CLASS: FINAL YEAR 1 ST SEMESTER

BRANCH: MECHANICAL ENGINEERING

REFRIGERATION AND AIR-CONDITIONING

(18MEC411)

QUESTION BANK

(Updated on November2021)

Prepared by

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IV B.Tech I Semester

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18MEC411 REFRIGERATION AND AIR-CONDITIONING

Course Educational Objectives:

CEO1: To understand the basics functions of Air Refrigeration system
CEO2: To know the working of Vapour Compression and Vapour Absorption Refrigeration systems
CEO3: To understand the behavior of Refrigerants, functions of System Components
CEO4: To know the Psychometric properties, processes & Air Conditioning Equipments
CEO5: To understand the air conditioning systems and cooling load estimation

UNIT – 1: AIR REFRIGERATION SYSTEMS

Necessity and applications – Unit of refrigeration and C.O.P – Refrigeration methods. **Air Refrigeration:** Open and dense air systems – Reversed Carnot and Bell-Coleman cycle – Refrigeration needs of air craft's.

UNIT – 2: VAPOUR REFRIGERATION SYSTEMS

Vapour Compression Refrigeration: Working principle and essential components of the plant – COP – Representation of cycle on T-S and P-h charts – Effect of sub cooling and super heating – Cycle analysis – Actual cycle – Influence of various parameters on system performance.**Vapour Absorption Refrigeration:** Working of aqua-ammonia (NH_3) – $LiBr_2$-water (two shells and four shells) systems – Calculation of maximum COP – Principle and operation of electrolux refrigerator (three fluid systems).

UNIT – 3: REFRIGERANTS AND SYSTEM COMPONENTS

Refrigerants: Desirable properties – Classification – Nomenclature – Secondary refrigerants – Ozone depletion – Global warming. **System Components:** Classification and working of compressors, condensers, evaporators and expansion valves. **Other Refrigeration Systems:** Working principle and basic components of steam jet refrigeration system, thermo-electric refrigeration system and vortex tube (Hilsch tube) refrigeration systems.

UNIT – 4: PSYCHROMETRY

Psychrometric properties and processes – Psychrometric chart – Problems on psychrometry – By-pass factor (BPF), efficiency of heating and cooling coils (contact factor-CF), sensible heat factor (SHF). **Air Conditioning Equipments:** Humidifiers, dehumidifiers, air filters, ducts, fans and blowers.

UNIT – 5: AIR CONDITIONING SYSTEMS AND COOLING LOAD ESTIMATION

Requirements of human comfort and concept of effective temperature – Comfort chart – Comfort air conditioning – Working principle of centralized air conditioning systems, split, ductable split, packaged air conditioning, VAV and VRV Systems – Indoor Air quality concepts. **Cooling Load Calculations:** Different types of loads heat load concepts – RSHF, GSHF and ERSHF – Estimation of total load – Dynamic and frictional losses in air duct – Equal friction method – Fan characteristics of duct system.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Acquire knowledge to understand the principles and applications of refrigeration systems.	PO1,PO2,PO3
CO2	Know the working of vapour compression and vapour absorption refrigeration system and identify methods for performance improvement.	PO1,PO2,PO3
CO3	Understand the behavior of Refrigerants, functions of System Components, contextual knowledge to assess societal, health, safety and also understand the impact of the professional engineering solutions in societal and environmental contexts	PO1,PO2,PO3,PO6,PO7
CO4	Apply psychrometric charts, analyze the problems on psychrometry and acquire knowledge on air conditioning equipment's	PO1,PO2,PO3
CO5	Understand the air conditioning systems and cooling load estimation and also to engage in independent and life-long learning	PO1,PO2,PO3,PO12

Text books:

1. Refrigeration and Air Conditioning, C.P. Arora, 3/e, 2008, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Refrigeration and Air Conditioning, P.L.Ballaney, 7/e, 2012, Khanna Publishers, New Delhi.

