6.	a)	Explain the principle involved in the determination of dissolved oxygen by Winkler's method.	4	L2	2	1
	b)	Define the following i) graft copolymer, ii) syndiotactic polymer, iii) degree of polymerization, iv) conducting polymer.	4	L1	2	1
	c)	Describe microwave and sol-gel methods for the preparation of nanoparticles.	8	L2	2	1
		Unit – III –4				
7.	a)	Explain the determination of the calorific value of solid fuel using a Bomb calorimeter.	8	L2	3	1
4	b)	Explain the nematic, smectic, and columnar phases of liquid crystals.	8	L2	3	1
8.	a)	On burning 0.83×10^{-3} kg of solid fuel in a bomb calorimeter, the temperature of 3.5 kg of water is increased from 26.5^0C to 29.2^0C. The water equivalent of the calorimeter and latent heat of steam is 0.385kg and 587×4.2kJ/kg respectively. Specific heat of water is 4.2kJ/kg/^{0}C. The fuel contains 0.7% of hydrogen. Calculate its Gross and Net calorific values. 47,819.27711 & 47819.25286	5	L3	3	2
	b)	Explain the mechanism of petrol knocking.	5	L2	3	1
	c)	Describe with an example, the liquid crystalline behavior of compounds based on their chemical constitutions.	6	L2	3	1

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

****

13. **An example for dissolved impurity is .....**
A) CO_2 B) HCO_3^-
C) NaCl D) All of these

14. **Which of the following statements is correct for Winkler's method?**
A) Azides are added to destroy nitrates B) The colour change at end-point is blue to colourless
C) Winkler's method is used to determine the amount of dissolved gases in water. D) Winkler's method is an example of Iodometric titration.

15. **Sludges are ..... precipitate found ..... boilers.**
A) Soft; adhered on the inner walls of B) Hard; adhered on the inner walls of
C) Soft; loosely scattered in D) Hard; loosely scattered in

16. **CVD method is employed to synthesize**
A) Metal oxide nanoparticles B) CO and CO_2
C) Carbon nanotubes D) N_2

17. **In presence of which gas is the fuel burnt to generate energy in form of heat?**
A) Oxygen B) Hydrogen
C) Methane D) Nitrogen

18. **Which one of the following is an example for secondary fuel?**
A) Coal B) Natural gas
C) Kerosene D) All of these

19. **In general, Liquid crystal state is also called as**
A) Triple phase B) Nematic phase
C) Mesophase D) Polymer dispersed phase

20. **Pitch is measured in case of ..... liquid crystals**
A) Smectic B) Nematic
C) Cholesteric D) Polymer dispersed

PART - B: DESCRIPTIVE ANSWER QUESTIONS

			Marks	BT*	CO*	PO*
		Unit – I – 30				
1.	a)	Derive the Nernst equation for single electrode potential.	6	L2	1	1
	b)	Give the construction and working of the calomel electrode.	6	L2	1	1
	c)	For the cell, Fe / Fe^{+2} (0.015M) // Ag^+ (0.13M) / Ag, Write the cell reactions and calculate the emf of the cell at STP if the standard electrode potentials of Fe and Ag are -0.44V and 0.80V respectively.	4	L3	1	2
2.	a)	What is corrosion? Explain the electrochemical theory of corrosion by taking iron as an example.	8	L2	1	1
	b)	Explain the two techniques of cathodic protection.	6	L2	1	1
	c)	The anodic metal coating is called sacrificial coating. Justify.	2	L5	1	1
3.	a)	Explain the construction and working of Li-ion battery.	6	L2	1	1
	b)	What is polarization? Explain any two factors affecting polarization.	3	L2	1	1
	c)	What is electroless plating? Explain the electroplating of chromium.	7	L2	1	1
		Unit – II – 20				
4.	a)	What is glass transition temperature (Tg)? Explain four factors affecting Tg.	5	L2	2	1
	b)	Explain the synthesis, properties, and applications of the following polymers i) polycarbonate ii) carbon fibre.	9	L2	2	1
	c)	Thermosetting polymers do not exhibit plastic deformation. Justify.	2	L5	2	1
5.	a)	Describe the determination of total hardness of water by EDTA method.	6	L2	2	1
	b)	Explain the hot lime-soda process for softening hard water.	7	L2	2	1
	c)	Explain the causes of boiler corrosion.	3	L2	2	1

NMAM INSTITUTE OF TECHNOLOGY, NITTE

Off-Campus Centre of Nitte (Deemed to be University)

First Semester B.Tech. (CBCS) Degree Examinations

December 2022

CY1001-1 – ENGINEERING CHEMISTRY

Duration: 3 Hours | Max. Marks:100

Note:

