ABES ENGINEERING COLLEGE, GHAZIABAD
Department of Mechanical Engineering 2023-24
Fundamentals of Mechanical Engineering (BME 101)

QUESTION BANK	Unit III
Topic	**Introduction to Refrigeration and Air-Conditioning**
Course	**B. Tech**
Semester	**I**

Q. NO.	Short Types Question (2 Marks)
1.	List the components of a vapor compression refrigeration system and show them in sequence by a block diagram.
2.	Define the functioning of air-conditioning and list the different components of window air conditioner.
3.	List the different methods of refrigeration.
4.	What is Refrigeration effect? Also define 1ton of refrigeration.
5.	Define the term 'air-conditioning' and 'comfort air-conditioning'.
6.	Define the COP of a refrigerator. Write expression of COP of a refrigerator with suitable diagram.
7.	State the difference between a refrigerator and a heat pump. Discuss the relation between COP of refrigerator and COP of heat Pump.
Q. NO.	**Long Types Question (7 Marks)**
8.	What do you mean by refrigeration? Explain basic components and working of domestic refrigerator with suitable sketch.
9.	What are the different methods of refrigeration? And also explain any four of the method.
11.	Explain basic components and working of Window Air Condition.
10.	Names any four Psychometric process and represent them on the Psychometric chart.
12	What is Heat Pump? Describe about the purpose, COP and concept of heat pump.
13.	Define the following Terms: (i) Dry Bulb Temperature (ii) Wet Bulb Temperature (iii) Dew point Temperature (iv) Specific humidity (v) Relative humidity (vi) Comfort condition
14.	Define coefficient of performance of Vapour compression refrigeration system. Also write down the expression of COP of vapour compression refrigeration system.
15	Explain the working of vapour compression refrigeration system by T-S and P-H diagram with related block diagram.
	NUMERICALS
16	A refrigeration system produces 40 Kg/hr of ice at 0°C from water at 25°C. Find the refrigeration effect per hour and TR. If it consumes 1KW of energy to produce the ice, find the COP. Take latent heat of solidification of water at 0°C as 335 KJ/Kg and specific heat of water is 4.19 KJ/Kg °C. Ans : 17,590KJ/hr, 1.39 TR, 4.88
17.	In an ammonia vapour compression system, the pressure in the evaporator is 2 bar. Ammonia at exit is 0.85 dry and at entry its dryness fraction is 0.19. During compression, the work done per Kg of ammonia is 150 KJ. Calculate the COP and volume of vapour entering the compressor per minutes, if the rate of ammonia circulation is 4,5 Kg/min. The latent heat and specific volume at 2 bar are 1325 KJ/Kg and 0.58 m^3/Kg respectively. Ans : 5.83, 2.61 m^3/min

18.	In a 5kW cooling capacity refrigeration system operating on V.C. cycle, refrigerants enter evaporator with an enthalpy of 75 KJ/kg, leaves with an enthalpy of 183 KJ/kg. Enthalpy of refrigeration after compression is 210 KJ/kg. Calculate: (i) COP (ii) Power input to compressor in kW (iii) Rate of heat transfer in condenser in KW. Ans : (i) 4 , (ii) 1.25 KW , (iii) 6.25 KW
19	A heat pump has a COP of 1.7. Determine the heat transferred to and from this heat pump when 50 kJ of work is supplied.
20	The food compartment of a refrigerator is maintained at 4°C by removing heat from it at a rate of 360 kJ/min. If the required power input to the refrigerator is 2 kW, determine (a) the COP of the refrigerator and (b) the rate of heat rejection to the room Ans : (a) 3, (b) 8 KW
21	The capacity of a refrigeration system is specified to be 12 tons. What is the cooling rate of the machine? Ans : 42KJ/s
22	250 litres of drinking water is required per hour at 10°C. Would the use of 1.5 ton refrigerating system be justified if the available water is at 30°C? Ans : Does not serve the purpose(Tonnage required is 1.658 TR)
23	A refrigerating machine takes 1.25kW and produces 25kg/hr of ice at 0°C from water available at 30°C. Determine refrigerating effect, tonnage and coefficient of performance of machine. Take Specific heat of water = 4.18 KJ/Kg K Enthalpy of solidification of water from and at 0°C = 335 KJ/kg Ans : 11,510 KJ/hr, 0.913 TR, 2.588
24	A domestic food freezer maintains a temperature of -15 °C. The ambient air temperature is 30º C. If heat leaks into the freezer at the continuous rate of 1.75 kJ/s what is the least power necessary to pump this heat out continuously. Ans : 0.305 KW
25	A cyclic heat engine operates betw een a source temperature of 900° C and sink temperature of 309 C. What is the least rate of heat rejection per KW not output of the engine?