

# END TERM EXAMINATION

FIRST SEMESTER

[B.TECH]

NOVEMBER-DECEMBER 2018

Exam Roll No. ....

Paper Code: ETCH 113

Time : 3 Hours

Note: Attempt any five questions including Q. No. 1 which is compulsory.  
Select one question from each unit.

Subject: Applied Chemistry

Maximum Marks : 75

- Q1. a) What is a fuel? State the features of a good fuel. (5x5=25)  
b) Draw the phase diagram of water. Explain the terms-critical point and triple point.  
c) What is a catalyst? Describe its characteristics features.  
d) Describe what is water softening by internal treatment.  
e) Discuss in detail the factors influencing corrosion.

## Unit-I

- Q2. a) What is cracking? Differentiate between thermal & catalytic cracking. (6.5)  
b) Explain knocking and anti knocking agents. What is cetane and octane number of a fuel? (6)
- Q3. a) Draw a Labelled diagram and explain the working of Otto-Hoffmann's by-product oven for the manufacturing of metallurgical coke. (6.5)  
b) The composition by weight of a coal sample is C=82% , H= 6%, O= 6%, S=1%, N= 2% and ash=3%.  
Calculate the minimum air required for complete combustion of 1kg of coal. (6)

## Unit-II

- Q4. a) State Gibb's Phase rule. Also, find the degree of freedom of the following systems:  
i)  $\text{NH}_4\text{Cl(s)} \rightleftharpoons \text{NH}_3\text{(g)} + \text{HCl(g)}$   
ii) Aqueous solution of NaCl and  $\text{Na}_2\text{CO}_3$ . (6)  
iii) Water (liquid) water (vapour).  
b) Draw the cooling curve of a pure substance and clearly identify the eutectic point in it. (6.5)
- Q5. a) Differentiate between congruent and Incongruent melting compound by giving suitable examples. (6)  
b) Draw and explain the phase diagram of Lead-Silver System. (6.5)

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Unit-III

- Q6. a) Describe in detail the EDTA method of determining the hardness of water. (6.5)
- b) Explain the use of catalyst in Industrially important processes. Give examples. (6)
- Q7. a) Discuss the lime-soda process used for external treatment for water softening. (6.5)
- b) A water sample has the following dissolved salts (mg/L). Calculate its temporary and permanent hardness in ppm of  $\text{CaCO}_3$ .  
 $\text{Mg}(\text{HCO}_3)_2 = 80$ ,  $\text{MgSO}_4 = 110$ ,  $\text{CaSO}_4 = 85$ ,  $\text{MgCl}_2 = 94$ ,  $\text{CaCl}_2 = 84$ ,  $\text{NaCl} = 50$ . (6)

Unit-IV

- Q8. a) Explain what is Soil Corrosion? How it is affecting the fertility of soil? How it can be prevented? (6.5)
- b) What is Cathodic protection and sacrificial Anodic protection? (6)
- Q9. What happens and why? (3)
- a) A piece of iron is kept in Saline water.  $\rightarrow$  rusting (3)
- b) A steel pipe is connected to copper plumbing. (3)
- c) A zinc plate is fixed below the ship. (3)
- d) Iron next/ washers/ valves are cleaned and packed with zinc dust and rotated. (3.5)

Const.	Amt (%)	Comb Eq <sup>n</sup>	Amt of $\text{O}_2$ (Kg)
C	0.82	$\text{C} + \text{O}_2 \rightarrow \text{CO}_2$	$\frac{32}{12} \times 0.82 = 2.18$
H	0.06	$\text{H}_2 + \frac{1}{2} \text{O}_2 \rightarrow \text{H}_2\text{O}$	$\frac{16}{2} \times 0.06 = 0.48$
O	0.06		
S	0.01	$\text{S} + \text{O}_2 \rightarrow \text{SO}_2$	$\frac{32}{32} \times 0.01 = 0.01$
N	—		
Ash	—		
			Total wt of $\text{O}_2 = 2.67$
			Net " " = 2.61
			Net wt of air = $\frac{100}{23} \times 2.61$

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B2/2  
= 11.35 kg



# END TERM EXAMINATION

FIRST SEMESTER [B.TECH.] DECEMBER 2016

Paper Code: ETCH-113

Time: 3 Hours

Subject: Applied Chemistry

Maximum Marks: 75

Note: Attempt any five questions including Q no.1 which is compulsory.  
Select one question from each unit.