*Part – A: Multiple Choice Questions: Answer all **Twenty** questions in the **OMR Sheet** provided. Each question carries equal marks.*

*Part – B: Descriptive Answer type Questions: Answer **Five full** questions choosing **Two full** questions from **Unit – I & Unit – II each** and **One full** question from **Unit – III.***

PART - A: MULTIPLE CHOICE QUESTIONS — 20 Marks

1. **The one, which converts chemical energy into electrical energy**
   A) Galvanic Cell B) Electrolytic Cell
   C) Anode D) Cathode
2. **Calomel electrode is an example for**
   A) Metal-metal ion electrode B) Metal- metal salt ion electrode
   C) Ion selective electrode D) Primary reference electrode
3. **pH of the solution can be determined using the following electrode combination.**
   A) Glass-calomel electrode B) Glass-Zinc electrode
   C) Platinum-Calomel electrode D) Zinc- Calomel electrode
4. **Voltage available from a battery depends upon**
   A) Difference in the standard electrode potential B) Conductivity of the electrolyte
   C) Reaction quotient for the cell reaction D) All the above
5. **Which of the following is a right Anode-Cathode-Electrolyte combination of a lithium-ion battery**
   A) Lithium intercalated Graphite-$LiCoO_2$ -$LiClO_4$ in ether B) Lithium intercalated graphite-$LiNiO_2$ – aqueous KOH
   C) Lithium-Copper- $LiBF_4$ in ether D) VH_2-$LiMn_2O_4$ – $LiPF_6$ in ether
6. **The rusting iron is the .....**
   A) Oxidation corrosion B) Liquid metal corrosion
   C) Wet corrosion D) Corrosion by other gases
7. **When the hydrogen overvoltage on the metal surface is high, cathodic reaction is .....**
   A) Higher B) Slower
   C) Constant D) All of these
8. **..... type of coating is used in the preparation of printed circuit boards**
   A) Electroplating B) Electroless plating
   C) Inorganic coating D) Organic coating
9. **A simple molecule having two or more bonding sites through which each can link to other to form a polymer chain is called .....**
   A) Polymer B) Monomer
   C) Initiator D) All of these
10. **What is the disadvantage of bulk polymerization?**
    A) Uncontrolled temperature rise B) Difficulty in constant stirring of reaction mixture
    C) Thermal degradation, discolouration of products D) All of these
11. **Natural rubber is the polymerized form of .....**
    A) Neoprene B) Isoprene
    C) Guttapercha D) Chloroprene
12. **A plastic which can be softened on heating and hardened on cooling is called .....**
    A) Thermoelastic B) Thermoplastic
    C) Thermosetting D) Thermite

SEE - April - May 2022

21CY110

Unit – III

7.	a)	Define Calorific value of fuel. Explain the experimental determination of calorific value of fuel by using Bomb calorimeter.	8	L3	3
	b)	Define knocking. Explain the mechanism of knocking in IC engine.	4	L2	3
	c)	Explain the four different types of classifications of mesophases.	8	L2	3
8.	a)	0.75 g of coal sample (carbon 90%, H_2 5% and ash 5%) was subjected to combustion in Bomb calorimeter. Mass of water taken in the calorimeter was 2.5 kg and the water equivalent of calorimeter is 0.65 kg. The rise in temperature was found to be 3.2°C. Calculate gross and net calorific values of the sample. Latent heat of steam =2457 kJ/kg and specific heat of water = 4.187 kJ/kg/°C.	6	L3	3
	b)	What is the objective of reforming of petrol and discuss the various methods of reforming?	6	L1	3
	c)	Explain the applications of liquid crystals in display systems.	8	L2	3

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

****

USN

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester B.E. (Credit System) Degree Examinations

April - May 2022

21CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours

Max. Marks: 100

Note: *Answer* ***Five full*** *questions choosing* ***Two full*** *questions from* ***Unit – I & Unit – II each*** *and* ***One full*** *question from* ***Unit – III.***

