

PARUL UNIVERSITY
FACULTY OF AGRICULTURE
B.Tech. (Dairy Technology) Winter 2019-20 Examination

Semester: 3**Subject Code: 20104205****Subject Name: Refrigeration and Air Conditioning****Date: 29/11/2019****Time: 10.30 am TO 12.30 pm****Total Marks : 50**

- Note:**
1. All questions are compulsory.
 2. Figures to the right indicate full marks.
 3. Make suitable assumptions wherever necessary.
 4. Start answer of new question on new page.
 5. Use properties table/chart, if necessary.

Q.1 A) Fill in the blanks (Each of 0.5 Mark) (05)

- i) One ton of refrigeration is equal to kJ/min
- ii) The working fluid in a vapour compression refrigeration cycle is called as
- iii) In a vapour compression refrigeration system, the condenser is connected in between and expansion valve (throttling device)
- iv) In actual vapour compression refrigeration system, the suction pressure in compressor isthan that in theoretical vapour compression refrigeration cycle
- v) Heat rejected in condenser is the sum of heat absorbed in evaporator and
- vi) Ammonia is an example of(primary / secondary) refrigerant
- vii) Ideally the condensation is a constant process
- viii) In LiBr-Water vapour absorption system is the refrigerant
- ix) is the most common type of expansion valve for small capacity refrigeration systems like home refrigerators
- x) Hair hygrometer is used to measure

B) Choose the correct answer from the alternatives given (Each of 0.5 Mark) (10)

- i) The superheating of vapour refrigerant at the entrance of compressor is due to
 - a. use of automatic control to prevent wet compression
 - b. heat gained by refrigerant through the pipes of overloaded evaporator
 - c. heat gained by refrigerant through the pipe connecting evaporator to compressor
 - d. all of the above
- ii) Most common refrigerant used in a large capacity industrial vapour compression refrigeration systems is
 - a. Ammonia
 - b. R-22
 - c. R-12
 - d. All of the above
- iii) The wet bulb approach is a performance indicator for
 - a. cooling tower
 - b. shell and tube condenser

- c. evaporator
- d. compressor

iv) In vapour absorption system, the work of compressor is achieved by

- a. absorber, analyzer and rectifier
- b. absorber and rectifier only
- c. analyzer and rectifier
- d. absorber, pump and generator

v) The Coefficient of Performance of vapour compression refrigeration cycle is given by

- a. (work done) / (refrigeration effect)
- b. (work done) x (refrigeration effect)
- c. (work done) + (refrigeration effect)
- d. (refrigeration effect) / (work done)

vi) is the temperature of air measured by using a thermometer having wet weak at surrounding its bulb

- a. Wet bulb temperature
- b. Dry bulb temperature
- c. Due point temperature
- d. None of these

vii) During evaporative cooling,

- a. water vapour pressure remains constant
- b. specific humidity of air remains constant
- c. condensation of water vapour takes place
- d. enthalpy of air remains constant

viii) The dry bulb temperature (DBT) of saturated air is always its wet bulb temperature (WBT)

- a. more than
- b. equal to
- c. less than
- d. independent of

ix) The wet bulb depression of air is an indication of its

- a. degree of saturation
- b. dry bulb temperature
- c. relative humidity
- d. Both a and c

