Unit – IV

7. a) Differentiate between temporary and permanent hardness. Write a note on determination of hardness of water by complexometric method. 7

b) Define Chemical Oxygen Demand (COD). Calculate the COD of the effluent sample when 30 cm^3 of the sample required 9.4 cm^3 of 0.001M $K_2Cr_2O_7$ for complete oxidation. 4

c) What is priming? What are the major causes of priming in boiler? How can it be prevented? 5

d) Classify nanomaterials based on their dimension, giving an example for each. 4

8. a) Explain the hot lime soda process for softening of water. Highlight the functions of lime and soda by giving reactions. 6

b) Justify the following:
i) The cation exchange column must be given acid wash at regular intervals.
ii) For a given sample of water, COD value is always greater than BOD value.
iii) Presence of silica in boiler water gives rise to hard scales. 6

c) Explain with a neat diagram the steps involved in secondary treatment of water. 4

d) How are ZnO nanoparticles synthesized by microwave assisted combustion method? 4

Unit – V

9. a) Define the term octane number. Describe any two methods to improve the octane number. 4

b) Define the term fuel. Explain the determination of calorific value of solid fuel. 6

c) Explain the following with examples:
i) Thermotropic liquid crystal ii) Lyotropic liquid crystal. 4

d) Explain Nematic phase and Columnar phase liquid crystals. 6

10. a) Calculate Gross calorific value and Net calorific value of a coal sample from the following data.

Weight of coal sample taken	=	8.5×10^{-4} kg
Weight of water taken in the calorimeter	=	3.5 kg
Water equivalent of calorimeter	=	0.5 kg
Initial temperature of water	=	25^0C
Final Temperature of water	=	27.5^0C
Percentage of H_2 in the coal sample	=	2.5
Latent Heat of steam	=	2455 kJ / kg

6

b) Explain the classification of fuels with examples. 4

c) Explain the effect of electric field on liquid crystals. 5

d) Explain with examples the liquid crystalline behaviour of compounds based on their chemical constitution. 5

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

April – May 2017

16CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours

Max. Marks: 100

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

			Marks	BT*
		Unit – I		
1.	a)	Distinguish between isotactic and syndiotactic polymer. Explain the condensation polymerization with suitable example.	5	L*2
	b)	Describe the synthesis and uses of phenolformaldehyde resin.	5	L2
	c)	Discuss the synthesis, properties and applications of (i) Kevlar (ii) Carbon fibre.	10	L6
2.	a)	Describe the formation of polystyrene based on free radical mechanism.	6	L2
	b)	What is an elastomer? Mention the any four disadvantages of natural rubber.	5	L1
	c)	Justify the following statements: (i) All simple molecules are not monomers (ii) Thermal control is rather difficult in bulk polymerization	4	L4
	d)	Explain the oxidative doping of polyacetylene.	5	L4
		Unit – II		
3.	a)	Derive the Nernst equation for the electrode reaction $Cu^{2+} + 2e^- \rightleftharpoons Cu$ at 298K.	6	L4
	b)	An electrochemical cell consists of iron electrode dipped in 0.01M $FeSO_4$ solution and copper electrode dipped in 0.1M $CuSO_4$ solution. Write the cell representation, cell reaction and calculate the emf of the cell at 298K. Given that standard reduction potential of iron and copper electrodes are -0.44V and 0.34V respectively.	6	L2
	c)	Describe the construction and working of calomel electrode. How the pH of a solution is determined using glass electrode?	8	L4
4.	a)	Explain the construction, working and applications of Zn-MnO_2 battery.	6	L2
	b)	What are fuel cells? Describe the construction and working of CH_3OH-O_2 fuel cell.	6	L4
	c)	Describe the construction and working of Li-ion battery. Mention its applications.	8	L4
		Unit – III		
5.	a)	Define corrosion. Describe differential aeration corrosions with suitable examples.	7	L2
	b)	Write a note on caustic embrittlement corrosion.	4	L2
	c)	Explain how nature of the corrosion product affects the rate of corrosion.	2	L3
	d)	What are inhibitors? Explain the working principle of anodic and cathodic inhibitors.	7	L2
6.	a)	Explain the following factors affecting the nature of electro deposit i) Organic additives ii) Complexing agents	7 6	L2 L2
	b)	How the throwing power of a bath is measured using Haring-Blum cell?	7	L2
	c)	Describe the electro less plating of copper with reactions and its application in PCBs.		

