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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 11 – 01- 2025 **Time:** 09:30 am –12:30 pm |

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| **School:** School of Engineering | **Program:** B.tech-ECE | |
| **Course Code :** ECE3065 | **Course Name :** RFID and Flexible Sensors | |
| **Semester**: VII | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **18** | **4** | **39** | **39** | **NA** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | At what frequencies does RFID tags work? | **2 Marks** | **L1** | **CO1** |
| **2** | What is Friis transmission equation? | **2 Marks** | **L1** | **CO3** |
| **3** | What is RFID? | **2 Marks** | **L1** | **CO1** |
| **4** | Which type of RFID tag has the least range? | **2 Marks** | **L2** | **CO2** |
| **5** | Define resolution of a Sensor. | **2 Marks** | **L1** | **CO4** |
| **6** | List out the different types of short-range RFID applications. | **2 Marks** | **L1** | **CO2** |
| **7** | What are organic and inorganic semiconductors? | **2 Marks** | **L2** | **CO3** |
| **8** | What are the components of RFID? | **2 Marks** | **L1** | **CO1** |
| **9** | Define Liquid Crystal Polymer. | **2 Marks** | **L1** | **CO4** |
| **10** | What are the advantages of passive RFID? | **2 Marks** | **L1** | **CO1** |

**Part B**

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| **Answer the Questions Total 80 Marks** | | | | | |
| **11.** | **a.** | An RFID sensor, also called an RFID tag, is a tiny device that uses radio waves to transmit its unique identification and other data. Describe in detail the basic considerations of sensor design. | **10**  **Marks** | **L3** | **CO4** |
| **or** | | | | | |
| **12.** | **a.** | In the broadest definition, a sensor is a device, module, machine, or subsystem that detects events or changes in its environment and sends the information to other electronics, frequently a computer processor. (a) What are the uses of sensors? (b) How many types of sensors are there? Explain in brief. | **2+8=10**  **Marks** | **L2** | **CO4** |
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| **13.** | **a.** | Wireless Sensor Network (WSN), is an infrastructure-less wireless network that is deployed in a large number of wireless sensors in an ad-hoc manner that is used to monitor the system, physical, or environmental conditions. Explain in detail the application of wireless sensor network. | **10**  **Marks** | **L3** | **CO4** |
| **or** | | | | | |
| **14.** | **a.** | Wireless Sensor Network (WSN), is an infrastructure-less wireless network that is deployed in a large number of wireless sensors in an ad-hoc manner that is used to monitor the system, physical, or environmental conditions. (a) What is wireless sensor? (b) Describe with a block diagram the wireless sensor network architecture. | **4+6=10**  **Marks** | **L3** | **CO4** |

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| **15.** | **a.** | Two *lossless X*-band (8.2–12.4 GHz) horn antennas are separated by a distance of 100λ. The reflection coefficients at the terminals of the transmitting and receiving antennas are 0.1 and 0.2, respectively. The maximum directivities of the transmitting and receiving antennas (over isotropic) are 16 dB and 20 dB, respectively. Assuming that the input power in the lossless transmission line connected to the transmitting antenna is 2 W, and the antennas are aligned for maximum radiation between them and are polarization-matched, find the power delivered to the load of the receiver using Friis transmission equation. | **5+5=10**  **Marks** | **L3** | **CO1** |
| **Or** | | | | | |
| **16.** | **a.** | Radio Frequency Identification (RFID) is a wireless technology that uses radio waves to identify and track objects, people. (a) What are the different types of coupling mechanisms used for communication between the reader and the tag? (b) What are the major encoding methods used in inductive and/or capacitive coupling RFID systems? | **10**  **Marks** | **L3** | **CO1** |

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| **17.** |  | Radio frequency energy harvesting (RFEH) is a technique that converts electromagnetic (EM) waves into usable electrical energy. (a) What is energy harvesting in RFID system? (b) With a neat block diagram, describe an active RFID tag driven by an energy-harvesting unit. | **15**  **Marks** | **L3** | **CO3** |
| **Or** | | | | | |
| **18.** | **a.** | An RFID cavity resonator is a type of resonator used in RFID cavities, which are innovations that help with RFID tracking in situations where the cost of the tag is comparable to the cost of the item being tracked. Describe the Cavity Resonator method for RF applications. | **5+10=15**  **Marks** | **L3** | **CO3** |

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| **19.** | **a.** | Liquid crystal polymers (LCPs) are a class of high-performance polymers that exhibit liquid crystalline phases. They have a number of unique properties. Illustrate the properties and benefits of using Liquid Crystal Polymer for RF applications. | **15**  **Marks** | **L3** | **CO4** |
| **Or** | | | | | |
| **20.** | **a.** | Inkjet printing is a noncontact method, which is able to deposit a desired number of materials directly from a computer-designed image onto a selected substrate. (a) Explain inkjet-printed technology with a block diagram. (b) What are the different types of inkjet-printed technology? | **10+5= 15**  **Marks** | **L3** | **CO4** |

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| **21.** | **a.** | RFID antenna delivers high-performance, capacity and range to track dense product traffic quickly and accurately, even in large application areas. (a) Explain Near Field Communication in relation to RFID systems. (b) What do you mean by Near field and Far field of a RFID tag antenna? (c) If an antenna has a dimension of 5mm × 2mm. Find the radius or the distance after which the Near field of the antenna will be applicable. | **5+10+5=20**  **Marks** | **L3** | **CO3** |
| **Or** | | | | | |
| **22.** | **a.** | RFID antennas are an essential element in an RFID system because they convert the RFID reader's signal into RF waves that can be received by the RFID tag. (a) Explain in brief the challenges for designing an RFID antenna. (b) What are the different parameters used to define the performance an antenna for RFID applications? (c) What is reflection coefficient? | **10+5+5= 20**  **Marks** | **L3** | **CO3** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***