b) Justify the following:
   i) For a fuel, GCV is always greater than NCV.
   ii) Use of leaded petrol can prevent knocking.

c) The chemical constitution of a molecule determines its liquid crystalline behavior. Discuss.

d) Explain chemical vapor deposition technique for synthesizing nanoparticles.

Unit – IV

7. a) Discuss the relationship between structure and following properties:
   (i) Strength (ii) Plastic deformation

   b) Differentiate between natural rubber and synthetic rubber. Justify that vulcanization process hardens the natural rubber.

   c) Explain the synthesis and applications of the following:
   (i)Buna-S (ii) Phenol-formaldehyde resin

8. a) What are adhesives? Explain the synthesis and two applications of Epoxy resin.

   b) Discuss the mechanism involved in free radical polymerization of ethylene.

   c) Write notes on (i) Emulsion polymerization (ii) compression moulding.

Unit – V

9. a) What constituents of water that makes it hard? Explain the determination of hardness of water by complexometric method.

   b) Discuss the purification of water by ion-exchange method.

   c) Differentiate between BOD and COD. 25 cm^3 of an industrial effluent requires 12.5 cm^3 0.5N $K_2Cr_2O_7$ for complete oxidation. Calculate COD of the sample. Assuming that the effluent contains only oxalic acid, calculate the amount of oxalic acid present in 1 dm^3 (given equivalent weight of oxalic acid as 45).

10. a) Explain the method of determination of alkalinity by indicators method.

    b) Describe the hot-lime soda process for softening of hard water.

    c) Write note on (i) Reverse osmosis and (ii) Activated sludge process.

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

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

Make up Examinations – January 2015

Duration: 3 Hours

14CY110 – ENGINEERING CHEMISTRY

Max. Marks: 100

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

Unit – I

1. a) What is electrode potential? Explain the origin of single electrode potential. 6
   b) Calculate the cell potential of the following cell at 298K $Ag|Ag^{+}(0.001M)||Ag^{+}(0.50M)|Ag$. What will be the potential, when the concentration of silver ions in the above cell is changed from 0.001M to 0.005M at same temperature? 4
   c) Give the construction and working of Ag-AgCl electrode 5
   d) Mention the advantages of secondary reference electrode. How is potential of an electrode measured using calomel electrode? 5

2. a) Give reasons: (i) Lithium, the lightest material used as anode in modern battery
   (i) Shelf life of Pb-acid battery is limited.
   (ii) A membrane is placed near the cathode on CH_3OH-O_2 fuel cell. 6
   b) Explain the construction and working of Zn-MnO_2 battery. 6
   c) How does a fuel cell differ from a galvanic cell? Describe the construction, working and applications of H_2-O_2 fuel cell. 8

Unit – II

3. a) Describe electrochemical theory of corrosion taking iron as an example. 6
   b) Explain the following factors influencing the rate of corrosion. 5
   (i) pH (ii) Electrode potential
   c) Justify the following
   i) Lead-antimony solder around copper wire gets corroded 4
   ii) Corrosion of metals is extractive metallurgy in reverse 5
   Explain why anodic metal coating is called sacrificial coating, write the process involved. 6
   Write a note on Polarization and overvoltage
   What is throwing power of plating bath? Describe the experimental determination of throwing power of the plating bath by using Haring -Blum cell 6
   Chromium metal passivates strongly in acid sulphate medium. Justify the answer. 2
   What is electroplating? Describe the electroless plating of copper. 6

Unit – III

If you are provided with a coal sample of 'm' gram weight, how do you estimate its calorific value by Bomb Calorimeter. 5
What is meant by reforming? Elaborate on the different types of Reforming in fuels. Illustrate each type with a reaction. 6
c) Write a note on Lyotropic Mesophase and Thermotropic Mesophase. 5
d) Taking ZnO as an example, explain how combustion and microwave methods can be combined to synthesize nanoparticles. 4

6. a) Calculate the gross calorific value of a coke sample from the following data: Mass of coke = 0.8 g; Mass of water = 1.3 kg; Water equivalent of calorimeter = 2.5 kg; Percentage of hydrogen in coal sample = 5%; Rise in temperature = 1.8 °C; Specific heat of water = 4.187 kJ/kg/°C; Latent heat of steam = 2457.182 kJ/kg 5

P.T.O.