Reference books:

1. Refrigeration and Air Conditioning, Manohar Prasad, 2/e, 2003, New Age International (P) Ltd, Publishers, New Delhi.
2. Principles of Refrigeration, Dossat, 4/e, 2007, Pearson Education, New Delhi.
3. Refrigeration and Air Conditioning, R.C.Arora, 2/e, 2010, Prentice-Hall of India, Pvt. Ltd., New Delhi.
4. Basic Refrigeration and Air-Conditioning, Ananthanarayanan, 4/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Codes/Tables: Steam table and Psychrometric chart of various refrigerants is permitted in the examinations.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	-	-	-	-	-	-	-	-	-
CO.2	3	3	3	-	-	-	-	-	-	-	-	-
CO.3	3	1	3	-	-	2	2	-	-	-	-	-
CO.4	3	2	3	-	-	-	-	-	-	-	-	-
CO.5	3	3	3	-	-	-	-	-	-	-	-	2
CO*	3	2.4	3	-	-	2	2	-	-	-	-	2

QUESTION BANK

Question No.	Questions	Bloom's Level
	UNIT 1 - AIR REFRIGERATION SYSTEMS	
	PART-A (Two Marks Questions)	
1	Illustrates the necessity and application of refrigeration systems?	BT2
2	What is meant by refrigeration?	BT2
3	What is meant by air conditioning?	BT2
4	Define Unit of refrigeration.	BT2
5	Why Co-efficient of Performance is greater than unity?	BT6
6	What is relative COP?	BT2
7	Differentiate between C.O.P. and efficiency.	BT4
8	Differentiate between heat engine, refrigerator and heat pump with formula.	BT4
9	Explain the principle of refrigeration?	BT2
10	What are the various types of refrigerators?	BT2
11	Explain the term "Tonne of refrigeration".	BT2
12	A machine working on reversed Carnot cycle operates between 30^0C and -15^0C. Determine COP, when it is operated as refrigerator.	BT4
13	A refrigerating machine working on reversed Carnot cycle consumes 6kW for producing refrigerating effect of 1000kJ/min. Determine the COP of machine.	BT4
14	What are the merits and demerits in air refrigeration system?	BT2
15	Explain the working principle of Bell-Coleman cycle.	BT2
16	Write the refrigeration needs of aircrafts.	BT2
17	What are the various methods of air refrigeration system in aircrafts?	BT2
18	Define the term "ram efficiency".	BT2
19	Draw the T-S diagram of boot strap air cooling system.	BT4
20	Draw the T-S diagram of reduced ambient air cooling system.	BT4
	PART-B (Ten Marks Questions)	
1	Derive the expression for air refrigeration system working on reversed Carnot cycle.	BT4
2	Derive the expression for air refrigeration system working on Bell-Coleman cycle.	BT4
3	In refrigerating plant, water at 20.5^0C is convert to producing as ice at -3^0C at 0.45 tones per hour. Calculate the power required to drive the compressor for production of ice.Assume latent heat of ice is 340 KJ/kg, specific heat of ice is 2.1kJ/kgK.	BT5
4	A cold storage plant is required to store 20Tof fish. The fish is supplied at a temperature of 25°C. The specific heat of fish above freezing point is 2.93kJ/kg K.The specific heat of fish below freezing point is 1.25kJ/kg K. The fish is stored incold storage which is maintained at -8^0C. The freezing point of fish is -3^0C. Thelatent heat offish is 232 kJ/kg and time taken to achieve cooling is within 8hrs. Find: (i) Thecapacity of the plant, (ii) Carnot COP between temperature range and (iii) Power required to run the plant, if the actual C.O.P. of the plant is 0.33 times the Carnot C.O.P.	BT6
5	A heat pump is used for heating the interior of a house in cold climate. The ambient temperature is -5^0C and the desired interior temperature is 25^0C. The compressor of heat pump is to be driven by a heat engine working between 1000^0C and 25^0C. Treating both cycles as reversible. Calculate the ratio in which the heat pump and heat engine share the heating load.	BT5
6	A refrigerator working on Bell-Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10^0C, compressed and, then it is	BT5