P.T.O.

b) Explain the hot lime soda process employed for softening of water. 6
c) Define BOD. How activated sludge process is effective in treating sewage water? 5
d) Classify nanomaterials based on their dimension. with example. 4

8. a) Differentiate between scales and sludges. What are the causes of scale formation in boilers? How can they be removed? 8
b) What is desalination? Explain the principle and process involved in Reverse osmosis and Electrodialysis. 8
c) Write a note on sol gel method of nanoparticle synthesis. 4

Unit – V

9. a) Discuss the process of fluidized catalytic cracking of heavy oil. 5
b) Explain the determination of calorific value of solid fuel. 6
c) Explain the applications of liquid crystals in display systems. 5
d) Distinguish between thermotropic and lyotropic liquid crystals. 4

10. a) Calculate gross and net calorific value of a coal sample from the following data:
Weight of coal sample = 0.98 g
Weight of water taken in calorimeter = 2600 g
Water equivalent of calorimeter = 368 g
Latent heat of steam = 2454 J/g
Specific heat of water = 4.187 J/g/K
Rise in temperature = 2.8 K
Percentage of hydrogen in coal sample = 5.8 6
b) Write a note on "Cetane number". 4
c) Explain with examples, the liquid crystalline behavior of compounds based on their chemical constitution. 5
d) Explain Nematic phase and Smectic phase. 5

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Make up / Supplementary Examination – July 2017

16CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours | Max. Marks: 100

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

			Marks	BT*
		Unit – I		
1.	a)	What is addition polymerization? Describe the free radical mechanism of addition polymerization.	7	L*2
	b)	Explain how the structure of a polymer influences the following properties: (i) Cyrstallinity (ii) Plastic deformation	6	L4
	c)	Give the synthesis and uses of (i) Epoxy resin (ii) Kevlar	7	L3
2.	a)	Define the glass transition temperature (Ta). Explain the factors affecting the Tg.	7	L2
	b)	Account for the following (i) Thermal control in solution polymerization is easier than that of bulk polymerization. (ii) Polymer composites are more stronger than polymer.	4	L3
	c)	Explain the synthesis and uses of following polymers (i) Plexi glass (ii) Silicone rubber (iii) Polycarbonate.	9	L4
		Unit – II		
3.	a)	Derive the Nernst equation for single electrode potential of a metal.	6	L4
	b)	A cell is constructed by coupling Ferod dipped in 0.5M $FeSO_4$ and Ni rod dipped in 0.05M $NiSO_4$. Write the cell representation, cell reaction. Calculate EMF of the cell. Given that standard reduction potentials Fe and Ni as –0.44 and -0.25 volt, respectively.	6	L2
	c)	Describe the construction and working of calomel electrode. How the potential of an electrode is determined using calomel electrode.	8	L4
4.	a)	Explain the construction, working and applications of Zn-MnO_2 battery	6	L2
	b)	Give any three similarities and differences between Galvanic cells and fuel cells. Explain the construction, working and application of CH_3OH-O_2 fuel cell.	8	L4
	c)	Describe the construction and working of Li-MnO_2 battery. What is the special property of lithium that makes it advantageous to use as an electrode material.	6	L4
		Unit – III		
5.	a)	Define corrosion. Explain the electrochemical theory of corrosion using Fe as an example.	7	L2
	b)	Describe the following factors affecting the rate of corrosion i) Relative areas of anode and cathode ii) Nature of the corrosion product	4	L4
	c)	Cathodic coating should be continuous Justify.	2	L4
	d)	Explain the anodic protection method of corrosion control.	7	L2
6.	a)	Explain the following factors affecting the electro deposit i)Current density ii) Throwing power	7	L2
	b)	What is electroplating? Describe electroplating of chromium with reactions	6	L4
	c)	Describe the electro less plating of copper with reactions. Explain it's applications in PCB'S.	7	L4
		Unit – IV		
7.	a)	A 50 ml of water sample required 16.3 ml of 0.01M EDTA for titration using EBT indicator. In another experiment, 50 ml of the same water sample was boiled and filtered. The filtrate required 7.2 ml 0.01M EDTA for titration using EBT indicator. Calculate i) total hardness ii) temporary hardness and iii) permanent hardness of the given water sample in terms of ppm of $CaCO_3$ equivalent.	5	L4

