Unit – IV

7. a) Explain the free radical polymerization mechanism of vinyl compound.
   b) What is the significance of glass transition temperature? Discuss the factors that influence Tg.
   c) Give an account of polymer composites.

8. a) Describe the mechanism of emulsion polymerization. Mention any two advantages.
   b) Explain the synthesis and applications of (i) SBR and (ii) Silicone rubber and (iii) epoxy resin.
   c) Give reason:
      (i) Plexi glass is used for manufacture of lenses;
      (ii) Thermal control in solution polymerization is easier than that of bulk polymerization.

Unit – V

9. a) Define BOD. How is it determined?

   b) What is boiler feed water? What are the causes for scale and sludge formation in boilers? What are the disadvantages?
   c) In a COD experiment 30ml of the effluent sample required 9.8ml of 0.001M $K_2Cr_2O_7$ for oxidation. Calculate the COD of the sample.
   d) Explain the synthesis of nano materials by sol-gel process.

10. a) Describe the experimental method for the determination of total hardness of water.
    b) Explain desalination of water by reverse osmosis. What are the advantages?
    c) Describe the synthesis of ZnO nanoparticles by microwave method.
    d) Write a note on activated sludge process.

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

Make up Examinations – January 2016

15CY110 – 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)	Derive the Nernst equation for the electrode reaction $Cu^{2+} + 2e^- \longrightarrow Cu$ at 298K	6	L*1 L4
	b)	What is standard electrode potential? The E^0 values of Mg and Cu are -2.38V and +0.34V and are in contact with 0.01M and 0.01M $MgSO_4$ and $CuSO_4$ solutions respectively. Represent the cell, write cell reactions and calculate the EMF of the cell at 298K.	6	L1 L3
	c)	Explain the construction of calomel electrode. How is pH of a unknown solution determined using glass electrode?	8	L2 L3
2.	a)	What are reserve batteries? Explain the construction and working of Pb-acid storage battery.	8	L1 L4
	b)	Mention the special properties of Li-metal that make it used as electrode material. Describe the working of Li-ion battery.	6	L1 L2
	c)	Give the construction and working of methanol-oxygen fuel cell.	6	L2
		Unit – II		
3.	a)	Write a note on following i) Galvanic corrosion ii) Tinning process	6	L2
	b)	Justify the following i)Ti is less reactive than Ag in galvanic series ii)Even if the zinc coating on iron is discontinuous, iron is free from corrosion iii)Inorganic coatings are generally chemical conversion coatings	6	L2 L5
	c)	What are corrosion inhibitors? Explain the mechanism of inhibitors action in corrosion control	8	L1 L2
4.	a)	Write a note on decomposition potential	4	L2
	b)	Define electroplating? Explain the following factors affecting the nature of the deposit i)Wetting agent ii) pH iii) Metal ion concentration and electrolytes	8	L1 L4
	c)	Explain the electroless plating of copper on PCB. Mention any two advantages of electroless plating	8	L2
		Unit – III		
5.	a)	Define HCV. Explain the determination of calorific value of a solid/liquid fuel using bomb calorimetric method	7	L1 L2
	b)	What is petrol knocking in IC engine? Describe knocking mechanism with reactions	7	L1 L2
	c)	Briefly explain electro-optic effect on liquid crystals	6	L2
6.	a)	What is cracking of heavy oil? Explain the fluidized bed catalytic cracking with suitable diagram.	7	L1 L2
	b)	Differentiate between thermotropic and lyotropic liquid crystals	6	L4
	c)	With suitable example explain the chemical constitution of liquid crystals.	7	L2

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b) Explain the liquid crystalline behavior based on the chemical constitution with suitable example.

c) Describe the application of liquid crystals in display systems.

Unit – IV

7. a) Describe solution and bulk polymerization techniques.
   b) How are the following polymers prepared? Mention their applications. (i) Teflon; (ii) Phenol-formaldehyde and (iii) Silicon rubber
   c) Account for the following
   (i) Polymer composites are stronger than polymer
   (ii)Thermosettings do not undergo reversible plastic deformation.

