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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

I Semester B. E. Examinations May-2023

Common to AI / BT / CSE / CY / CD / IS

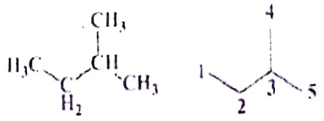
CHEMISTRY OF SMART MATERIALS AND DEVICES

Time: 03 Hours ***Maximum Marks: 100***

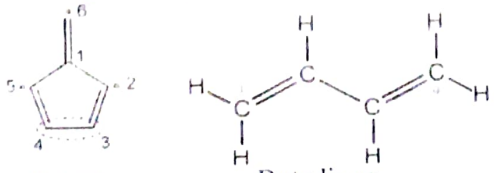
Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer SIX full questions from Part B. In Part B question number 2 and 11 are compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8 & 9 and 10.
3. Handbook of chemistry is permitted.

PART-A

1	1.1	Write the structure of polymer; *Poly* $(3-hydroxybutyrate-co-3-hydroxyvalerate)$ or *PHBV*.	01
	1.2	What is the SI unit of capacity of a battery?	01
	1.3	List the various applications of bio-compatible polymeric materials.	01
	1.4	Predict the edge adjacency matrix for the following molecule. Δ	01
	1.5	Compile the vertex-adjacency matrix for isopentane molecule.  Molecular structure Graph	01
	1.6	At the functionalization site of *CNT*, mention the hybridization of carbon atom before and after functionalization.	01
	1.7	Write the structure of ascorbic acid.	01
	1.8	Give one example of natural biomaterial used in bio-composite based memory device.	01
	1.9	List any two organic molecules used in electrical memory devices.	01
	1.10	What is the role of tri-Iodide electrolyte in *QDSSC*?	01

PART-B

2	a	Illustrate any three green chemistry principles with appropriate examples.	07
	b	What useful byproduct is produced when lead-acid batteries are recycled? Explain the key steps involved in the lead-acid battery recycling using pyro metallurgical process.	07
3	a	Categorize and compare the different non-covalent interactions present in protein structures.	07
	b	Construct the vertex adjacency matrix for fulvene and butadiene.  fulvene Butadiene	07

		OR	
4	a	Define molecular topology. Explain the applications of molecular topological descriptors in $QSAR$ and drug design.	07
	b	What are topological indices? Explain with examples of Zagreb indices and Wiener topological indices.	07
5	a	What are memory devices? Discuss the classification of electronic memory device with example.	07
	b	Distinguish between organic light emitting diode ($OLED$) and light emitting electrochemical cells (LEC). With the schematic diagram, explain the construction of $OLED$.	07
		OR	
6	a	Provide a comprehensive explanation of the semiconductor chip manufacturing process.	07
	b	What are liquid crystals? Explain the fabrication and working of liquid crystal display.	07
7	a	Describe the working principle of Piezoelectric and Electrochemical sensors with schematic diagram.	07
	b	Cylindrical molecules that consist of rolled-up sheets of single-layer carbon atoms are used in $RFID$ devices. Construct the experimental setup and design the procedure for the synthesis. How one can introduce carboxylic or hydroxyl groups ($-COOH, -OH$) on these material?	07
		OR	
8	a	Write the conducting structure of polyaniline and explain its synthesis with applications.	07
	b	Explain the working principle of glucose sensor using electrochemical principle.	07
9	a	Explain the working and steps involved in the current generation of organic solar cells ($OPVs$). Mention any two limitations of organic photovoltaics.	07
	b	Explain the construction and working of $LiCoO_2$ battery with neat labeled diagram.	07
		OR	
10	a	Discuss the materials used in different types of super capacitors. Explain the construction and working of electrostatic double-layer capacitors ($EDLCs$) with neat labeled diagram.	07
	b	With a neatly labeled diagram, explain the construction and working principle of the quantum dot sensitized solar cell ($QDSSC's$).	07
11	a	Explain the principle, procedure and calculation involved in the determination of sodium using flame photometry.	10
	b	Discuss the conductometric principle and procedure used for the estimation of HCl in the given solution using $NaOH$ solution. Plot the typical graphs and explain the chemistry behind variation of conductance.	10