

Hall Ticket No

Question Paper Code: **AHSB03**



# **INSTITUTE OF AERONAUTICAL ENGINEERING**

**(Autonomous)**

**Dundigal, Hyderabad - 500 043**

## **MODEL QUESTION PAPER-I**

First Year B.Tech II Semester End Examinations, May - 2020

**Regulations: R18**

### **ENGINEERING CHEMISTRY**

(Common to AE/ECE/ME/CE)

**Time: 3 hours**

**Max. Marks: 70**

Answer ONE Question from each Module

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

#### **MODULE- I**

1. a) Explain the construction of calomel electrode. How the potential of calomel electrode vary with concentration of KCl? [7M]
- b) Derive Nernst Equation. Calculate the electrode potential of copper wire dipped in 0.1 M  $\text{CuSO}_4$  solution at  $25^\circ\text{C}$ . The standard electrode potential of copper is 0.34 V [7M]
2. a) What is oxidation corrosion and how does it takes place? Describe the mechanism of oxidation corrosion? [7M]
- b) Explain the process of tinning. How does it prevent the corrosion of iron and mention its applications. [7M]

#### **MODULE - II**

3. a) Write the experimental procedure for the determination of total hardness by EDTA method. [7M]
- b) Distinguish between Temporary and Permanent hardness of water. [7M]  
One liter of water from an underground reservoir in Tirupathi Town in Andhra Pradesh showed the following analysis for its contents:  
 $\text{Mg}(\text{HCO}_3)_2 = 42\text{mg}$ ;  $\text{Ca}(\text{HCO}_3)_2 = 146\text{mg}$ ;  $\text{CaCl}_2 = 71\text{mg}$ ;  $\text{NaOH} = 40\text{mg}$ ;  
 $\text{MgSO}_4 = 48\text{ mg}$ ; organic impurities = 100 mg; Calculate temporary, permanent and total hardness of this sample of 10,000 liters of water.
4. a) Describe the method of Softening of water by using Ion exchange process. [7M]
- b) What is Potable water? Discuss the steps involved in the treatment of Potable water. [7M]

#### **MODULE - III**

5. a) Explain with the neat diagrams the molecular energy level diagrams of following molecules  $\text{N}_2$  and  $\text{F}_2$ ? [7M]
- b) Calculate number of bonding and anti bonding orbital's in  $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{F}_2$ ,  $\text{CO}$  &  $\text{NO}$  molecules? [7M]

6. a) Write a brief account on the following: [7M]  
i. Crystal field theory and magnetic properties of metal complexes.  
ii. Strong and weak field ligands.  
b) With the help of suitable illustrations explain the crystal field splitting of octahedral geometry? [7M]

#### MODULE – IV

7. a) Define addition and substitution reactions and write differences between addition and substitution reactions? [7M]  
b) What is nucleophilic substitution? Explain the mechanism, factors affecting and rate of  $S_N^1$  mechanism. [7M]
8. a) What is Saytzeff's rule? Explain the saytzeff's rule with suitable example. [7M]  
b) The concentration of an optically active compound dissolved in chloroform is 6.15/100ml. A portion of this solution in a 5cm polarimeter tube produced an observed rotation of  $-1.2^\circ$ . Calculate the specific rotation of the compound. [7M]

#### MODULE – V

9. a) Explain in detail about the ultimate analysis of coal. Discuss its advantages. [7M]  
a) Carbon and hydrogen b) Nitrogen c) Sulphur d) Oxygen  
b) Define cracking. Explain about Fixed bed catalytic cracking with a neat diagram? [7M]
10. a) Explain the composition, properties and applications of LPG and CNG? [7M]  
b) Distinguish between Gross calorific value and Net calorific value [7M]  
Calculate the minimum amount of air required for complete combustion of 1 kg of coal sample having the following compositions: C=80%, S=2%, H=5%, N=1% and ash = 4%  
Oxygen in air is 23% by weight.



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## COURSE OBJECTIVES

The course should enable the students to:

I	Apply the electrochemical principles in batteries, understand the fundamentals of corrosion.
II	Analysis of major chemical reactions that are used in the synthesis of molecules.
III	Analyze microscopic chemistry in terms of atomic, molecular orbital's and Intermolecular forces.
IV	Analysis of water for its various parameters and its significance in industrial and domestic applications.
V	Understand the chemistry of various fuels and their combustion.