			Marks	BT*	CO*	PO*
		Unit – I				
1.	a)	Explain the construction and working of calomel electrode. Mention its application.	6	L*2	1	1
	b)	Define Ion-selective electrode. Illustrate the construction and working of the glass electrode.	6	L2	1	1
	c)	An electrochemical cell consists of a copper electrode dipped in 0.5 M $CuSO_4$ and silver electrode dipped in 0.25 M $AgNO_3$. Write the cell representation, half-cell and net cell reactions. Also, calculate the emf of the given cell. (SRPs of Cu and Ag are 0.34 and 0.80 V respectively).	8	L3	1	2
2.	a)	Define corrosion. Describe the corrosion of iron when it is exposed to moist environment by using electro chemical theory.	8	L2	1	1
	b)	Describe the following metal coating techniques: i) Galvanization ii) Tinning	6	L2	1	1
	c)	Describe (i) Sacrificial anode method (ii) Impressed current method.	6	L4	1	1
3.	a)	Explain the application of electroless plating of copper on PCB.	6	L3	1	1
	b)	What are fuel cells? Illustrate the construction, working and use of Methanol-Oxygen fuel cell.	7	L2	1	1
	c)	Describe the following battery characteristics. (i) Power density (ii) Electric storage density (iii) Voltage.	7	L2	1	1
		Unit – II				
4.	a)	Explain the free radical mechanism of addition polymerization using ethylene.	6	L2	2	1
	b)	Describe the synthesis, properties and applications of PMMA and Polycarbonate.	8	L2	2	1
	c)	What are conducting polymers? Describe the mechanism of conduction in polyacetylene with reactions.	6	L2	2	1
5.	a)	What is desalination? How can we make use of reverse osmosis technique in desalination process?	6	L3	2	1
	b)	Explain the following types of internal treatment of water. (i) Phosphate conditioning (ii) Colloidal conditioning (iii) Calgon conditioning	5	L2	2	1
	c)	Describe the determination of dissolved oxygen by Winkler's method.	5	L2	2	1
	d)	Identify any two reasons for the problems of boiler corrosion.	4	L3	2	1
6.	a)	What is sewage water? Describe the secondary sewage treatment process of sewage water with a neat labeled diagram.	6	L2	2	1
	b)	Explain the synthesis, properties and applications of carbon fiber.	8	L2	2	1
	c)	How are the nanoparticles synthesized by Sol-gel process?	6	L1	2	1

P.T.O.

Unit – IV

7.	a)	Describe the estimation of hardness of water by EDTA method.	7	L2	4
	b)	Give an account of boiler corrosion.	7	L2	4
	c)	Describe sol-gel method for preparation of nano-materials.	6	L2	4
8.	a)	Describe the hot-lime soda process for softening of hard water.	7	L3	4
	b)	Explain the Desalination of water by elelctrodialysis method.	5	L2	4
	c)	Calculate COD of effluent sample when 25cm^3 of effluent requires 9.3 cm^{3}of 0.001M $K_2Cr_2O_7$ for complete oxidation.	4	L3	4
	d)	How are nanomaterials classified based on the dimension.	4	L4	4

Unit – V

9.	a)	Explain the determination of calorific value of a solid fuel using bomb calorimetric method.	6	L2	5
	b)	Give an account of mechanism of petrol knocking in IC engine.	6	L2	5
	c)	Explain the liquid crystalline behavior based on chemical constitution.	8	L2	5
10.	a)	Define LCV. Calculate gross and net calorific value of a coal sample from the following data: Weight of coal sample= 0.98g; Weight of water in the calorimeter=2600g; Water equivalent of calorimeter=368g; Latent heat of steam = 2454 kJ/kg; Specific heat of water = 4.187kJ/kg/K;Rise in temperature =2 .8K; Percentage of hydrogen in coal sample = 5.8.	6	L3	5
	b)	What is cracking? Explain fluidized bed catalytic cracking.	6	L2	5
	c)	Discuss the molecular ordering in the following liquid crystal phases with exmples: (i) Twisted nematic phase; (ii) Smectic phase	8	L2	5

