

Name: Enrolment No:			
UPES End Semester Examination, December 2025			
Course: Fuel Chemistry Program: B.Sc. (H) Chemistry Course Code: CHEM2016K		Semester: III Time : 03 hrs. Max. Marks: 100	
Instructions: Read all the below mentioned instructions carefully and follow them strictly: 1) Mention Roll No. at the top of the question paper. 2) Scientific calculator is allowed. 3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Define oxygenated fuels with suitable examples. Describe the merits and demerits of oxygenated fuels.	4	CO1
Q 2	A petroleum testing laboratory receives two unknown fuel samples, Sample A and Sample B, to be diesel and petrol. The chemists are asked to identify each fuel and assess their quality using standard analytical techniques. The tests conducted in laboratory and their results are as follows: • Density at 15°C: Sample A = 0.830 g/mL, Sample B = 0.740 g/mL • Viscosity at (40°C): Sample A = 3.2 cSt, Sample B = 0.85 cSt • Distillation Range: Sample A = 180–350°C, Sample B = 40–200°C • Cetane Number: Sample A = 50, Sample B = 10 • Flash Point: Sample A = 60°C, Sample B = –20°C • Aromatic Hydrocarbon Content: Sample A = 25%, Sample B = 38% Based on the test results, identify which sample is diesel and which is petrol, giving chemical reasoning.	4	CO1
Q 3	Explain the term lubricants and classify them based on their composition.	4	CO3
Q 4	In a bomb calorimeter, 0.25 g of coal sample was taken for determination of calorific value. The residue formed in the calorimeter was extracted with acid and acid extract was treated with BaCl ₂ solution. In this reaction white precipitates of Barium sulphate (BaSO ₄) was obtained. The precipitates were filtered, dried and weighed. The weight of BaSO ₄ ppt was 0.2 g. Calculate the percentage of Sulphur in the sample.	4	CO2

Q 5	List out the products obtained in the fractional distillation of coal tar.	4	CO2
SECTION B (4Qx10M= 40 Marks)			
Q 6	Discuss its composition, calorific value, and major industrial applications of Coal gas.	10	CO2
Q 7	A 2.1 g coal sample is combusted in a combustion tube. During the process, the mass of the CaCl₂ tube increases by 0.53 g, and the mass of the KOH tube increases by 5.73 g. (a) Calculate the percentage of carbon and hydrogen present in the coal sample based on the combustion data. (b) Identify the type of coal based on its composition and discuss its industrial significance.	6+4	CO2
Q 8	Describe the various methods of the preparation and applications of petrochemical-Vinyl acetate. OR Describe the various methods of the preparation and applications of petrochemical- Propylene oxide.	10	CO3
Q 9	Mention ten different petroleum products obtained from the fractional distillation of crude oil. For each product, state its approximate boiling point range and one major industrial or domestic application.	10	CO2
SECTION-C (2Qx20M=40 Marks)			
Q 10	What is transesterification reaction? Describe in detail the reaction mechanisms involved in acid-catalyzed and base-catalyzed transesterification processes used in biodiesel production. Discuss the key steps, reaction conditions, and comparative advantages of each method. OR Write the short notes on the following: 1. Biogas 2. Fuel cell 3. CO₂ to valuable product 4. Synthetic fuels	20 4x5=20	CO3
Q 11	Define cracking and explain its significance in petroleum refining. Discuss in detail the various types of cracking processes. Elaborate on the moving-bed catalytic cracking process, describing its working principle with the help of a neat and labelled diagram.	5+5+10	CO2