SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL NO: | | | | | | | | | | | | |

Total number of pages: [02] **Total number of questions: 08**

M. Tech. Chemical Engineering - 3rd Semester (RP)

Refrigeration Engineering

Subject Code: MTCH-313

Paper ID:

Time allowed: 3 Hrs **Max Marks: 100**

Important Instructions:

- **Attempt any five questions**
- **All questions carry equal marks**
- **Assume, if any additional data is required but justify the same.**
- **Use of steam tables and refrigeration tables is allowed.**

Q. 1: **(a)** Using P-V and T-s diagrams and mentioning suitable assumptions, derive an expression of COP of reversed Carnot refrigeration cycle (single phase). What are it's limitations? **(10 Marks)**

(b) Explain difference between heat engine, refrigerator and heat pump. **(10 Marks)**

Q. 2: Describe simple vapour compression cycle with the help of p-v, T-s, p-h and schematic diagram. Show the mass flow rate of refrigerant, work done per of refrigeration and COP. Describe the effect of subcooling, superheating, condenser pressure, evaporator pressure and use of regenerative heat exchanger on performance of simple vapour compression system. **(20 Marks)**

Q. 3: An ammonia refrigerating plant is working at an evaporating temperature of -35°C and condensing temperature of 40°C. There is subcooling of 5°C of liquid refrigerant, and the vapour in dry saturated state at inlet to the compressors. The capacity is 150 kW refrigeration.

Estimate the power consumption, when two stage compression with flash intercooling and flash gas removal is used. If two stage compression is compared with single stage

compression, then what will be the percentage saving in the power consumption?

(20 Marks)

Q. 4: **(a)** Explain the working of practical aqua ammonia vapour absorption refrigeration system using schematic diagram. Clearly describe the function of each and every component of the system. **(10 Marks)**

(b) Describe Electrolux refrigeration system with neat sketch. **(10 Marks)**

Q. 5: **(a)** What do you understand by nomenclature of refrigerants? How are various refrigerants i.e. halocarbon compounds, inorganic compounds, hydrocarbon compounds and azeotropes are designated? **(10 Marks)**

(b) Considering environmental aspects discuss about alternative refrigerants.

(10 Marks)

Q. 6: **(a)** Discuss the selection of compressors for various refrigeration applications.

(10 Marks)

(b) Explain various expansion devices used in refrigeration industry. **(10 Marks)**

Q. 7: **(a)** Explain Linde-Hampson liquefaction system using schematic diagram and temperature-entropy diagram. **(10 Marks)**

(b) Describe the refrigeration system to obtain solid carbon dioxide using suitable diagrams.

(10 Marks)

Q. 8: **(a)** Explain steam jet refrigeration system using a neat schematic diagram. What are its limitations? Write approximately minimum temperature can be achieved by it.

(10 Marks)

(b) Write short note on the following:

(i) Joule-Thomson coefficient and throttling of real gases.

(ii) Flooded evaporator with schematic diagram. **(10 Marks)**