8. a) What is syndiotactic polymer? Explain the free radical mechanism of addition polymerization taking vinyl chloride as an example.
   b) Discuss any five factors influencing the glass transition temperature. Mention its significance
   c) Give an account of conducting polymers.

Unit – V

9. a) Write a brief note on Secondary treatment of sewage.
   b) Discuss the phenomenon of boiler corrosion. Write relevant chemical reactions.
   c) Explain the chemical vapour deposition method for preparation of nanomaterial with an example.
   d) Write a brief note on reverse osmosis.

10. a) Describe the ion-exchange process for softening of hard water.
    b) Define BOD and COD. Calculate the COD of effluent sample when 25 cm^3 of effluent needed 8.3 cm^3 of 0.001 M $K_2Cr_2O_7$ for oxidation of the impurities.
    c) What are nanomaterials? Write a note on applications of nanomaterials.
    d) Explain the synthesis of nanoparticles by combustion method.

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 2016

Duration: 3 Hours

15CY110 – ENGINEERING CHEMISTRY

Max. Marks: 100

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

			Marks	BT*
		Unit – I		
1.	a)	Derive an expression for single electrode potential.	5	L*4
	b)	Define EMF of a cell. Write the half cell and net cell reactions and calculate the voltage generated in the following cell. $Mn(s)\|Mn^{2+}\|\|Fe^{2+}\|Fe$, when iron rod is immersed in 6.9×10^{-4}M $FeSO_4$ and Mn rod immersed in 2.6×10^{-6}M $MnSO_4$ solution. Given E^0 for $Fe^{2+}\|Fe$ is -0.4V and $Mn^{2+}\|Mn$ is -1.18V	6	L3
	c)	Justify the following: (i) In a galvanic cell anode is positive and cathode is negative. (ii) Calomel electrode is reversible with chloride (Cl^-) ions.	4	L3
	d)	Explain how glass electrode can be used in the determination of pH of a given solution.	5	L4
2.	a)	Define a battery. Explain any three characteristics of battery.	7	L4
	b)	Describe the construction and chemical reactions of Li-ion battery.	6	L2
	c)	Give the construction of CH_3OH-O_2 fuel cell with the half cell and net cell reaction. Mention its applications	7	L4
		Unit – II		
3.	a)	Describe the mechanism of wet corrosion taking iron as example.	6	L2
	b)	Explain the following factors influencing the rate of corrosion. (i) Relative areas of anode and cathode (ii) Hydrogen overvoltage	6	L4
	c)	Justify the following. i) Ocean going ships suffer differential aeration corrosion, but ships sunk under sea do not ii) Anodic coatings are sacrificial coatings	4	L5
	d)	Write a note on Galvanization.	4	L2
4.	a)	Write a note on Polarization and Overvoltage.	7	L2
	b)	What is throwing power of plating bath? Describe the experimental determination of throwing power of the plating bath by using Haring -Blum cell.	6	L2
	c)	Explain the electroless plating of copper on PCB and mention any two applications.	7	L4
		Unit – III		
5.	a)	Define fuel. Describe the bomb calorimetric method to determine the calorific value of a solid/liquid fuel.	7	L2
	b)	Explain the diesel knocking in IC engine.	6	L2
	c)	Briefly describe two types of liquid crystals with suitable example.	7	L2
6.	a)	Define calorific value of a fuel. A coal sample with 93% C, 5% H and 2% ash, is subjected to combustion in a bomb calorimeter. Calculate the gross and net calorific value of coal, given that mass of coal sample taken is 0.0095 kg. Mass of water in the copper calorimeter is 2 kg, water equivalent of calorimeter is 0.7 kg, rise in temperature of water = 2.8 K, Specific heat of water =4.2 kJ/kg/^{0}C and latent heat of steam is 2454 kJ/kg.	7	L3