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17CY110

Unit – IV

7. a) What are scales and sludges? How are they formed in boiler?
   b) Discuss the experimental determination of dissolved oxygen by Winkler's method.
   c) Define COD. Calculate the COD of effluent sample when $25cm^3$ of an effluent requires $19.3cm^3$ of 0.001N $K_2Cr_2O_7$ for complete oxidation.
   d) Describe the sol-gel formation technique to synthesize nanomaterials.

8. a) Classify the nanomaterials based on their dimension. Give example for each.
   b) Explain the synthesis of nanomaterials by chemical vapour deposition method.
   c) Explain the process of electrodialysis for desalination of sea water.
   d) Explain with the reactions, ion exchange process for softening of hard water.

Unit – V

9. a) Define gross calorific value and net calorific value of a fuel. Explain the determination of calorific value of a solid fuel using bomb calorimeter.
   b) What is reforming? Give the reactions involved in reforming.
   c) Explain the molecular ordering in the following liquid crystalline phases.
      i) Nematic phase ii) Smectic phase

10. a) Differentiate between thermotropic and lyotropic liquid crystals.
    b) What is petrol knocking? Explain the knocking mechanism with chemical reactions.
    c) What is cracking? With the neat diagram describe fluidized bed catalytic cracking.
    d) Explain the working of liquid crystals in display systems.

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

November - December 2017

17CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours | Max. Marks: 100

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

		Marks	BT*
	Unit – I		
a)	Explain the free radical mechanism of addition polymerization taking ethylene as example.	6	L*2
b)	Define the glass transition temperature. Give its significance. Explain any 4 factors that influence glass transition temperature.	6	L5
c)	Discuss the synthesis, properties and application of the following: i) Epoxy resin ii) Kevlar	8	L2
a)	What are conducting polymers? Explain the mechanism of conduction in polyacetylene. Mention their applications.	6	L4
b)	Differentiate the following with examples: i) Natural rubber and synthetic rubber ii) Addition polymerization and condensation polymerization	6	5
c)	Explain how following polymers are formed? Mention their applications. (i) Phenol formaldehyde resin. (ii) Polyurethane.	8	L2
	Unit – II		
a)	What are ion selective electrodes? Discuss the construction and working of a glass electrode.	8	L2
b)	Define standard electrode potential. Derive Nernst equation for single electrode potential.	7	L4
c)	What are concentration cells? The E.M.F of the following cell $Ag\|AgNO_3(0.0083M)\|AgNO_3(xM)\|Ag$ was found to be 0.074V at 298k. Calculate value of x and write cell reaction.	5	L4
a)	Explain the following battery characteristics: i) Capacity ii) Voltage iii) Cycle life	6	L3
b)	Define fuel cell. Explain the construction and working of hydrogen – oxygen fuel cell. Mention any two applications.	6	L2
c)	Discuss the construction, working and applications of Lead-acid battery.	8	L4
	Unit – III		
a)	Explain the electrochemical theory of corrosion with an example.	5	L2
b)	What is cathodic protection? Explain the sacrificial anodic and impressed current method of corrosion control.	7	L4
c)	Explain differential metallic corrosion with example.	4	L4
d)	Give reason: i) Part of nail inside the wood undergoes corrosion easily. ii) Zinc coated iron pipe / sheet is protected from corrosion even when coating is scratched.	4	L5
a)	Explain the influence of following factors on the nature of the electrodeposit. i) Current density ii) Throwing power	6	L5
b)	Write a note on polarization.	4	L2
c)	Define metal finishing. Mention its technological importance.	3	L4
d)	Explain the electroless plating of copper. Brief the process of manufacture of double sided PCB with copper.	7	L2

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