REFRIGERATION AND AIR CONDITIONING

QUESTION BANK

PREPARED BY

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1. Short questions (2 marks)
    a) Write the name of four important components of vapour compression system.
    b) Define ‘tonne’ of refrigeration.
    c) Differentiate between heat pump and refrigerator.
    d) Define sub-cooling. Explain its effect on COP of a vapour compression refrigeration cycle
    e) Define COP of refrigerator and heat pump.
    f) What is the function of refrigerant
    g) Define relative humidity
    h) What do you mean by refrigeration
    i) Define sensible heat factor
    j) Define DBT, DPT, WBT
    k) Define humidity ratio
    l) Why comfort chart is recommended
    m) What do you understand by human comfort
    n) What is the use of air filter and blower in air conditioning system
    o) Define moist air
    p) Name the equipment used in air conditioning system
    q) What are the chemical formula of refrigerant R-11, R-12, R-22, R114
    r) What is saturated air
    s) Draw T-S and P-H diagram for VCRS when vapour after compression is (i) dry saturated and (ii) wet
    t) Why throttle valve is used in VCRS instead of expansion cylinder
    u) Define heat rejection factor
    v) Define fouling factor
    w) Define the function of a condenser in refrigeration system
    x) What are the factors affect heat transfer capacity of an evaporator.
    y) Name the components of air conditioning system.
2. Questions (5 Marks)
    a) Differentiate between open and close refrigeration system
    b) Explain different physical properties of refrigerant
    c) Describe simple VARS
    d) Compare VARS with VCRS
    e) Differentiate between summer air conditioning and winter air conditioning system.
    f) State the factors considered while selecting a refrigerant
    g) Describe chemical properties of a ideal refrigerant
    h) With the help of psychrometric chart, explain sensible heating and sensible cooling

i) In a vapour absorption refrigeration system, heating, cooling and refrigeration takes place at the temperature of 100°C, 20°C and -5°C respectively. Find COP of refrigeration system.

j) Derive the expression for COP of vapour compression cycle when vapour is superheated before compression with proper P-h and T-S diagram.

k) Write down properties of refrigerant-absorbent combination in vapour absorption refrigeration cycle

l) A Carnot refrigeration cycle works between the temperature limit of 27°C and -3°C. Determine (i) COP as refrigerator

(ii) If heat absorb is 1130 KJ/min, find work done per second
and (iii) COP of heat pump

m) Explain with the help of diagram, the practical vapour absorption refrigeration system.

n) State the advantages of closed air refrigeration system over open air refrigeration system

o) A carnot cycle machine operates between the temperature limits of 47°C and -30°C. Determine the COP when it operates as a. refrigerator, b. heat pump and c. heat engine.

p) Describe the mechanism of simple VCRS

q) Draw ideal and actual p-v diagram for reciprocating compressor.

r) Compare between air cooled and water cooled condenser

s) Explain working of automatic expansion valve.

t) What is a sling psychrometer? Explain with neat sketch

u) Write a short note on by-pass factor for cooling coils.

3. Questions (10 marks)

a) Atmospheric air at pressure 1 bar and temperature 10°C is drawn in compressor of Bell-Coleman cycle. The air is then compressed to 5 bar. The compressed air is cooled to 25°C before entering to the expansion valve. Considering $PV^{1.2} = C$ for the compression and expansion, find COP of the cycle.

b) A refrigerating system working on bell- Coleman cycle receives air from cold chamber at -5°C and compresses it from 1 bar to 4.5 bar. The compressed air is then cooled to temperature of 37°C before it is expanded in the expander. Calculate COP of the system when the compression and expansion are isoentropic.

c) A vapour compression refrigerator uses ammonia and operates between temperature limits of -10°C and 25°C. At the end of compression, the refrigerant is dry-saturated. Find the COP of the refrigerator assuming no under-cooling. [5]

Saturation temperature °C	Liquid heat (kJ/kg)	Latent heat(kJ/kg)	Liquid entropy (kJ/kg K)

25	298.9	1166.94	1.1242
-10	135.37	1297.68	0.5443

d) A VARS operates between temperature limits of -10°C and 45°C. At entry to the compressor, the refrigerant is dry and saturated and after compression it acquires a temperature of 60°C. Find COP of the refrigerator.

Saturation temperature °C	Enthalpy		Entropy	
	Liquid (kJ/kg)	Vapour (kJ/kg)	Liquid (kJ/kg K)	Vapour(kJ/kg K)
45	133.0	483.6	0.485	1.587
-10	45.4	460.7	0.183	1.637

e) How actual VCRS differs from theoretical VCRS

f) A single stage reciprocating compressor is required to compress 1.5 m3/min of vapour refrigerant from 1 bar to 8 bar. Find power required to drive the compressor if the compression of refrigerant is 1. Isothermal, 2. Polytropic with n=1.12 and 3. isoentropic.

g) Explain various types of water cooled condenser.

h) Write a short note on cooling tower, spray pond and evaporative condenser.

i) The atmospheric condition of air are 25°C DBT and specific humidity of 0.01 kg per kg of dry air. Find Partial pressure of vapour, relative humidity and dPT

j) An air conditioning plant is required to supply 60 m3 of air per minute at a DBT of 21°C and 55% RH. The outside air is at DBT of 28°C and 60% RH. Determine the mass of water drained and capacity of cooling coil. Assume cooling and dehumidification process.

k) Write a short note on factors affecting comfort air conditioning