COURSE CODE: 22CHY22C

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RV COLLEGE OF ENGINEERING Autonomous Institution affiliated to VTU II Semester B.E. Sept/Oct -2023 Examinations DEPARTMENT: Chemistry

COURSE TITLE: CHEMISTRY OF FUNCTIONAL MATERIALS

Time: 03 Hours Maximum Marks: 100

Instructions to candidates:

- 1. Answer all questions from Part A. Part A questions should be answered in the 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, one full question from 5 and 6, one full question from 7 & 8 and one full question from 9 & 10, and 11 lab components (Compulsory)
- 3. Handbook of Chemistry is permitted.

PART-A

	1.1	In Li-air battery, identify the product formed in the presence of non-aqueous						
		electrolyte during cathodic reaction.	1					
	1.2	Supercapacitors can be charged faster than batteries. Justify.	1					
	1.3	Mention some of the properties of the materials that change after reduction of size						
1		to nanoscale.						
-	1.4	What is the reason to functionalize carbon nanotubes?	1					
	1.5	Which semiconducting material has semi-insulating property?	1					
	1.6	Give example for material used in thin film transistor.	1					
	1.7	What are electrostrictive materials?	1					
	1.8	Give any one hazardous effect of cadmium leakage from e-waste.	1					
	1.9	Justify the role of electrolyte in quantum dot sensitized solar cell (QDSSC)	1					
	1.10	On which principle, does pulse oximetry sensor work?	1					

PART-B

UNIT-I

2	a	Discuss the working mechanism of LiCoO ₂ battery with neat labelled diagram.				
		Write the reactions involved during charging and discharging events.	7			
-		Why is fuel cell considered as sustainable technology? Explain the construction and				
	b	working of hydrogen-oxygen fuel cell along with chemical reactions at anode and				
		cathode terminals.	7			

UNIT-II

3	a	Elucidate the synthesis methodology of sol-gel technique with schematic diagram				
	а	by taking a suitable example.	7			
	b	What are carbon nanotubes (CNT)? Outline the synthesis of CNT using metal				
	U	organic chemical vapor deposition (MOCVD). What are the merits of CNTs?	7			
		OR				
4		i) Write the principle behind solution combustion synthesis. Why is this technique				
		preferred for synthesizing nano-metal oxides?				
	a	ii) A beaker containing an aqueous redox mixture of stoichiometric amounts of 5 g				
		of Aluminium (III) nitrate nonahydrate (Al(NO ₃) ₃ .9H ₂ O, Mol.Wt = 375.14) and	7			

		urea ($CO(NH_2)_2$, $Mol.Wt. = 60$). Calculate the amount of fuel required to synthesize Al_2O_3 nanoparticles.	
	b	.Describe the synthesis of graphene using modified Hummer's method. Write the properties and applications of graphene.	7
		UNIT-III	<u> </u>
5	a	With neat labelled diagram, describe two different crystal growth techniques used for the production of electronic grade semiconductors.	7
	b	Explain different properties of GaAs (Gallium arsenide) and its applications.	7
		OR	
6	a	Illustrate various structures of polyaniline along with conducting property. Write the synthesis procedure for polyaniline with mechanism.	7
	b	What are dielectric storage materials? Discuss the working principle with schematics and applications of dielectric storage materials.	7
		UNIT-IV	
7	a	Define electrochromism. Explain the device structure with neat labelled diagram with examples. Mention its applications.	7
	b	What are NEMS and MEMS? Give examples. Outline the fabrication of NEMS.	7
		OR	
8	a	What is e-skin? Mention the prime requirements to design e-skin? With the necessary diagram, explain the principle and materials used for e-skin.	7
	b	What are thermochromic materials? Write a note on different types of thermochromic materials and explain the working mechanism.	7
		UNIT-V	/
9	a	What are sensors? With the help schematic representation, explain the working principle and applications of piezoelectric sensor.	7
	b	Mention the significance of each electrodes of electrochemical sensor device and explain its application in biomolecule sensing mechanism with a suitable example.	7
		OR	/
10	a	Sketch different electrode connections of gas sensors with all the components involved in it. Describe the working mechanism of CO gas sensor.	7
	b	Illustrate the method for monitoring oxygen saturation in blood using sensor technology.	7
		Lab Component	
11		With neatly labelled experimental setup describe the principle, procedure and	
11	a	working concepts involved in flame photometric estimation of sodium. Mention its applications along with its societal relevance.	10
	b	With the help of Nernst equations of the iron and chromium electrodes formed during the redox titration, discuss the potentiometric principle and procedure used for the estimation of iron in the given solution. Plot the typical graphs and explain the chemistry behind the variation of potential.	10
		1	1 10

Signature of Scrutinizer:	Signature of Chairman
Name:	Name:

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PART-A

Q.No	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10
ВТ	3	4	1	2	5	2	1	1	4	3
COs	1	3	2	2	1	2	3	4	2	2

PART-B

Quest No		B T Levels	Cos addressed		Question No		BT Levels	Cos addressed
2	a	1	1		2	a	1	1
2	b	4	2		3	b	3	1
4	a	2	1		5	a	2	1
4	b	4	4			b	1	2
(a	3	4		7	a	2	2
6	b	1	1		/	b	4	3
0	a	2	1		0	a	1	4
8	b	1	2		9	b	3	2
10	a	1	3		11	a	3	4
10	b	2	1		11	b	2	3