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Unit – IV

7.	a)	Define and differentiate addition and condensation polymerization with suitable examples.	5	L2	
	b)	Explain the manufacture and uses of following polymers (i) PMMA; (ii) butyl rubber and (iii) epoxy resin	9	L4	
	c)	Give an account of mechanism of conduction in polyacetylene.	6	L3	
8.	a)	Discuss the free radical mechanism of addition polymerization of ethene.	6	L4	
	b)	Justify the following statements: (i) All simple molecules are not monomers; (ii) Thermal control is rather difficult in bulk polymerization; (iii) PVC has higher T_g than polyethylene	6	L5	
	c)	Explain how the Kevlar and Carbon fibre are produced. Mention their properties and applications.	8	L4	

Unit – V

9.	a)	What is potable water? Discuss the purification of water by reverse osmosis process.	5	L4	
	b)	Describe the determination of dissolved oxygen by Winkler's method. Give the reactions involved.	6	L2	
	c)	25ml of an industrial effluent required 22.5ml of 0.50N $K_2Cr_2O_7$ for complete oxidation. Calculate the COD of the sample.	4	L3	
	d)	Explain the sol-gel method for preparation of nanomaterials with an example.	5	L2	
10.	a)	Define COD of sewage. How is it determined?	6	L3	
	b)	Describe the hot lime - soda process for softening of hard water.	6	L2	
	c)	Explain the preparation of ZnO nanoparticles by microwave method.	5	L4	
	d)	Write a note on phosphate conditioning.	3	L2	

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 Examinations – July 2016

15CY110 – 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)	Derive the following equation: $E = E^0 + \frac{0.0591}{n} \log [M^{n+}]$	6	L*4
	b)	A concentration cell was constructed by immersing two tin (Sn) electrodes in 0.5M and 10M Sn^{2+} solutions. Write the cell representation, cell reactions and calculate the e.m.f. of the concentration cell.	6	L3
	c)	Explain the working of calomel electrode. How is potential of an electrode measured using calomel electrode?	8	L4
2.	a)	Explain the construction and working of following batteries. (i) Zn-MnO_2 battery; (ii) Ni-MH battery	10	L4
	b)	Mention the advantages of using methanol as fuel in CH_3OH-O_2 fuel cell. Explain the working of CH_3OH-O_2 fuel cell.	5	L4
	c)	Write a note on reserve batteries.	5	L2
		Unit – II		
3.	a)	Define galvanic corrosion. Describe the electrochemical theory of corrosion taking iron as example.	8	L2
	b)	Write a note on i) Phosphating ii) Sacrificial anode method	6	L4
	c)	Justify the following. i) Copper utensils should not be fitted with steel rivets. ii) Dust particles on metal surface needs to be cleaned regularly. iii) Corrosion of metals can be considered as extractive metallurgy in reverse.	6	L5
4.	a)	What is decomposition potential? Mention its significance.	4	L3
	b)	Discuss the following factors influencing the nature of the deposit: i) Current density of deposition ii) pH of the bath	6	L2
	c)	Explain the methods of cleaning a metal surface prior to plating.	4	L4
	d)	Distinction between electroplating and electroless plating. Mention three advantages of electroless plating.	6	L2
		Unit – III		
5.	a)	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 26.8^0C to 30.1^0C. 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/^{0}C. If the fuel contains 4.7% of hydrogen, calculate its gross and net calorific values.	6	L3
	b)	Define petrol knocking. Explain the methods of prevention of knocking in IC engine.	7	L2
	c)	Distinguish between nematic, twisted nematic LC with examples.	7	L4
6.	a)	Define reformation of a fuel. Briefly explain reformation reactions.	6	L2
	b)	Explain briefly smectic phases in liquid crystals.	6	L2
	c)	What is pitch of the liquid crystal? Explain the optic effect on cholesteric liquid crystals.	8	L2

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Unit – IV

7. a) What are scales? What are the causes of scale formation in boilers?
   b) Write a note on: i) Reverse osmosis ii) Activated sludge process
   c) How are carbon nanotubes synthesized by chemical vapor deposition technique?
   d) Define BOD. An effluent sample contains 150 mg/dm^3 of an organic matter represented by the formula $C_6H_{12}O_6$. Calculate the BOD value of the water sample assuming that it was completely oxidized in the BOD test. Given atomic weight of H=1, C=12, O=16.