## COURSE OUTCOMES (COs):

CO 1	Understand the relationship between charge delivered or produced and the amount of reactant used or product formed for both galvanic and electrolytic cells.
CO 2	Ability to describe the purpose and operational steps of water treatment processes used to improve water quality.
CO 3	Recognize that molecular orbital theory is a method used by chemists to determine the energy of the electron in a molecule as well as its geometry.
CO 4	Identify the fundamental principles of stereochemistry, chemical bonding, chemical reactions and mechanism.
CO 5	Understand and analyze the combustion mechanisms of various fuels.

## COURSE LEARNING OUTCOMES (CLOs):

AHSB03.01	Extrapolate the knowledge of electrolytic cell, electrochemical cell, electrode Potential and reference electrodes.
AHSB03.02	Use of primary and secondary batteries in various fields such as automobiles, railways, medical devices, aircrafts and day to day life.
AHSB03.03	Explain the characteristic factors of a metal and environment influencing the rate of Corrosion.
AHSB03.04	Use appropriate methods such as protective, metallic and organic coatings to Control corrosion in metals.
AHSB03.05	Evaluate the quality and utility of suitable water for industrial as well as domestic applications.
AHSB03.06	Use innovative methods to improve the quality of soft water for Potable and industrial purpose at cheaper cost.
AHSB03.07	Understand the basic tenets of molecular orbital theories.
AHSB03.08	Understand the different approaches to types of chemical bonding.
AHSB03.09	Recognize and draw structural isomers, stereoisomerism including enantiomers and diastereomers and racemic mixture.
AHSB03.10	Understand the mechanisms of major classes of organic reactions, including substitutions, eliminations and addition.
AHSB03.11	Retrieve and critically review information on drugs, including how to synthesize them, from literature resources.

AHSB03.12	Demonstrate comprehensive knowledge of conventional fuel properties on engine performance.
AHSB03.13	Understand the importance of cracking, knocking in IC engines and operations involved in petroleum refining.
AHSB03.14	Describe the physical and chemical properties of fuels like natural gas, LPG and CNG.
AHSB03.15	Determine efficiency of the fuel in terms of calorific value and combustion reactions of the fuel.

#### MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No	Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level	
1	a	AHSB03.01	Extrapolate the knowledge of electrode, cell, anode, cathode, electrolysis, electromotive force and reference electrodes.	CO 1	Understand
	b	AHSB03.01	Extrapolate the knowledge of electrode, cell, anode, cathode, electrolysis, electromotive force and reference electrodes.	CO 1	Understand
2	a	AHSB03.02	Identify the electrolytic cell and electrochemical cells with the different types of batteries.	CO 1	Understand
	b	AHSB03.01	Extrapolate the knowledge of electrode, cell, anode, cathode, electrolysis, electromotive force and reference electrodes.	CO 1	Understand
3	a	AHSB03.03	Know the main factors affecting the rate of corrosion.	CO 2	Remember
	b	AHSB03.04	Apply the corrosion control methods to prevent corrosion on metals.	CO 2	Remember
4	a	AHSB03.04	Apply the corrosion control methods to prevent corrosion on metals.	CO 2	Remember
	b	AHSB03.04	Apply the corrosion control methods to prevent corrosion on metals.	CO 2	Remember
5	a	AHSB03.05	Understand the basic tenets of molecular orbital theories	CO 3	Remember
	b	AHSB03.05	Understand the basic tenets of molecular orbital theories	CO 3	Remember
6	a	AHSB03.06	Understand the different approaches to types of chemical bonding	CO 3	Understand
	b	AHSB03.06	Understand the different approaches to types of chemical bonding	CO 3	Understand
7	a	AHSB03.07	Understand the basic tenets of molecular orbital theories	CO 4	Remember
	b	AHSB03.07	Understand the basic tenets of molecular orbital theories	CO 4	Understand
8	a	AHSB03.08	Demonstrate comprehensive knowledge of conventional fuel properties on engine	CO 4	Understand
	b	AHSB03.10	Understand the mechanisms of major classes of organic reactions, including substitutions, eliminations and additions and	CO 4	Understand
9	a	AHSB03.09	Recognize and draw structural isomers, stereoisomer including enantiomers and diastereomers and racemic mixture	CO 5	Remember
	b	AHSB03.13	Understand the importance of cracking, knocking and operations involved in petroleum refining.	CO 5	Understand
10	a	AHSB03.14	Identify the physical and chemical properties of natural gas, LPG and CNG	CO 5	Remember
	b	AHSB03.15	Describe the combustion process of the fuels and the calorific values of the fuels.	CO 5	Understand

Signature of Course Coordinator

HOD, CE