Thermoelectric-Photovoltaic Wearable Energy Harvesters.	13	3	3
OR				
13 (b)	Enumerate in detail about principles of energy harvesting using human body as a heat source for power generation.	13	3	3
OR				
14 (a)	Elucidate the wireless communication techniques and protocols used for wearable devices.	13	4	4
OR				
14 (b) i)	How does IEEE802.15 play a role in wearables?	8	4	4
ii)	Illustrate the system architecture of WBAN and discuss each block in detail.	5	4	4
OR				
15 (a)	Explain the application of wearable systems in sports medicine.	13	5	3
OR				
15 (b) i)	Explain about Medical Monitoring-Patients with chronic disease.	5	5	3
ii)	Describe in detail about working of multi parameter patient monitoring device.	8	5	3

**PART- C (1 x 15 = 15 Marks)**

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	What are all the physiological signals used for wearable physiological monitoring systems? With any one physiological parameter discuss how its sensed.	15	2	5