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Programme Outcome

****

USN | | | | | | | | | | |

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi

First / Second Semester B.E. (Credit System) Degree Examinations

Supplementary Examination – September 2022

20CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours | Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*	CO*	PO*
	Unit – I				
1. a)	What is the functionality in adipic acid? Describe the free radical mechanism of addition polymerization taking styrene as an example.	7	L*2	1	1
b)	Justify the following				
	(i) Simple organic molecules not produce polymers.				
	(ii) Tg of PVC is higher than PE.				
	(iii) Resol resin swell in alcohols.	6	L3	1	1
c)	Explain the synthesis and uses of (i) Epoxy resin and (ii) Kevlar	7	L2	1	1
2. a)	Explain the suspension polymerization. Give two examples and mention any two advantages.	6	L2	1	1
b)	Give the synthesis and applications of following polymers (i) Polycarbonate; (ii) Butyl rubber.	6	L2	1	1
c)	Describe the mechanism of conduction in polyacetylene. Mention any four applications of conducting polymers.	8	L3	1	1
	Unit – II				
3. a)	Derive Nernst equation for electrode potential of the equilibrium $Ni^{2+} + 2e^- \rightleftharpoons Ni$.	6	L2	2	1
b)	Give the construction of glass electrode. Describe the experimental method of determination of pH using a glass electrode.	8	L3	2	1
c)	The e.m.f of the cell, $Fe\|Fe^{2+}(0.009M) \parallel Fe^{2+}(x\ M)\|Fe$ is 0.086V at 298K, Find the concentration of (x) unknown. Write the half and net cell reactions.	6	L3	2	2
4. a)	Explain the following characteristics of a battery (i) Cycle life (ii) Energy density.	4	L2	2	1
b)	Explain the construction and working of Ni-metal hydride battery	6	L2	2	1
c)	Give any two applications of flow batteries.	2	L1	2	1
d)	Describe the construction and working of methanol-oxygen fuel cell. Indicate the advantage of H_2SO_4 as electrolyte over alkali electrolyte.	8	L2	2	1
	Unit – III				
5. a)	What is wet corrosion? Explain the mechanism of corrosion based on electrochemical theory taking iron as an example.	8	L2	3	1
b)	Explain with suitable examples how the rate of carrion vary with following factors:				
	(i) Relative areas of anodic and cathodic parts.				
	(ii) Nature of corrosion product.	6	L2	3	1
c)	Write a note on anodic and cathodic inhibitors.	6	L2	3	1
6. a)	Define overvoltage. Give the significance of overvoltage in electroplating.	4	L2	3	1
b)	Describe the electroplating of chromium with applications.	8	L2	3	1
c)	Give any four advantages of electroless plating. Explain theelectroless plating of Cu on PCB.	8	L2	3	1

P.T.O.

6.	a)	What is glass transition temperature? Explain any five factors affecting the glass transition temperature.	6	L2		
	b)	Describe the hot-lime soda process for softening of hard water.	7	L2	2	
	c)	Explain the preparation of nano - particles by microwave and sol-gel method.	7	L2	2	2

Unit – III

7.	a)	Explain the determination of calorific value of solid fuel using Bomb calorimeter with a neat diagram.	7	L2	3	
	b)	What is petrol knocking in IC engine? Explain the mechanism of petrol knocking with reactions.	7	L2	3	
	c)	Explain the electro-optic effect of liquid crystals.	6	L2	3	
8.	a)	A 0.6 g coal sample with 92% C, 5% H_2 and 3% ash, caused a rise in the temperature of 2000 g of water by 3.2° C in a bomb calorimeter experiment. Calculate the gross and net calorific value of coal, given water equivalent = 200 g; Specific heat of water = 4.187 kJ/kg/°C; Latent heat of steam = 580 calories/g.	6	L3	3	
	b)	What is octane number? Explain any five reactions involved in reformation.	6	L2	3	
	c)	Describe with suitable examples, the liquid crystalline behavior of compounds based on their chemical constitutions.	8	L2	3	

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

****

USN | | | | | | | | | | |

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester B.E. (Credit System) Degree Examinations

September - October 2022

21CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours | Max. Marks: 100

Note: *Answer* ***Five full*** *questions choosing* ***Two full*** *questions from* ***Unit – I & Unit – II each*** *and* ***One full*** *question from* ***Unit – III.***

			Marks	BT*	CO*	PO*
		Unit – I				
1.	a)	Derive the Nernst equation for the electrode reaction. $Cu^{2+} + 2e^- \rightleftharpoons Cu$, at 298 °K	6	L*2	1	1
	b)	An electrochemical cell consists of iron electrode dipped in 0.01 M $FeSO_4$ solution and copper electrode dipped in 0.1 M $CuSO_4$ solution. Write the cell representation, cell reaction and calculate the emf of the cell at 298 K. Given that standard reduction potential of iron and copper electrodes are -0.44 V and 0.34 V respectively.	6	L3	1	2
	c)	What is ion-selective electrode? Explain the experimental method of determination of pH of a solution using glass electrode. Mention any two advantages.	8	L2	1	1
2.	a)	Explain the electrochemical theory of corrosion taking iron as an example.	7	L2	1	1
	b)	Write a note on anodized coating and galvanization.	7	L2	1	1
	c)	Explain the following factors affecting the rate of corrosion: i) Complexing agent ii) pH	6	L2	1	1
3.	a)	Describe the following battery characteristics: i) Voltage ii) Capacity iii) cycle life	8	L2	1	1
	b)	Explain the construction, working of Ni-MH battery.	6	L2	1	1
	c)	Define polarization. Describe any five factors affecting polarization.	6	L2	1	1
		Unit – II				
4.	a)	Describe the polymerization of vinyl chloride by free radical mechanism.	7	L2	2	1
	b)	Explain the synthesis, application of following polymers: i) Polycarbonate ii) Epoxy resin	7	L2	2	1
	c)	What are conducting polymers? Discuss the mechanism of conduction in poly-acetylene.	6	L2	2	1
5.	a)	Explain the determination of dissolved oxygen by Winkler's method.	7	L2	2	1
	b)	Explain Boiler Corrosion with reactions.	6	L2	2	1
	c)	Describe the purification of water by reverse osmosis and electrodialysis.	7	L2	2	1

P.T.O.