	cooled to 30^0C before entering the expansion cylinder. The expansion and compression follows the law $PV^{1.3}$ = Constant. Determine the theoretical C.O.P of the system?	
7	A dense air refrigeration system of 10TR capacity works between 4bar and 16bar. The air leaves the cold chamber at 0^0C and discharges at 25^0C to the expansion cylinder after air cooler. The expansion and compression cylinders are double acting. The mechanical efficiency of compressor and expander are 85% and 80% respectively. The compressor speed is 250rpm and has a stroke of 250mm. Determine: (i) COP of the system, (ii) power required and (iii) bore of compression and expansion cylinders. Assume isentropic compression and polytropic expansion. Take, n=1.25.	BT4
8	Explain withneat sketch of "simpleaircooling system" in aircraft refrigeration and indicate the cycle in T-S diagram.	BT4
9	Explain withneat sketch of "simple air evaporative cooling system" in aircraft refrigeration and indicate the cycle in T-S diagram.	BT4
10	Explain withneat sketch of "boot-strap air cooling system" in aircraft refrigeration and indicate the cycle in T-S diagram.	BT4
11	Explain withneat sketch of "boot-strap air evaporative cooling system" in aircraft refrigeration and indicate the cycle in T-S diagram.	BT4
12	Explain withneat sketch of "reduced ambient air cooling system" in aircraft refrigeration and indicate the cycle in T-S diagram.	BT4
13	Explain withneat sketch of "regenerative air cooling system" in aircraft refrigeration and indicate the cycle in T-S diagram.	BT4
14	An air craft moving with speed of 1000 km/h uses simple gas refrigeration cycle for airconditioning. The ambient pressure and temperature are 0.35 bar and -10^0C respectively. The pressure ratio of compressor is 4.5. The heat exchanger effectiveness is 0.95. Theisentropic efficiencies of compressor and expander are 0.8 each. The cabin pressure andtemperature are 1.06 bar and 25^0C. Determine: the temperature and pressures at all points ofthe cycle. Also find the volume flow rate through compressor inlet and expander outlet for100 TR. Take C_P=1.005 kJ/kg K; R=0.287 kJ/kg K and C_P/C_V=1.4 for air.	BT5
15	A simple air cooling system is used for an aircraft having a load of 10T. The atmospheric pressure and temperature are 0.9bar and 10^0C respectively. The pressure increases to 1.013bar due to ramming. The temperature of air is reduced by 50^0C in the heat exchanger. The pressure in the cabin is 1.01bar and the temperature of air leaving the cabin is 25^0C. Find, (i) power required to take the load of cooling in the cabin and (ii) COP of the system. Assume that all the compression and expansions are isentropic. The pressure of compressed air is 3.5bar.	BT5

Question No.	Questions	Bloom's Level
	UNIT 2 –VAPOUR REFRIGERATION SYSTEMS	
	PART-A (Two Marks Questions)	
1	Explain the working principle of simple vapour compression refrigeration system.	BT2
2	Describe the essential components of the refrigeration plant.	BT2
3	Draw the T-S and p-h diagram for vapour compression refrigeration systems.	BT4
4	Write the merits and demerits of vapour refrigeration system over the air refrigeration system.	BT2
5	List the different types ofvapourcompression refrigeration systems to improving the COP of simple cycle.	BT2
6	Why the condensers are oversized when compared with evaporator?	BT4
7	List the different methods of improving the COP of simple vapour compression	BT2
8	Explain the influence of various parameters on refrigeration system performance.	BT2
9	What is purpose of condenser in vapour compression system?	BT2