14CY110

Unit – IV

7. a) Describe the manufacture of plastics by (i) Compression and (ii) Injection moulding
   b) Explain the synthesis and applications of the following:
      a) Butyl rubber b) Polycarbonate
   c) Polymer with conjugation after doping gains the property of electrical conductance. Justify by taking polyacetylene as an example.

8. a) Justify ;(i) Bulk polymerization is not preferred commercially.
      (ii) Suspension polymerization also termed as pearl polymerization.
      (iii) All organic compounds do not form polymers.
   b) Write any two differences between thermoplastics and thermosetting with an example each? Describe the synthesis and two applications of Epoxy resin.
   c) What are high polymers? Explain the free radical polymerization of styrene.

Unit – V

9. a) Discuss the types of impurities present in natural water.
   b) Explain the hot lime soda process of desalination of water.
   c) Explain how boiler corrosion takes place due to presence of (i) dissolved O_2 and (ii) dissolved Mg salt
   d) Write a note on activated sludge process.

10. a) What are the different types of alkalinity of water? Explain the indicators method of determination of alkalinity of water.
    b) Explain with reactions the demineralization of hard water and regeneration of ion exchange resin.
    c) Define BOD and COD. In a COD experiment, $30cm^3$ of an effluent sample required $9.8cm^3$ of 0.001M $K_2Cr_2O_7$ for oxidation. Calculate the COD of the sample.

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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 2015

14CY110 – ENGINEERING CHEMISTRY

Duration: 3 Hours

Max. Marks: 100

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

Unit – I

1. a) Electrode potential is developed due to the formation of Helmholtz electrical double layer. Discuss. 6
   b) Write the electrode reactions and calculate the emf of the following cell at 298K given $E^0_{cell} = 1.30V$; $Cu(s) / Cu^{2+} (1\times10^{-2}M) // Ag^{+}(1\times10^{-1}M) / Ag(s)$ 5
   c) Derive Nernst equation for glass electrode potential (Eg). Explain the experimental method of determination of pH of a solution using glass electrode. 9

2. a) Explain the following battery characteristics:
   (i) Current (ii) Capacity (iii) Energy density 6
   b) Explain the construction and working of Nickel-metal hydride battery. Mention its uses. 7
   c) Write a note on construction and working of CH_3OH-O_2 fuel cell. Mention the advantage of using H_2SO_4 as an electrolyte. 7

Unit – II

3. a) Define metallic corrosion. Discuss the mechanism of wet corrosion, taking iron as example. 8
   b) Write a note on i) phosphating ii) corrosion inhibitors 8
   c) Give reason for following.
   i) Copper utensils should not be fitted with steel rivets
   ii) Dust particles on metal surface needs to be cleaned regularly 4

4. a) What is decomposition potential? How is it determined? Mention its significance. 7
   b) Discuss the following factors influencing the nature of the deposit:
   i) Temperature. ii) pH of the bath iii) Metal ion concentration and electrolytes 7
   c) Distinguish between electroplating and electroless plating. Mention the advantages of electroless plating 6

Unit – III

5. a) What is meant by cracking of a fuel? Write a note on the working of Moving-Bed Catalytic cracking. 5
   b) A 0.6 gram coal sample with 92% C, 5% H2 and 3% ash caused a rise in the temperature of 2000 gram of water by 3.2 °C in a bomb calorimeter experiment. Calculate the gross and net calorific value of coal, given water equivalent = 200 gram; specific heat of water = 4.187 kJ/kg/°C; latent heat of steam = 2436 kJ/kg. 5
   c) The dielectric anisotropy and optical anisotropy observed in twisted nematic liquid crystals make them suitable for applications in display systems. Justify. 6
   d) Classify nanomaterials based on dimensions, giving an example for each. 4

6. a) If you are provided with a coal sample of 'm' gram weight, how do you estimate its calorific value by Bomb Calorimeter? 5
   b) What is knocking? Explain the mechanism of knocking in petrol engines. 6
   c) Write a note on Lyotropic Mesophase and Thermotropic Mesophase. 5
   d) Explain sol gel method for synthesizing nanoparticles. 4

P.T.O.

c) Write a note on the electro-optic effect observed in twisted nematic liquid crystals.
d) Classify nanomaterials based on dimensions, giving an example for each.

