Roll No.											

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 13 – 12- 2025 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B.Tech. (PET)	
Course Code: PET3013	**Course Name:** Advanced Refining Engineering	
Semester: VII	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Marks	**N.A.**	**N.A.**	**26**	**24**	**24**	**26**

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2 marks. **10Q x 2M=20M**

1.	In a petroleum refinery, Naphtha is a primary feedstock for the catalytic reforming process. List the components that are present in Naphtha.	**2 Marks**	**L2**	**CO3**
2.	State the reason why FAU-type zeolite is commonly used in catalytic cracking.	**2 Marks**	**L2**	**CO3**
3.	Describe the main function of a gasifier in the Flexi-coking process.	**2 Marks**	**L2**	**CO3**
4.	Define the catalytic reforming process and state its main purpose.	**2 Marks**	**L2**	**CO4**
5.	State the meaning of the term Dehydrocyclization by recalling what this term refers to in petroleum refining, specifically in relation to the chemical transformation that converts straight-chain hydrocarbons into aromatic compounds.	**2 Marks**	**L2**	**CO4**
6.	List four essential process variables in the “Sulfuric acid alkylation” process.	**2 Marks**	**L2**	**CO5**
7.	Define the isomerization process and mention one suitable example.	**2 Marks**	**L2**	**CO5**

8.	State why zeolite-type materials are preferred as acidic supports in the isomerization process.	**2 Marks**	**L2**	**CO6**
9.	Describe why acid concentration must be kept above 88% during alkylation process.	**2 Marks**	**L2**	**CO6**
10.	Define the term "Alkylation".	**2 Marks**	**L2**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Apply the principles of the Power Forming process to a real petroleum-refining scenario by illustrating how the selected catalyst, operating conditions, and process objectives would be implemented to improve gasoline octane number in a refinery.	**10 Marks**	**L3**	**CO3**
	b.	Using a practical refinery situation, demonstrate how the Selecto Forming process can be implemented to achieve improved reformate quality. Apply your understanding of its objectives, process conditions, and industrial applications to show how this process enhances modern refining performance.	**10 Marks**	**L3**	**CO3**
Or					
12.	**a.**	A refinery receives a feedstock with high naphthene content. Apply your understanding of reforming processes to select and implement the most suitable technology-Platforming, Houdri Forming, or Ultra-Forming-and explain how your chosen process improves octane number and overall unit performance.	**10 Marks**	**L3**	**CO3**
	b.	Apply the principles of feedstock selection and reaction-condition optimization to design a cracking strategy that minimizes coke formation during naphtha steam cracking. Justify the operating parameters you choose.	**10 Marks**	**L3**	**CO3**

13.		Apply the principles of catalytic reforming to illustrate, using a suitable diagram, how key reactions (such as dehydrogenation, isomerization, and hydrocracking) occur in the process. Using this diagram, demonstrate how the choice of catalyst influences the resulting products and explain how these outcomes can be applied to enhance fuel quality in industrial refining operations.	**20 Marks**	**L3**	**CO4**
Or					
14.	**a.**	Using your understanding of the principles of Houdry catalytic cracking, construct a detailed and neatly labelled process flow diagram (PFD) that represents the major units involved in the operation of the process. Apply the concepts of fixed-bed	**10 Marks**	**L3**	**CO4**

		catalytic cracking to demonstrate, step-by-step, how feedstock is preheated, brought into contact with the catalyst, cracked into lighter hydrocarbons, and finally separated into useful product streams. In your explanation accompanying the diagram, clearly show how catalyst deactivation, regeneration cycles, temperature control, and flow direction influence the overall product distribution, including gasoline, light gases, and coke formation. Further, apply your knowledge of reactor operation to explain how changes in operating conditions (temperature, feed characteristics, and catalyst activity) affect the yields and selectivity of the major products.			
	b.	Illustrate the application of rare-earth materials in catalytic systems by using relevant examples to show how their properties enhance catalyst performance in industrial processes.	**10 Marks**	**L3**	**CO4**

15.	**a.**	Analyze the influence of varying steam concentration on naphtha cracking by comparing how changes in steam-to-hydrocarbon ratio alter the reaction mechanism, shift the product distribution, and affect the tendency for coke formation.	**10 Marks**	**L4**	**CO5**
	b.	Examine the sulfuric acid (H_2SO_4) alkylation process by analyzing the key operational challenges and evaluating the effectiveness of different mitigation strategies used to address issues such as corrosion, acid consumption, emulsions, and product quality.	**10 Marks**	**L4**	**CO5**
Or					
16.	**a.**	Analyze the Hydrofluoric Acid (HF) alkylation process by differentiating its key process stages and operational considerations, and illustrate how each stage contributes to the overall process by constructing and interpreting a detailed flow analysis diagram.	**10 Marks**	**L4**	**CO5**
	b.	Compare and analyze the process overview, reaction conditions, product formation pathways, and industrial applications of the alkylation process, highlighting the interrelationships between these aspects and their influence on process performance.	**10 Marks**	**L4**	**CO5**

17.		Analyze the isomerization process that employs a platinum catalyst in conjunction with an acidic support by breaking down its key functional components-metal function, acidic function, reaction mechanism, catalyst composition, and process conditions. Further, compare and examine how these components collectively influence industrial applications and	**20 Marks**	**L4**	**CO6**

		assess the specific advantages provided by the platinum catalyst within the process.			
Or					
18.		Analyze the key differences between Hydrofluoric Acid (HF) and Sulfuric Acid (H_2SO_4) alkylation processes by examining their reaction mechanisms, catalyst characteristics, operational conditions, equipment design requirements, and product quality. Further, evaluate how variations in catalyst behavior, corrosion issues, environmental risks, and safety considerations influence the selection of either process in modern refinery operations. Provide a comparative analysis supported with scientific reasoning.	**20 Marks**	**L4**	**CO6**