<table>
<tr><td>10</td><td>Draw the T-S and p-h diagram for actual vapour compression refrigeration cycle.</td><td>BT4</td></tr>
<tr><td>11</td><td>Define the term “throttling”.</td><td>BT2</td></tr>
<tr><td>12</td><td>Define the term “superheat horn”.</td><td>BT2</td></tr>
<tr><td>13</td><td>Write the effect of suction (evaporator) pressure?</td><td>BT4</td></tr>
<tr><td>14</td><td>Write the effect of discharge (condenser) pressure?</td><td>BT4</td></tr>
<tr><td>15</td><td>Write the effect of liquid sub-cooling?</td><td>BT4</td></tr>
<tr><td>16</td><td>Write the effect of suction vapour superheat?</td><td>BT4</td></tr>
<tr><td>17</td><td>How to improve the COP in aqua-ammonia vapour absorption system?</td><td>BT3</td></tr>
<tr><td>18</td><td>What is the function of an absorber in vapour absorption system?</td><td>BT2</td></tr>
<tr><td>19</td><td>Write the advantages of vapour absorption refrigeration system over ofvapourcompression refrigeration systems.</td><td>BT2</td></tr>
<tr><td>20</td><td>What are the refrigerant and absorbent in Li-Br and water absorption system?</td><td>BT2</td></tr>
<tr><td colspan="3">PART-B (Ten Marks Questions)</td></tr>
<tr><td>1</td><td>Draw the vapour compression refrigeration cycle on T-s diagram when therefrigerant is dry and saturated at the end of compression and find an expression forthe C.O.P in terms of (i) Temperature and entropies; (ii)Enthalpy.</td><td>BT4</td></tr>
<tr><td>2</td><td>Explain the different methods of improving the COP of simple vapour compression refrigerationcycle.</td><td>BT4</td></tr>
<tr><td>3</td><td>A simple saturation cycle using F12 is designed for taking a load of 10 tons. Therefrigerator and ambient temperatures are -10^{0}C and 30^{0}C respectively. Aminimum temperature difference of 5^{0}C is required in evaporator andcondenser for heat transfer. Find:i) mass flow rate through the system, ii) power required in kw.iii) cylinder dimensions assuming L/D = 1.2 for single cylinder, single actingcompressor if it runs at 300 r.p.m. with volumetric efficiency = 0.9.</td><td>BT5</td></tr>
<tr><td>4</td><td>A refrigerating machine using R-12 as refrigerant operates between the pressures 2.5 bar
and 9.0 bar. The compression is isentropic and there is not under cooling in the condenser.
The vapour is dry and saturated condition at the beginning of the compression. Estimate the theoretical COP. If the actual COP is 0.65 of theoretical COP, calculate the net cooling
produced per hour. The refrigerant flow is 5 Kg/min.
The properties of refrigerant are :
<table>
<tr><th rowspan="2">Sat. Temp.^{0}C</th><th rowspan="2">Pressure bar</th><th colspan="2">Enthalpy,kJ/kg</th><th>Entropy,kJ/kg K</th></tr>
<tr><th>liquid</th><th>vapour</th><th>vapour</th></tr>
<tr><td>36</td><td>9.0</td><td>70.55</td><td>201.8</td><td>0.6836</td></tr>
<tr><td>-7</td><td>2.5</td><td>29.62</td><td>184.5</td><td>0.7001</td></tr>
</table>
Take specific heat of superheated vapour at 9 bar as 0.64 kJ/kg K.</td><td>BT5</td></tr>
<tr><td>5</td><td>The temperature limits of an ammonia refrigerating system operating on simple vaporcompression cycle are 25^{0}C and -10^{0}C respectively. If the gas is dry at the end ofcompression, calculate the C.O.P of the system, assuming no under cooling of theliquid ammonia. Use the following table for the properties of ammonia.
<table>
<tr><th>Temperature (^{0}C)</th><th>Liquid heat (kJ/kg)</th><th>Latent heat (kJ/kg)</th><th>Liquid entropy (kJ/kg-K)</th></tr>
<tr><td>25</td><td>298.9</td><td>1166.94</td><td>1.1242</td></tr>
<tr><td>–10</td><td>135.37</td><td>1297.58</td><td>0.5443</td></tr>
</table></td><td>BT5</td></tr>
</table>