8. a) What is the principle underlying the determination of hardness of water by complexometric method? Explain the procedure and calculations involved.
   b) List out any three differences between hot lime soda process and cold lime soda process. Explain with a neat diagram the ion exchange method for softening of water.
   c) How are nanomaterials classified based on their dimensions?

Unit – V

9. a) On burning 0.85 x 10^{-3} kg of a solid fuel in a bomb calorimeter, the temperature of 2.1 kg water is raised from 24°C to 27.6°C. The water equivalent of calorimeter and latent heat of steam are 1.1 kg and 2454 kJ/kg respectively. Specific heat of water is 4.187 kJ/kg. If the fuel contains 2% hydrogen, calculate its gross and net calorific values.
   b) Discuss the following: i) Power alcohol ii) Biodiesl.
   c) What are liquid crystals? Explain the classification of liquid crystals.
   d) Explain the effect of electric field on liquid crystals.

10. a) Explain bomb calorimetric method of determining calorific value of a solid fuel.
    b) What is reforming of petroleum? Give any four reactions involved in reforming.
    c) What are liquid crystals? Explain the molecular ordering in the following liquid crystal phases.
       (i) Nematic phase ii) Smectic phase.
    d) Explain with examples, the liquid crystalline behavior of compounds based on their chemical constitution.

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 2016

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)	Explain the free radical mechanism of polymerization in propene.	6	L*2
	b)	Discuss the structure property relationship with respect to chemical resistance and nature of polymer chain.	6	L4
	c)	Give the synthesis and applications of (i) Epoxy resin (ii) Carbon fibre	8	L3
2.	a)	What is glass transition temperature? Explain any five factors that affect glass transition temperature.	6	L4
	b)	Give polymerization reaction involved in the synthesis of following polymers: (i) Silicone rubber (ii) Polycarbonate	4	L3
	c)	Give reason for the following (i) Natural rubber needs vulcanization. (ii) Thermosetting plastics cannot be reused and reshaped.	4	L4
	d)	Explain conduction mechanism in doped polyacetylene.	6	L4
		Unit – II		
3.	a)	Derive Nernst equation for a single electrode potential.	6	L2
	b)	What are reference electrodes? Calculate the voltage of the cell $Mg \mid Mg^{2+}(aq) \mid\mid Cd^{2+}(aq) \mid Cd$ at 250C when $[Cd^{2+}] = 7.0 \times 10\text{-}11M$, $[Mg^{2+}] = 1.0$ M and $E^0_{cell} = 1.97V$.	6	L2
	c)	Describe the construction and working of a calomel electrode. How it is used to determine the potential of another electrode?	8	L4
4.	a)	Explain the construction and working of Nickel-metal hydride battery. Mention its uses.	6	L2
	b)	Explain the construction, working and applications of H_2-O_2 fuel cell, with cell reaction. Why the water formed in the H_2-O_2 fuel cell needs to be removed continuously?	8	L2
	c)	Describe the construction and working of Li-MnO_2 battery. Mention its applications	6	L4
		Unit – III		
5.	a)	Define corrosion. Describe differential aeration corrosion with suitable example.	7	L2
	b)	Nickel spatula can not be used for stirring copper (II) sulfate solution - Justify.	2	L3
	c)	Explain the following factors affecting the rate of corrosion i) Electrode potential ii) Hydrogen over voltage	4	L2
	d)	What is metal coating? Give the steps involved in galvanization and tinning process.	7	L2
6.	a)	Define overvoltage. Mention any four technological importance of metal finishing.	5	L2
	b)	Explain the following factors affecting the electro deposit: i) current density ii) organic additives	6	L2
	c)	Define throwing power? Describe the electroplating of chromium with reactions.	6	L4
	d)	Give any three advantages of electro less plating over electroplating.	3	L1

P.T.O.