- (a) Define HCV and GCV. (2.5)
- (b) Define order and molecularity of a reaction with suitable example. (2.5)
- (c) What is biodiesel? (2.5)
- (d) State Gibb's phase rule. (2.5)
- (e) What is Pilling-Bed-Worth rule? (2.5)
- (f) What is an eutectic mixture? (2.5)
- (g) Explain what is happening at the triple point of water. How many phases are there in the system at this point? (2.5)
- (h) What is synthetic petrol? (2.5)
- (i) Name the catalyst used for the following reactions/processes:- (5)
  - (a) Fischer Tropsch process
  - (b) Contact Process
  - (c) Zeigler Natta Polymerisation
  - (d) Haber's Process
  - (e) Homogeneous hydrogenation reaction

## UNIT-I

(2.5x4=10)

- Q2 (a) Differentiate the following:-
  - (i) Chemical fuel and nuclear fuel
  - (ii) High temperature and low temperature carbonization
  - (iii) Fixed and Fluidized bed catalytic cracking.
  - (iv) Octane and cetane number
 (b) What is sweetening of petrol? (2.5)
- Q3 (a) Explain how the calorific value of a fuel can be determined by Bomb's calorimeter with the help of a neat diagram. (6.5)
- (b) Calculate GCV and NCV of a gaseous fuel from the following data obtained from calorimeter experiment.
 

Volume of gaseous fuel burnt at STP = 0.08m<sup>3</sup>  
 Temperature of inlet water = 26°C  
 Temperature of outlet water = 32°C  
 Weight of water produced by steam Condensation = 0.01 kg.  
 Latent heat of steam = 587 Kcal/kg

 (6)

## UNIT-II

- Q4 (a) What is "degree of freedom" of a system? Calculate degrees of freedom of the following systems:- (10)
  - (i) Water (liquid)  $\leftrightarrow$  water vapour at 1 atm.
  - (ii)  $S_F \leftrightarrow S_M \leftrightarrow S_L \leftrightarrow S_V$
  - (iii) An aqueous solution of glucose
  - (iv) Pure crystals of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
 (b) What are cooling curves? (2.5)
- Q5 (a) Explain Langmuir Hinshelwood mechanism of catalysis in detail. (6)
- (b) How does a catalyst increase the rate of reaction by affecting the reaction pathway? Will it affect the rate of backward reaction in case of a reversible reaction? Also describe auto catalysis with suitable examples. (6.5)

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**UNIT-III**

- Q6 (a) Describe the principle and theory of EDTA method for determination of hardness of water. (6.5)  
(b) 1g of  $\text{CaCO}_3$  was dissolved in dil.HCl and solution dilute to 1 litre. 50 ml of this solution required 42 ml of EDTA solution while 50 ml of sample water required 15 ml of EDTA. On the other hand when 50 ml of boiled water sample-titrated against EDTA consumed 9 ml of solution. Calculate total, permanent and temporary hardness of water in ppm. (6)
- Q7 Explain the following:-  
(a) Carbonate and phosphate conditioning. (6)  
(b) Lime soda process (6.5)

**UNIT-IV**

- Q8 (a) Define the factors affecting the corrosion rate. (6.5)  
(b) Explain with reasons:- (6)  
(i) Stainless steel is resistant to atmospheric conversion  
(ii) Iron in contact with copper corrodes more rapidly than lead.  
(iii) Cr anodes are not used in chromium plating.
- Q9 (a) Describe the "Electrochemical theory of corrosion". (6.5)  
(b) Write short note on soil corrosion and its control. (6)

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**END TERM EXAMINATION**

FIRST SEMESTER [B.TECH] DECEMBER 2014-JANUARY 2015

Paper Code: ETCH-113

Time: 3 Hours

Subject: Applied Chemistry

Maximum Marks: 75

Note: Attempt any five questions including Q.no.1 which is compulsory.  
Select one question from each Unit.

