



**B.E DEGREE EXAMINATIONS: DEC 2022**

(Regulation 2018)

Fifth Semester

**ELECTRONICS AND INSTRUMENTATION ENGINEERING**

U18EIE0001: Flexible and Wearable Electronics

**COURSE OUTCOMES**

- CO1:** Identify different types of wearable technology devices and issues involved.  
**CO2:** Design and Verify energy harvesting techniques required for wearable technology devices  
**CO3:** Apply various data mining techniques in Wearable algorithms and Interpret the results  
**CO4:** Detect various types of diseases with wearable devices  
**CO5:** Human Body Communication with high Data rate networks

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**  
**PART A (10 x 2 = 20 Marks)**  
**(Answer not more than 40 words)**

- |   |     |                   |
|---|-----|-------------------|
| 1. List the merits and demerits of wearable electronics.                                    | CO1 | [K <sub>1</sub> ] |
| 2. Define Basal metabolic rate.   | CO1 | [K <sub>1</sub> ] |
| 3. Short notes on Pedometer.  | CO2 | [K <sub>2</sub> ] |
| 4. Why Do Wearable Sensors Need Algorithms, what are Wearable Algorithms?                   | CO2 | [K <sub>2</sub> ] |
| 5. Outline the Data Mining used for Body Sensor Network                                     | CO3 | [K <sub>1</sub> ] |
| 6. What is meant by Wearable Haptics  | CO3 | [K <sub>1</sub> ] |
| 7. What is WBAN Device Authentication Techniques?   | CO4 | [K <sub>2</sub> ] |
| 8. List the Wearing Sensors used Outside of the Human Body for Early Detection of Diseases. | CO4 | [K <sub>2</sub> ] |
| 9. Define endocarditic of HBC.  | CO5 | [K <sub>1</sub> ] |
| 10. List the Human Body Communication coupling methods.                                     | CO5 | [K <sub>1</sub> ] |

**Answer any FIVE Questions:-**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

- |   |   |     |                   |
|---|---|-----|-------------------|
| 11. a) Illustrate in detail about the dual mode tongue drive system with neat sketch. | 8 | CO1 | [K <sub>2</sub> ] |
| b) Explain in detail about energy harvesting from human body using wearable device.   | 8 | CO1 | [K <sub>2</sub> ] |

- |     |    |  |    |     |                   |
|-----|----|--|----|-----|-------------------|
| 12. | a) | Discuss in detail about the secret key establishment in WBAN with suitable examples  | 8  | CO2 | [K <sub>1</sub> ] |
|     | b) | What is wearable haptics? Categorize the wearable haptics and tactile display with brief explanations.                             | 8  | CO2 | [K <sub>1</sub> ] |
| 13. |    | Discuss in detail the Non-Invasive sweat monitoring device by using a sweat sensor.  | 16 | CO3 | [K <sub>2</sub> ] |
| 14. |    | Explain in detail the measurement of Energy Expenditure by Body-worn heat-Flow Sensors   | 16 | CO4 | [K <sub>2</sub> ] |
| 15. |    | Illustrate the working principle of optical heart rate monitoring and also mention its application in Bio-medical instrumentation. | 16 | CO5 | [K <sub>3</sub> ] |
| 16. | a) | Elaborate that CVD is detected at early stage by using wearable sensor placed inside/outside of the human body.                    | 8  | CO2 | [K <sub>3</sub> ] |
|     | b) | Explain any one wearable assistive devices used for severe paralysis people  | 8  | CO2 | [K <sub>3</sub> ] |

\*\*\*\*\*