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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: LNG & Storage of Natural Gas **Semester: VII**
Program: B.Tech. APE Gas **Time: 03 hrs**
Course Code: CHGS4005 **Max. Marks: 100**
No of pages: 02
Instructions: Assume suitable data, if necessary.

SECTION A
(Scan and upload) **(5Qx 4M = 20 Marks)**

Q. No.	Short answer type questions. Each carries 4 marks.	Marks	CO
Q.1	Define and explain the term LNG.	4	CO1
Q.2	Outline the significance of underground LNG storage tanks.	4	CO2
Q.3	List the facilities required at LNG regasification terminal.	4	CO3
Q.4	Describe the construction and working of a 'Submerged Combustion Vaporizer' (SCV) for LNG. Diagram is not required.	4	CO4
Q.5	Recall and write the significance of storage of natural gas.	4	CO5

SECTION B
(Scan and upload) **(4Qx 10M = 40 Marks)**

Q. No.	Medium answer type questions. Each carries 10 marks.	Marks	CO
Q.1	Analyze the new technology developments leading to cost reduction in LNG shipping along with the constraints.	10	CO2
Q.2	Describe the guidelines for LNG contract negotiations with regard to 'Shipping and Transportation' and 'Supply or Pay'. As India is an importer of LNG and likely to continue in future, the guidelines should be with respect to buyer's side.	10	CO3
Q.3	Illustrate the construction and working of an 'Open Rack Vaporizer' for LNG (Diagram is necessary). Also list its merits and demerits.	10	CO4
Q.4	Analyze and describe 'depleted reservoirs' as one of the methods of underground storage of natural gas. **OR** Analyze and describe 'salt cavern storage' as one of the methods of underground storage of natural gas.	10	CO5

SECTION C (Scan and upload)		(2Qx 20M = 40 Marks)	
Q. No.	**Long answer type questions. Each carries 20 marks.**	**Marks**	**CO**
Q.1	Open rack vaporizer is being used for regasification of LNG entering at -161.5 ^{o}C to RLNG leaving at 0 ^{o}C. Sea water is being used as heating medium entering at 25 ^{o}C and leaving at 5 ^{o}C. Overall heat transfer coefficient based on outer tube surface is 80000 W/(m^2K). Calculate surface area and total number of tubes required for following cases. Justify your answers. Case 1: Tube length = 4 m Case 2: Tube length = 8 m Case 3: Tube length = 12 m **Data** • Tube OD = 20 mm • Type of flow = countercurrent • LMTD correction factor = 0.9 • Flow rate of sea water = 24000 m^3/hr • Density of sea water = 1.03 g/ml • Specific heat of sea water = 3850 J/kg K	**20**	**CO4**
Q.2	Describe with flow diagram, 'BHP Nitrogen Expander Process' for LNG production. Also, give the advantages and areas of concern of the same process. **OR** Describe with flow diagram, 'Black & Veatch-Pritchart PRICO Process' for LNG production. Also, discuss the advantages and areas of concern of the same process.	**20**	**CO1**