x) The sling psychrometer can measure

- a. only dry bulb temperature

- b. only wet bulb temperature
 - c. both dry bulb temperature and wet bulb temperature
 - d. either dry bulb temperature or wet bulb temperature
- x) refrigeration system can be ideal for dairy industry as different products need different storage temperatures
- a. Multi-evaporator
 - b. Simple vapour compression
 - c. Compound compression
 - d. All of these
- xii) The simple vapour compression refrigeration cycle has following process sequence
- a. evaporation- compression-expansion-condensation
 - b. compression-condensation-expansion-evaporation
 - c. condensation-evaporation-compression-expansion
 - d. expansion-evaporation-condensation-compression
- xiii) The function performed by compressor in vapour compression refrigeration system is combinedly performed by vapour absorption refrigeration system.
- a. absorber and generator
 - b. pump and generator
 - c. absorber and pump
 - d. absorber, pump and generator
- xiv) Rectifier used in absorption refrigeration system removes
- a. water vapours from the refrigerant vapour and prevents its entry into condenser
 - b. refrigerant vapours from refrigerant and prevents its entry into evaporator
 - c. water vapours from the refrigerant vapour and prevents its entry into generator
 - d. water vapours from the refrigerant vapour and prevents its entry into evaporator
- xv) The Chlorofluorocarbon (CFC) refrigerants are being banned step by step because of
- a. their cost
 - b. their ozone depletion potential
 - c. their toxicity
 - d. all of the above
- xvi) Superheating of refrigerant in evaporator when other factors are unchanged would
- a. decrease COP
 - b. improve COP
 - c. have no effect of COP
 - d. none of these
- xvii) Cold storage loads consist of
- a. air change load

- b. product load
- c. wall gain load
- d. all of these

xviii) Flash chamber is connected in the vapour compression refrigeration system.

- a. to ensure liquid feed to evaporator
- b. to remove the vapour formed during throttling
- c. to prevent subcooling of refrigerant
- d. both a and b

xix) Cooling tower is essential if thecondenser is used.

- a. air cooled
- b. water cooled
- c. evaporative
- d. none of these

xx) The evaporative cooling is a

- a. constant temperature process
- b. constant enthalpy process
- c. constant humidity process
- d. constant volume process

Q.2 A Define the following (Any five)

(05)

- (1) Sensible Heat Ratio
- (2) COP
- (3) Ton of Refrigeration
- (4) Compression Ratio
- (5) Bypass Factor of cooling coil
- (6) Dew Point Temperature
- (7) Specific Humidity

B Answer the following (Any five)

(05)

- (1) 10 m³/min air at 36 °C is passed over cooling coil having surface temperature of 10 °C, which cools the air up to 16 °C. The bypass factor of coil is.
- (2) Water at 32.5 °C is passed through a cooling tower having air of 22 °C wbt. If water temperature drops by 8 °C, find the efficiency of cooling tower.
- (3) Why ammonia is preferred over other refrigerants in large refrigeration systems?
- (4) State the relation between wet bulb depression, dry bulb temperature and wet bulb temperature.

- (5) Vapour absorption system having -5°C , 30°C and 100°C as evaporator, condenser and generator temperatures respectively. Its C.O.P. will be
- (6) What do you understand by the term 'sub-cooling' of refrigerant after condensation
- (7) What is the function of 'generator' in a vapour absorption refrigeration system?

Q.3 Write short notes on the following (Any five)

(10)

- (1) Types of cooling loads in cold storage
- (2) Principle of operation of cooling tower.
- (3) Function of thermostatic expansion valve.
- (4) Rectifier in vapour absorption system
- (5) Dehumidification with cooling
- (6) Sensible heating of air

Q.4 Answer the following in detail (Any three)

(15)

- (1) With a neat sketch or p-h diagram, explain the working of a vapour compression refrigeration system. Also state the effect of: i) superheating of vapour refrigerant before compression and ii) subcooling of liquid refrigerant after condensation, on the COP of the cycle.
- (2) Give a neat sketch of psychrometric chart indicating different lines on it. Describe any three psychrometric processes with its representation on the chart.
- (3) A refrigerating machine works between 30°C and -10°C uses ammonia as refrigerant. If the vapour is dry at the end of compression, calculate the performance of cycle assuming no sub-cooling. Also find the mass flow rate of the refrigerant required to achieve the capacity of 5 TR.
- (4) Explain the operation of multi load system operating at same temperatures and at different temperatures respectively. Draw neat operational diagram and p-H interpretation.