<table>
<tr><td>6</td><td>A vapour compression refrigerator uses R-12 as refrigerant and the liquid evaporates inthe evaporator at -15^{0}C. The temperature of this refrigerant at the delivery from thecompressor is 15^{0}C when the vapour is condensed at 10^{0}C. Find the coefficient ofperformance if the liquid is cooled by 5^{0}C before expansion by throttling. Take specificheat at constant pressure for the superheated vapour as 0.64kJ/kg K and that for liquidas 0.94 kJ/kg K. the other properties of refrigerant are as follows:
<table>
<tr><th rowspan="2">Temperature (^{0}C)</th><th colspan="2">Specific enthalpy</th><th colspan="2">Specific entropy</th></tr>
<tr><th>liquid</th><th>vapour</th><th>liquid</th><th>vapour</th></tr>
<tr><td>-15</td><td>22.3</td><td>180.88</td><td>0.0904</td><td>0.7051</td></tr>
<tr><td>10</td><td>45.4</td><td>191.76</td><td>0.1750</td><td>0.6921</td></tr>
</table></td><td>BT5</td></tr>
<tr><td>7</td><td>A vapour compression refrigeration machine, with Freon-12 as refrigerant, has a capacityof 12 tonne of refrigeration operating between -28^{0}C and 26^{0}C. The refrigerant is subcooled by 4^{0}C before entering the expansion valve and the vapour is superheated by 5^{0}Cbefore leaving the evaporator. The machine has a six-cylinder single-acting compressorwith stroke equal to 1.25 times the bore. It has a clearance of 3% of the stroke volume.Determine (i) Theoretical power required, (ii) C.O.P, (iii) Volumetric efficiency, (iv) Boreand stroke of cylinder. The speed of compressor is 1000 r.p.m. the following properties ofFreon-12 may be used:
<table>
<tr><th rowspan="2">Sat. Temp. C</th><th rowspan="2">Pressure bar</th><th rowspan="2">Sp.Volume of vapour, m^3/kg</th><th colspan="2">Enthalpy,kJ/kg</th><th colspan="2">Entropy,kJ/kg K</th></tr>
<tr><th>liquid</th><th>vapour</th><th>liquid</th><th>vapour</th></tr>
<tr><td>-28</td><td>1.093</td><td>0.1475</td><td>10.64</td><td>175.11</td><td>0.0444</td><td>0.7153</td></tr>
<tr><td>26</td><td>6.697</td><td>0.0262</td><td>60.67</td><td>198.11</td><td>0.2271</td><td>0.6865</td></tr>
</table>
Specific heat of liquid refrigerant=0.963 kJ/kg K and specific heat of superheatedvapour=0.615 kJ/kg K.</td><td>BT5</td></tr>
<tr><td>8</td><td>Explain with a flow diagram, the working of aqua-ammonia vapour absorption refrigeration system.</td><td>BT2</td></tr>
<tr><td>9</td><td>With a neat sketch explain the working principle of Li Br-water absorptionrefrigeration system.</td><td>BT2</td></tr>
<tr><td>10</td><td>With a neat sketch explain the working principle of a three fluid vapour absorptionrefrigeration system.</td><td>BT2</td></tr>
<tr><td>11</td><td></td><td></td></tr>
<tr><td>12</td><td></td><td></td></tr>
<tr><td>13</td><td></td><td></td></tr>
<tr><td>14</td><td></td><td></td></tr>
<tr><td>15</td><td></td><td></td></tr>
</table>

Question No.	Questions	Bloom's Level
	UNIT 3 – REFRIGERANTS AND SYSTEM COMPONENTS	
	PART-A (Two Marks Questions)	
1	Name some secondary refrigerants	BT2
2	What are hydrocarbons?	BT2
3	How the refrigerants are classified?	BT4
4	State the desirable properties of ideal refrigerants.	BT2
5	Write the objectionable property of R-717.	BT4
6	Explain the concept of greenhouse effect?	BT2
7	Explain the concept ofglobal warning?	BT2
8	Explain ASHRAE numbering (designation) system for saturated hydro carbon refrigerants.	BT2
9	Explain ASHRAE numbering (designation) system for un-saturated hydro carbon refrigerants.	BT2