Unit – IV

7. a) What is glass transition temperature? Explain 5 factors affecting Tg. Mention one of its significance.
   b) Explain the synthesis and applications of the following:
   i)Teflon ii) Epoxy resin
   c) Polymer with conjugation after doping gains the property of electrical conductance. Justify by taking polyacetylene as an example.

8. a) Explain the free radical mechanism of addition polymerization.
   b) Write notes on (i) Bead polymerization (ii) Emulsion polymerization
   c) How is synthetic rubber advantageous over natural rubber? Explain the vulcanization of rubber.

Unit – V

9. a) How is the hardness of water determined by complexometric method?
   b) What is lime-soda process for water softening? Give chemical reactions involved during softening.
   c) Write a note on reverse osmosis process of desalination of water
   d) 25 cm^3 of an industrial effluent requires 12.5 cm^3 0.5N $K_2Cr_2O_7$ for complete oxidation. Calculate COD of the sample. Assuming that the effluent contains only oxalic acid, calculate the amount of oxalic acid present in 1 dm^3 (given equivalent weight of oxalic acid as 60).

10. a) 50 ml of a sample required 18ml of 0.04N H_2SO_4 for neutralization to methyl orange end point. When the same volume of the water sample was treated with phenolphthalein, it did not turn pink. Determine type and amount of alkalinity.
    b) How does the dissolved oxygen affect the quality of water in boiler? What are various methods employed in deaeration of water?
    c) Explain the following. (i) Desalination of water by electrodialysis method and (ii) Secondary treatment for water treatment
    d) Justify the following: (i) Sodium azide is used in Winkler's method and (ii) Scale formation lowers the boiler safety.

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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 2015

Duration: 3 Hours

14CY110 – ENGINEERING CHEMISTRY

Max. Marks: 100

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

Unit – I

1. a) Derive the Nernst equation for the electrode reaction $Mg^{2+} + 2e^- \longrightarrow Mg$ at 298K — 6
   b) For the cell, $Fe|Fe^{2+}(0.015M)||Ag+(0.13M)|Ag$, write the cell reaction and calculate the emf of the cell at STP, if standard electrode potentials of iron and silver are – 0.44V and 0.80V respectively. — 4
   c) Justify the following.
      (i) Calomel electrode is reversible with respect to $[Cl^-]$
      (ii) Above a pH of 9 an alkaline error is introduced in the glass electrode. — 4
   d) Give the construction and working of Ag-AgCl electrode. Mention its applications — 6

2. a) Explain the construction and applications of lead-acid battery along with the reactions involved during charging. — 7
   b) Describe the construction and working of Li-ion battery. — 6
   c) Mention the advantages of fuel cells. Explain the construction, working and applications of H_2-O_2 fuel cell. — 7

Unit – II

3. a) Write a note on i) Anodic protection ii) water line corrosion — 8
   b) Give reason:
      i) Cathodic coating should be continuous for total protection against corrosion.
      ii) Iron corrodes faster when in contact with copper than when in contact with tin
      iii) In Zn-Al couple, Zn is corroded while Al is protected — 6
   c) What is anodization? Explain anodization of aluminium — 6

4. a) What is decomposition Potential? How is it determined? — 6
   b) Discuss the following factors influencing the nature of the deposit:
      i) pH of the electrolytic bath. ii) organic additives — 8
   c) Mention the advantages of electroless plating. Explain electroplating of chromium and its applications — 6

Unit – III

5. a) If you are provided with a coal sample of 'm' gram weight, how do you estimate its calorific value by Bomb Calorimeter? — 5
   b) Define cetane number. An increase in ignition delay gives rise to a rattling sound in diesel engines. Explain. — 5
   c) Explain how the chemical constitution of a molecule determines its liquid crystalline behavior. — 6
   d) Explain the sol-gel method for synthesizing nanoparticles. — 4

6. a) What is meant by cracking of a fuel? Write a note on the working of Moving-Bed Catalytic cracking. — 5
   b) On burning 0.83×10^{-3} kg of a solid fuel in a bomb calorimeter, the temperature of 3.5 kg of water is increased from 26.5 °C to 29.2 °C. The water equivalent of calorimeter and latent heat of steam are 0.385 kg and 587 x 4.2 kJ/kg respectively. Specific heat of water = 4.2 kJ/kg/ °C. If the fuel contains 0.7 % of hydrogen, calculate its gross and net calorific values. — 5

P.T.O.

