CO7. Synthesize knowledge of water treatment processes and impurities to design appropriate treatment strategies.

CO8. Apply proximate and ultimate analysis techniques to determine the composition of coal samples and calculate the calorific value of fuels using Dulong's formula and experimental methods.

Printed pages: 03 **Univ. Roll No. .....**

Mid Term Examination, Odd Semester 2023-24
B. Tech. (CSE) I Year, I Semester
BCHS 1101: Engineering Chemistry

Time: 3 Hours **Max. Marks: 30**

Section – A

Note: All questions are compulsory ***3 × 5 = 15 Marks***

No.	Detail of Question	Marks	CO	BL	KL
1	You are an engineering student working on a project related to food processing and quality control. You are curious about the use of artificial food colour in food industry, their chemical content and any potential engineering challenges or consideration related their production and application. Suggest the purpose of using artificial food colour, chemical content and what type of disease is caused by overconsumption.	3	CO5	A	C
2	Discussing the industrial importance of calorific value of fuel, illustrate how HCV of a fuel can be obtained using Bomb calorimeter with suitable diagram. **OR** Provide a detailed breakdown of the differences in 'Graft and Block polymers' highlighting their unique characteristics and properties.	3	CO2	An	C

3	Evaluate the water treatment requirements for 50,000 liters of water sourced from the GLA University Mathura sewage treatment plant (STP). The water contains the following impurities: $Ca(HCO_3)_2$ at 7 ppm, $Mg(HCO_3)_2$ at 8 ppm, $CaCl_2$ at 9 ppm, $MgCl_2$ at 10 ppm, $CaSO_4$ at 11 ppm, and $MgSO_4$ at 12 ppm. Given that lime is 94% pure and soda is 97% pure, calculate the quantities of lime and soda required for effective water treatment.	3	CO2	E	C
4	a. $CaCO_3$ is globally accepted as a standard to represent hardness of water, why? b. Difference LCV and HCV of a fuel.	3	CO4	A	M
5	In your role as the lead engineer at the thermal power plant, you are tasked with optimizing coal combustion. Can you explain the methodology for determining the fixed carbon and volatile matter percentages in coal? Furthermore, discuss the significance of these percentages in the context of enhancing power plant efficiency and performance.	3	CO5	C	M

Section – B

Note: All questions are compulsory *3 × 5 = 15 marks*

No.	Detail of Question	Marks	CO	BL	KL
6	Demonstrate the 'Permutit process' using a clear and informative diagram. Also, discuss the advantages and limitations of this water treatment method to understand its practical implications in environmental science. A zeolite softener was 70 % exhausted when 7000 liters of hard water passed through it. The hardness of water is 250 ppm. How many liters of 15 % NaCl solution would be required to regenerate?	5	CO1	A	F

7	Considering yourself as an engineer, you need to create a clear and informative diagram illustrating the experimental method for determining the percentages of nitrogen in solid fuels, which method you will consider to complete this task. Also, calculate the volume of air required for complete combustion of 100 L of gaseous fuel having the composition CO = 40 % CH_4= 15%, H_2 = 5%, C_2H_4 20%, N_2= 10% and remaining being O_2.	5	CO2	A	C
8	Analyze and compare the functions of (i) flour improvers (specifically antistaling agents and bleaches), (ii) antioxidants, and (iii) preservatives in food products. **OR** In the field of engineering, critically evaluate and compare the preparation method, properties and applications of (i) PET (ii) Bakelite (iii) Delrin	5	CO3	An	C

End of Question paper