

[5254]-50
B.E. (Mechanical)
CRYOGENIC ENGINEERING
(2008 Pattern) (Open Elective)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of logarithmic tables, Mollier charts, electronic pocket calculator is allowed.*
- 6) Assume suitable data, if necessary.*

SECTION - I

- Q1)** a) Explain the working and thermodynamic analysis of Linde-Hampson system with the help of neat diagram and develop the expression for liquid yield. **[10]**
- b) Explain, briefly the variation of thermal properties of gases in cryogenic range of temperature. **[6]**

OR

- Q2)** Write Short Notes on : **[16]**

- a) Collins Heat Exchanger
- b) Kapitza System
- c) Meissner Effect
- d) Vacuum shielded vessels

- Q3)** a) State the different landmarks in the history of Cryogenics since its inception. **[4]**
- b) Explain the concept of Superconductivity observed at Cryogenic temperature. **[6]**
- c) State with neat sketch Super-fluidity phenomena observed in case of liquid Helium. **[6]**

P.T.O.

OR

- Q4)** a) What are the system performance parameters in liquefaction systems- Explain. [8]
- b) Explain effect of Cryogenic temperature on thermal properties of solids in detail. [8]

- Q5)** a) Develop an expression for work requirement per unit mass for an ideal liquefaction system. [8]
- b) Determine the ideal work requirement for liquefaction of helium beginning at 1 atm. and 300 K. Also determine the heat rejected in the ideal isothermal compressor in KJ/kg. [10]

Properties of Helium			
Pressure (atm)	Temperature (K)	Enthalpy (KJ/kg)	Entropy (KJ/kg.K)
1.00	4.224 (Sat. Liq)	9.711	3.454
	4.224 (Sat. Vap.)	30.13	8.287
1.00	300	1573.0	31.41

OR

- Q6)** a) Explain the working of Gifford McMahon Cryorefrigerator with neat diagram. [8]
- b) Represent Stirling Cycle on P-V and T-s diagram. Develop an expression for C.O.P. of the Stirling Cycle. When used as a liquefier, what is its efficiency? [10]

SECTION - II

- Q7)** a) Name and explain the instruments used for measuring strain in cryogenic temperature range. Also discuss the effect of low temperature on strain measurements. [8]
- b) Discuss : [8]
- Cryogenic fluid Storage vessel piping arrangements
 - Methods of draining the vessels

OR

- Q8)** a) Give classification of heat exchangers used in cryogenic Air Separation plants. Explain with the help of neat sketches the construction and working of aluminum brazed multi-channel plate-fin heat exchangers. [10]
- b) Explain in detail, what is meant by J-T effect and Inversion Curve. [6]

Q9) Write short note on : [16]

- a) Applications of cryogenics
- b) Cryogenic insulations
- c) Space Simulation chamber
- d) Cryogenic Valves

OR

- Q10)** a) Explain, briefly the variation of thermal properties of solids in cryogenic range of temperature. [8]
- b) Explain in detail, what is meant by J-T effect and Inversion Curve. [8]

- Q11)** a) Name and explain the instruments used for measuring strain in cryogenic temperature range. Also discuss the effect of low temperature on strain measurements. [8]
- b) Explain the different possible piping arrangements in Dewar vessel. Recommend the most desirable piping arrangement with explanation. Explain the method used for draining the Dewar Vessel. [10]

OR

- Q12)** a) Draw a schematic diagram of Heylandt cycle. Explain its operation using T-s diagram. Develop expressions for yield, work and efficiency. [12]
- b) Discuss the effect of compressor and expander efficiency on system performance. [6]