10	How to designate for in-organic referents?	BT2
11	What is meant by isothermal refrigeration?	BT2
12	What is meant by non-isothermal refrigeration?	BT2
13	What is meant by space refrigeration?	BT2
14	What is meant by process refrigeration?	BT2
15	What is the basic principle of steam jet refrigeration system?	BT2
16	Define nozzle efficiency in steam jet refrigeration system?	BT2
17	Define entrainment nozzle efficiency in steam jet refrigeration system?	BT2
18	Define condenser efficiency in steam jet refrigeration system?	BT2
19	State the classification of condenser used in refrigeration system?	BT2
20	What are the basic principles of thermo-electric modules in thermos-electric refrigeration system?	BT2
	PART-B (Ten Marks Questions)	
1	Explain the various desirable properties of ideal refrigerants.	BT4
2	What is an azeotrope? Give some examples to indicate its importance.	BT4
3	Mention the chemical formula and the refrigerant number of following refrigerants: (i) Dichlorodifluoro methane, (ii) Dichlorotetrafluoro ethane, (iii) Propylene, (iv) Ethlyleneand (v) Sulphur dioxide.	BT2
4	Explain working principle of evaporative condenser with neat sketch?	BT4
5	Describe the working principle and basiccomponents steam jet refrigeration system.	BT2
6	Derive the mass of motive steam required in steam jet refrigeration system.	BT4
7	A steam jet refrigeration installation is to deliver chilled water at the rate of2300 kg per minute at 8^0C from supply water at 18^0C. Condenser saturationtemperature is 38^0C, nozzle efficiency is 90%, entrainment efficiency is 68% and diffuser efficiency is 78%.Quality of flashed vapour is 0.97.the steamconsumption for the motive jet is 6500 kg/hr.Estimate the pressure of the dryand saturated motive steam.	BT5
8	In a steam jet refrigeration plant, steam enters the thermocompressor at0.01 bar and with dryness fraction of 0.09, make up water enters the flashchamber at 18^0C. Determine i)Quality of steam leaving the flash chamber. ii)COP of the plant based on heat input from motive steam .Assume isentropicefficiency n of turbine =90%: Nozzle efficiency=90%: Entrainment efficiency=65%: Thermocompressure efficiency= 65%	BT5
9	Explain the working principle and operation of thermoelectric refrigerator.	BT2
10	Explain the working principle and operation of vortex tube or Hilsch tube	BT2
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Question No.	Questions	Bloom's Level
	UNIT 4 – PSYCHROMETRY	
	PART-A (Two Marks Questions)	
1	What is important of psychrometry?	BT2
2	List out the various psychrometric properties of air.	BT2
3	Define moist air.	BT1
4	Define saturation air.	BT2
5	Define specific humidity.	BT2
6	Define sensible and latent heat.	BT2

7	List out the various psychrometry processes.	BT2
8	Explain the process of heating and humidification.	BT2
9	How dehumidification of air achieved	BT2
10	Define sensible heat factor.	BT2
11	Define bypass factor.	BT4
12	What are the various losses in the duct?	BT2
13	What is constant airvolume (CAV) system?	BT2
14	What is variable air volume system (VAV)and dual duct system?	BT2
15	What is the purpose of air handling units?	BT2
16	List different types of dehumidifiers.	BT2
17	What is sensible heat gain and latent heat gain?	BT2
18	Where the fan coil units (FCU) are used?	BT3
19	What is the meaning of fresh air handling unit (FAHU)?	BT2
20	What is the difference between fan and blower in air conditioning system?	BT4
	PART-B (Ten Marks Questions)	
1	List out the various psychrometric properties of air and explain each.	BT4
2	The pressure, temperature and relative humidity of air at a pace are 1.013 bar, 32^0C and65% respectively. Findi. The dew point.ii. Specific volume of the constituent andiii. The humidity ratio. The universal gas constant. R =8.3143 kJ/kg mole K.	BT5
3	Air at 25^0C WBT 25% RH is to be conditioned to 22^0C DBT and specific humidity 11 gm/ kg dry air. Determine heat transfer per kg of dry air referring the psychrometric chart. Represent the process on chart by sketch.	BT6
4	Calculate the following when the DBT is 35^0C, WBT is 23^0C and the barometerreads 750mm Hg: (i) Relative humidity ii) Humidity ratio iii) DPT iv) Density(v) Enthalpy of atmospheric air.	BT5
5	Atmospheric air having DBT=16^0C and RH=25% is passed through a furnace and thenthrough a humidifier to maintain a final DBT of 30^0C and 50% R.H. Find the heat andmoisture added to the air during the process. Also calculate the sensible heat factor ofthe process.	BT5
6	Explain the concept of sensible heat factor and bypass factor with suitablesketches?	BT5
7	List different types of dehumidifiers. Describe most commonly used type with sketch.	BT4
8	Explain the principle of various dehumidification methods.	BT2
9	Explain with neat sketch the various losses in the duct?	BT2
10	What is sensible heat gain and latent heat gain and list the sources of sensible andlatent heat gain in a restaurant?	BT4
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12		
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Question No.	Questions	Bloom's Level
	UNIT 5 - AIR CONDITIONING SYSTEMS AND COOLING LOAD ESTIMATION	
	PART-A (Two Marks Questions)	
1	Define the term air conditioning.	BT2
2	Classify air conditioning systems.	BT2
3	What are human comfort conditions?	BT2