- Explain how the hardness of water is removed by EDTA method. (2.5x10=25)
- Define the terms thermal cracking and anti knocking agents.
- What is power alcohol? How is it manufactured from starchy material?
- 100 ml of  $H_2O$  sample when titrated against  $\frac{N}{50} H_2SO_4$  using phenolphthalein as an indicator, gave the end point with 10 ml of acid. Another 100 ml of the sample also required 10 ml of the acid to obtain methyl orange end point. What type of alkalinity is present in the sample and what is its magnitude?
- Explain what is autocatalysis?
- Derive Gibb's phase Rule.
- Draw the phase diagram of water system and explain the importance of a triple point.
- What is Pilling-Bedworth Rule?
- What is gawanzation and explain how it is done.
- Explain the use of inhibitors and promoters in a catalytic reaction.

**Unit-I**

- Explain what is ultimate analysis of coal? How one can find the % composition of C, H, N & S using it? (6.5)
- 2.16 g of coal was Kjeldalized and  $NH_3$  gas thus evolved was absorbed in 25ml of 0.1N  $H_2SO_4$ . After absorption, the excess acid required 12.5 ml of 0.1 N NaOH for exact neutralization. Determine the percentage of N in sample of coal. (6)
- How the calorific value of a fuel can be determined by Boy's gas calorimeter? Explain with the help of a neat diagram. (6.5)
- The % analysis by volume of producer gas is  $H_2 = 18.3\%$ ,  $CH_4 = 3.4\%$ ,  $CO = 25.4\%$ ,  $CO_2 = 5.1\%$ ,  $N_2 = 47.8\%$ . Calculate the volume of air required per  $m^3$  of the gas. (6)

**Unit-II**

- Draw and explain the phase diagram of Pb-Ag system. What is Pattinson's process? (6.5)
- Find out the number of phases, component and degrees of freedom in the following:- (6)
  - $NH_3(g)$  at  $42^\circ C$
  - Crystals of  $CuSO_4 \cdot 5H_2O$ .
  - An aqueous solution of glucose.
- What is criteria for choosing the catalyst for industrial process? Explain the application of catalyst in industry by taking suitable examples. (6.5)

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- (b) Write short note on the following:-  
 (i) Wilkinson's catalyst.  
 (ii) Heterogeneous catalysis.

### Unit-III

- Q6 (a) Explain the following terms:-  
 (i) Reverse Osmosis (ii) Electro dialysis (iii) Priming & foaming.  
 (b) 50 ml of a sample of hard water was titrated against 0.01 EDTA, it required 15 ml of EDTA for titration. 50 ml of the same hard water after boiling and filtering etc required 5ml of EDTA for titration. Calculate the total and temporary hardness of water. (6.5)
- Q7 (a) What is caustic embrittlement? Explain its causes and prevention. (6.5)  
 (b) What are the methods of water softening of by external treatment? (6)

### Unit-IV

- Q8 (a) What happens and why?  
 (i) Iron sheets gets corroded, when riveted with copper rivets.  
 (ii) An iron pole is partly buried under earth.  
 (iii) Zinc plate fixed below the ship.  
 (b) Write a short note on soil corrosion and its control. (6)
- Q9 Write short note on the following:-  
 (i) Electroplating  
 (ii) Electroless plating  
 (iii) Corrosion inhibitors  
 (iv) Cathodic protection  
 (v) Galvanic corrosion (12.5)

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Write your Exam Roll No.)

Exam Roll No. ....

# END TERM EXAMINATION

FIRST SEMESTER [B.TECH.] DECEMBER 2013

Code: ETCH113

3 Hours

Subject: Applied Chemistry

Maximum Marks :75

Attempt five questions including Q.no.1 which is compulsory. Select one question from each unit.