6.	a)	What are synthetic polymers? Describe Emulsion polymerization technique.	5	L2	2	
	b)	Describe Ion exchange method for demineralization of water.	8	L2	2	
	c)	Define 2D nanomaterials. Explain sol-gel approach for the preparation of nanomaterials.	7	L2	2	

Unit – III

7.	a)	Define HCV. Explain the determination of calorific value of a solid / liquid fuel using bomb calorimetric method.	8	L2	3	
	b)	What is petrol knocking in IC engine? Describe knocking mechanism with reactions.	6	L2	3	
	c)	Briefly explain electro-optic effect on liquid crystals.	6	L2	3	
8.	a)	Define Calorific Value of a fuel. On burning 8.7×10^{-4} kg of a solid fuel in a bomb calorimeter, the temperature of 4.1 kg of water was increased from 26.8°C to 30.1°C. The water equivalent calorimeter and latent heat of steam were 0.416 kg and 2454 kJ/kg respectively. Specific heat of water = 4.2 kJ/kg/°C. If the fuel contains 4.7% of hydrogen, calculate its gross and net calorific values.	7	L2	3	
	b)	What is cracking of heavy oil? Explain the fluidized bed catalytic cracking with suitable diagram.	7	L2	3	
	c)	Distinguish between nematic, twisted nematic LC with examples.	6	L2	3	

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

****

USN | | | | | | | | | | |

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester B.E. (Credit System) Degree Examinations

Makeup Examination - November 2022

21CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours | Max. Marks: 100

*Note: Answer **Five full** questions choosing **Two full** questions from **Unit – I & Unit – II each** and **One full** question from **Unit – III.***

			Marks	BT*	CO*	PO*
		Unit – I				
1.	a)	Define EMF of a cell. Derive Nernst equation for the electrode reaction $Mg^{2+} + 2e^- \rightleftharpoons Mg$ at 298 °K.	7	L*2	1	1
	b)	A cell is formed by dipping Nickel rod in 0.01M Ni^{2+} solution and lead rod in 0.5M Pb^{2+} solution. The standard electrode potentials of Ni and Pb are -0.24V and -0.13V respectively. Write the cell representation, cell reaction and calculate the e.m.f of the cell.	6	L3	1	1
	c)	Explain the experimental method of determination of pH of a solution using glass electrode. Mention any two advantages of glass electrode.	7	L2	1	1
2.	a)	Define galvanic corrosion. Explain the electrochemical theory of corrosion with reactions.	8	L2	1	1
	b)	Passivity of nonferrous metals due to the formation of oxide film. Defend your answer with suitable example	2	L2	1	1
	c)	Explain the following factors affecting the rate of corrosion. i) relative areas of anode and cathode ii) nature of the corrosion product	6	L1	1	1
	d)	Describe the sacrificial anode method to prevent corrosion.	4	L2	1	1
3.	a)	Explain the construction and working of Nickel-metal hydride battery. Mention it's any two uses.	7	L2	1	1
	b)	Explain the construction and working of CH_3OH-O_2 fuel cell. Mention its applications.	7	L2	1	1
	c)	What is throwing power of plating bath? Describe the experimental determination of throwing power of the plating bath using Haring - Blum cell.	6	L2	1	1
		Unit – II				
4.	a)	What are High polymers? Explain the free radical mechanism of addition polymerization of styrene.	7	L2	2	1
	b)	Define Tg. Describe any four factors which influence glass transition temperature.	5	L2	2	1
	c)	What are elastomers? Give the synthesis and any two applications of the following polymers: i) Butyl rubber ii) Silicone rubber.	8	L3	2	1
5.	a)	Describe Winkler's method for the determination of dissolved oxygen present in water sample.	7	L3	2	1
	b)	With neat diagram, describe the hot-lime soda process for softening of hard water.	8	L2	2	1
	c)	With suitable diagram discuss the Activated Sludge process for water purification process.	5	L2	2	1

P.T.O.