4	What are the factors affecting human comfort?	BT2
5	What is effective temperature in air conditioning?	BT2
6	What factors affect effective temperature?	BT4
7	Draw the schematic layout of summer air conditioning systems.	BT4
8	Draw the schematic layout of winter air conditioning systems.	BT4
9	What is year round air conditioning?	BT2
10	Define room sensible heat factor (RSHF).	BT2
11	Define grand sensible heat factor GSHF.	BT2
12	Define effective room sensible heat factor (ERSHF).	BT2
13	What is meant by unitary air conditioning system?	BT2
14	What is meant by year round air conditioning system?	BT2
15	What is meant by district cooling system?	BT2
16	What is meant by central air conditioning system?	BT2
17	List out various air conditioning equipments and mention their functions.	BT1
18	What are the important considerations in the design of air conditioning system?	BT2
19	What are the sources of heat for heat pumps?	BT2
20	What is the purpose of ventilation in air-conditioning system?	BT2
	PART-B (Ten Marks Questions)	
1	With the help of a circuit diagram explain how a single air conditioning unit is usedas an air-conditioner in summer and heat pump in winter.	BT4
2	Define air-conditioning. Classify air-conditioning system and explain central A/C system.	BT4
3	What is comfort air-conditioning? Draw a rough comfort chart.	BT4
4	Explain the thermal exchange mechanism of human body with environment?	BT4
5	Explain factors affecting human comfort?	BT4
6	Draw a labeled sketch and explain working of window air conditioning system?	BT4
7	State application of refrigeration from domestic, commercial and industrial area?	BT4
8	A small office hall of 25 persons capacity is provided with summer air conditioningsystem with the following data:Outside conditions = 34^0C DBT and 28^0C WBT, inside conditions = 24^0C DBT and 50 % RH, volume of air supplied = 0.4 m^3/min/person, sensible heat load in room = 125600 kJ/hr, latent heat load in the room = 42000 kJ/hr. Find the sensible heat factor of the plant.	BT5
9	A cold storage room has walls made of 0.23 m of brick on the outside, 0.08 m ofplastic foam and finally 15 mm of wood on the inside. The outside and insidetemperature are 22^0C and -2^0C respectively. If the inside and outside heat transfercoefficient are 29 and 12 W/m^{20}K respectively the thermal conductivities of bricks,foam and wood are 0.98, 0.02 and 0.17 W/m^0K respectively. Determine rate of heatremoval by refrigeration per unit area of wall.	BT6
10	The design conditions for an air conditioned hall is Inside condition 24°C DBT and 60% RH Outside condition 38°C DBT and 28°C WBT,Sensible heat gain 167040 kJ/hr, Latent heat gain 41760kJ/hr, Infiltrated air 20CMM, Coil ADP 10°C, 60% of total air is recirculated and mixed with conditioned air after cooling coil. Determine i) The condition of air before entering the hall ii) The condition of air leaving the conditioner coil iii) BPF of cooling coil iv) refrigeration load on cooling coil.	BT5
11		
12		
13		
14		
15		

Note:

Bloom's Taxonomy

Bloom's Level	Descriptions	Bloom's Level	Descriptions
BT 1	Remember	BT 2	Understand
BT 3	Apply	BT 4	Analyze
BT 5	Evaluate	BT 6	Create

Prepared by	Recommended by	Approved by
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ALL THE BEST