- (a) Define the terms cetane number and octane number. (2.5)
- (b) Distinguish between producer gas and water gas.
- (c) Briefly explain the temporary and permanent hardness of water.
- (d) Calculate the temporary and total hardness of a sample of water containing  $\text{Mg}(\text{HCO}_3)_2 = 7.3 \text{ mg/l}$ ,  $\text{Ca}(\text{HCO}_3)_2 = 16.2 \text{ mg/l}$ ,  $\text{MgCl}_2 = 0.5 \text{ mg/l}$ ,  $\text{CaSO}_4 = 13.6 \text{ mg/l}$ .
- (e) State Gibb's phase rule.
- (f) Draw and explain the phase diagram of water system.
- (g) Explain the term inhibitors and poisoning agents in a catalytic reaction with suitable examples.
- (h) Determine the number of components in a following system:  
(i)  $\text{Br}_2$  dissolved in  $\text{CCl}_4$ . (ii) A mixture of  $\text{N}_2$ ,  $\text{H}_2$  and  $\text{NH}_3$  gas.
- (i) What is Pilling-Bedworth Rule?
- (j) What are the conditions for dry and wet corrosion? Explain why impure metal corrodes faster than pure metal under identical conditions? (2.5x10=25)

## UNIT-I

- (a) Differentiate between Proximate and Ultimate Analysis of coal. How is coke manufactured by Otto-Hoffmann Oven? (6.5)
- (b) A sample of coal was found to contain the following: (6)  
 $\text{C}=81\%$ ,  $\text{H}=4\%$ ,  $\text{O}=2\%$ ,  $\text{N}=1.0\%$  the remaining being ash. Estimate the quantity of minimum air required for complete combustion of 1kg of the sample. Find the composition of dry flue gas by volume, if 40% excess air is required.
- (c) Describe the bomb's calorimeter used for the determination of calorific value of fuels. Also, outline the principles involved in refining of petroleum and name of chief components separated. (6.5)
- (d) Calculate the HCV (in kJ/kg) of 0.75g of a fuel containing 85% of carbon, when burnt in a bomb calorimeter, increased the temperature of water from  $27.5^\circ\text{C}$  to  $29.3^\circ\text{C}$ . The calorimeter contains 250g of water and its water equivalent is 150g. (6)

## UNIT-II

- (a) What is Pattinson's process for desilverisation of lead? Draw its phase diagram also. (6.5)
- (b) Draw the phase diagram of  $\text{CO}_2$  system and explain how it is different from water system. (6)
- (c) Explain the difference between the Heterogeneous and Homogeneous catalysis with suitable examples. (6.5)
- (d) Derive the Michaelis-Menten equation for enzyme catalysis. Explain the effect of adding an inhibitor on this equation. (6)

## UNIT-III

- (a) Explain the EDTA method to estimate the total hardness of water. (6)
- (b) Explain the carbonate and phosphate conditioning methods for water softening. (3.5)
- (c) A sample of ground water has 150mg/l of  $\text{Ca}^{2+}$  and 60mg/l of  $\text{Mg}^{2+}$ . Find the total hardness expressed in milliequivalents per litre and mg/L in terms of  $\text{CaCO}_3$ . (3)
- (d) What is the principle of reverse osmosis? Name the membranes employed in it. (4)
- (e) Also, state the advantages of this process. (2.5)
- (f) A 50ml of a sample of hard water consumes 22.5ml of 0.01M EDTA, what will be the hardness of water. (2.5)
- (g) Define the following: (i) Calgon conditioning (ii) Priming and foaming (iii) Electrolysis (6)

## UNIT-IV

- (a) Describe the different types of corrosion and discuss the factors that affect the corrosion. (6.5)
- (b) Explain the following protective measures for corrosion: (i) Cathodic protection (ii) Electroplating (6)
- (c) Galvanizing and tinning (iii) Electroless plating (6.5)
- (d) Explain the term "passivity". What are the factors which affect corrosion? (6)
- (e) Write short notes on the following: (i) Galvanic corrosion (ii) Electroless plating (6)
- (f) Corrosion inhibitors (i) Corrosion inhibitors (i) Corrosion inhibitors (6)