6. a) Define knocking and octane number. Discuss the knocking prevention methods. 6
   b) Why Soap - water mixture shows liquid crystalline behavior? 7
   c) Explain Chiral nematic liquid crystalline phase with suitable example. 7

Unit – IV

7. a) Define the term degree of polymerization. Give the mechanism of free radical polymerization of styrene. 7
   b) Discuss the relationship between the structure and following properties (i) Crystallinity; (ii) Chemical resistance 7
   c) What are polymer composites? Give the method of preparing carbon fibre. 6

8. a) Explain the mechanism of suspension polymerization with advantages. 5
   b) Describe the synthesis and applications of following polymers (i) Plexiglass; (ii) Polycarbonate and (iii) Epoxy resin 10
   c) Explain the electrical conductivity in polyacetylene 5

Unit – V

9. a) Describe the process of determination of COD of industrial waste water. 6
   b) Write a brief note on priming and foaming. 4
   c) Explain the desalination of water by electro-dialysis. 6
   d) Explain the classification of nanomaterials with examples. 4

10. a) 20ml of the sewage sample was diluted to 600ml and equal volumes were filled in 2 BOD bottles. Dissolved oxygen in one bottle was determined immediately and 200ml of the solution required 4.2ml of N/40 $Na_2S_2O_3$ solution. The second sample was incubated for 5days and 200ml of the solution required 2.2ml of same $Na_2S_2O_3$ solution. Calculate BOD.
   b) Explain the steps involved in tertiary treatment of sewage. 5
   c) Describe the synthesis of nanomaterials by microwave method. 5
   d) Describe hot lime-soda process of softening of hard water. 4

BT* Bloom's Taxonomy, L* Level 6

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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 2015

15CY110 – ENGINEERING CHEMISTRY

tion: 3 Hours

Max. Marks: 100

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

		Marks	BT*
	Unit – I		
a)	Discuss the formation of Helmholtz electrical double layer.	5	L*4 L2
b)	The cell potential of concentration cell of Cu was measured 0.0591V. One of the concentrations of $CuSO_4$ solution was 0.001M. Calculate the concentration of other $CuSO_4$ solution.	4	L1 L4
c)	Describe the construction and working of Ag-AgCl electrode.	5	L2
d)	Derive an expression for the electrode potential of a glass electrode.	6	L4 L2
a)	Give reasons: (i) Zn-MnO_2 battery undergoes self-discharge (ii) Water produced in Hydrogen-Oxygen fuel cell should be removed. (iii) Lithium, the lightest material used as anode in modern battery.	6	L2
b)	Construct and describe the working of lead accumulator battery.	7	L2
c)	Distinguish between a fuel cell and battery. Explain the construction and working of H_2-O_2 fuel cell.	7	L2
	Unit – II		
a)	What is corrosion? Explain the caustic embrittlement corrosion.	6	L1 L2
b)	Explain the following factors affecting the rate of corrosion i) Nature of corrosion product and tendency to form protective film ii) Temperature	6 6	L2 L4
c)	Describe two techniques of cathodic protection	2	L5
d)	Stainless steel containers used for transporting corrosive chemicals, give reason	6	L4
a)	Explain electroplating of chromium		L1
b)	Define metal finishing? Mention the technological importance	6	L4 L3
c)	Mention the advantages of electroless plating. Explain electroless plating of copper and mention any two applications	8	L2
	Unit – III		
a)	On burning A 0.6 gm coal sample with 92% C,5% H and 3% ash, caused a rise in the temperature of 2000 gm of water by 3.20C in a bomb calorimeter experiment. Calculate the gross and net calorific value of coal, given water equivalent=200 gm.Specific heat of water =4.2 kJ/kg/0C. Latent heat of steam = 580 calories/gm.	6	L1 L3
b)	Give one example for secondary fuel? Explain the fluidized bed catalytic cracking of heavy oil.	7	L1 L2
c)	Briefly discuss on discotic or columnar mesophase.	7	L2

P.T.O.