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Question Paper Code: **AHSB03**



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## MODEL QUESTION PAPER-II

First Year B.Tech I Semester End Examinations, December- 2019

**Regulations: R18**

### ENGINEERING CHEMISTRY

(Common to CSE/EEE/IT)

**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) What is Electrochemical cell? Describe the construction and electrode reactions of Daniel cell. [7M]
- b) What are reference electrodes? Explain the construction and working of Quinhydrone electrode. [7M]
  
2. a) Explain how nature of corroding environment influences the rate of corrosion in metals? [7M]
- b) Describe the process of galvanization. How does it prevent the corrosion of iron and mention its applications. [7M]

#### MODULE – II

3. a) How is natural water sterilized by chlorine, bleaching powder, chloramines and ozone? [7M]
- b) One liter of water sample collected from a water source in Telangana has shown the following analysis. Mg (HCO<sub>3</sub>) = 14.6 mg, MgSO<sub>4</sub> = 12 mg, Ca (HCO<sub>3</sub>)<sub>2</sub> = 16.2 mg, CaCl<sub>2</sub> = 22.2 mg, MgCl<sub>2</sub> = 9.5 mg and organic impurities 100 mg. Calculate temporary and permanent hardness in Degree French. [7M]
  
4. a) Explain the following internal treatment methods: [7M]
  - i. Carbonate conditioning
  - ii. Calgon conditioning
  - iii. Phosphate conditioning
- b) What is Potable water? Discuss the steps involved in the treatment of Potable water. [7M]

#### MODULE – III

5. a) Write a short note on LCAO? Explain molecular energy level diagrams for CO and NO molecule with the neat diagram? [7M]
- b) Write a brief account on the following: [7M]
  - i. crystal field theory and magnetic properties of metal complexes
  - ii. strong and weak field ligands

6. a) With the help of suitable illustrations explain the crystal field splitting of octahedral geometry? [7M]
- b) Give the reasons for the following [7M]
- $O_2$  is paramagnetic
  - $N_2$  is diamagnetic
  - CO is diamagnetic
  - NO is paramagnetic

#### MODULE – IV

7. a) What is Markovnikov's rule? Explain briefly with suitable example. [7M]
- b) The concentration of an optically active compound dissolved in chloroform is 6.15/100ml. [7M]  
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.
8. a) Write short notes on the following [7M]
- Electrophiles
  - Nucleophiles
  - Transition state
- b) What are substitution reactions? Explain nucleophilic and electrophilic substitution reactions. [7M]

#### MODULE – V

9. a) Explain the Proximate analysis of coal? [7M]  
a) Moisture b) volatile matter c) ash content d) fixed carbon.
- b) Explain the refining of petroleum by giving the composition, boiling range and uses of various fractions obtained during refining? [7M]
10. a) What is Octane number and Cetane number? Explain their significance. [7M]
- b) A sample of coal contains the following composition Carbon = 84%, Hydrogen = 12%, Oxygen = 2%, Sulphur = 1% and the remainder being ash. Calculate the gross and net calorific values of the fuel. [7M]



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## COURSE OBJECTIVES

The course should enable the students to:

S. No	Description
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	Describe and understand the operation of electrochemical systems for the production of electric energy, i.e. batteries.
CO 2	Explain the mode by which potable water is produced through the processes of screening, micro straining, aeration, coagulation and flocculation, sedimentation, flotation, filtration and Disinfection.
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	Demonstrate an ability to design, implement, and evaluate the results of experimentation using standard scientific methodologies such as hypothesis formulation and testing.
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	AHSB03.02	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
2	a	AHSB03.02	Identify the electrolytic cell and electrochemical cells with the different types of batteries.	CO 1	Understand
	b	AHSB03.02	Identify the electrolytic cell and electrochemical cells with the different types of batteries.	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	AHSB03.07	Understand the basic tenets of molecular orbital theories.	CO 3	Remember
	b	AHSB03.07	Understand the basic tenets of molecular orbital theories.	CO 3	Remember
6	a	AHSB03.08	Understand the different approaches to types of chemical bonding.	CO 3	Understand
	b	AHSB03.08	Understand the different approaches to types of chemical bonding.	CO 3	Understand
7	a	AHSB03.07	Recognize and draw structural isomers, stereoisomers including enantiomers and diastereomers and racemic mixture.	CO 4	Remember
	b	AHSB03.07	Recognize and draw structural isomers, stereoisomers including enantiomers and diastereomers and racemic mixture.	CO 4	Remember
8	a	AHSB03.10	Understand the mechanisms of major classes of organic reactions, including substitutions, eliminations and additions.	CO 4	Remember
	b	AHSB03.10	Understand the mechanisms of major classes of organic reactions, including substitutions, eliminations and additions.	CO 4	Understand
9	a	AHSB03.12	Demonstrate comprehensive knowledge of conventional fuel properties.	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	Understand the importance of cracking, knocking and operations involved in petroleum refining.	CO 5	Understand
	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, CSE**