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**UNIVERSITY OF PETROLEUM
AND ENERGY STUDIES**



End Semester Examination, April, 2017

Program/course: B.Tech. APE Gas
Subject: LNG & NGL Conversion & Handling
Code : PTEG 464
No. of page/s: 02

Semester – VIII
Max. Marks: 100
Duration : 3 Hrs

- Note:** 1) Mention Roll No at the appropriate place in the question paper.
2) No student will leave the room till one hour from the commencement of examination.
3) Assume suitable data, if necessary.

Section A

Answer any five questions. Each carries 12 marks. [12X 5 = 60 Marks]

Q.1 Describe with flow diagram, mechanical refrigeration process for natural gas liquid (NGL) recovery. [12]

Q.2 What marine facilities are required for LNG receiving terminal? Explain in detail. [12]

Q.3 Describe LNG pricing conceptualization with respect to pricing formula, straight line approach and ceiling and floor approach. Figures are necessary. [12]

Q.4 Draw well labelled sketches for each of the following LNG vaporizers: [12]

a) Open rack vaporizer b) Submerged combustion vaporizer c) Glycol-water intermediate fluid vaporizer

Q.5 Elaborate on “Selection of NGL recovery processes”. [12]

Q.6 LNG tanker, DISHA (Hull No. 2210) was delivered on 20 March 2017 from Ras Laffon, Qatar to LNG terminal Dahej, India for transporting 15 MMT (million metric tons) of LNG. The tanker reached its destination on 25 March 2017. Estimate the total quantity of boil-off gas produced (in kg) during transportation, for a boil-off rate of 0.2 wt % per day. [12]

Section B

Answer both the questions. Each carries 20 marks. [20X 2 = 40 Marks]

Q.7 Describe with flow diagram, Black & Veatch-Pritchard PRICO process for LNG production. Also give its advantages and areas of concern. [20]

Q.8 Open rack vaporizer is being used for regasification of LNG entering at -161.5°C to RLNG leaving at 0°C . Sea water is being used as heating medium entering at 30°C and leaving at 5°C . Overall heat transfer coefficient based on outer tube surface is $50000\text{ W/m}^2\text{C}$. Calculate surface area and total number of tubes required for the same vaporizer if tube length is 8 m.

Data for Q.8:

- Tube OD = 20 mm
- Type of flow = countercurrent
- LMTD correction factor = 1
- Flow rate of sea water = $24000\text{ m}^3/\text{hr}$
- Density of sea water = 1.03 g/ml
- Specific heat of sea water = $3850\text{ J}/(\text{kg }^{\circ}\text{C})$

Answer following sub-questions related to Q.8:

- a) How many tubes will be required if sea water flow rate is reduced to $15000\text{ m}^3/\text{hr}$? Rest is unchanged.
- b) How many tubes will be required if overall heat transfer coefficient is reduced to $30000\text{ W/m}^2\text{C}$? Rest is unchanged.

Justify your answers.

[20]

