Code No: R1632033 **R16** SET - 1

III B. Tech II Semester Regular Examinations, April/May- 2019

REFRIGERATION & AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	Define tonne of refrigeration?	[2M]
	b)	List out the advantages of vapour refrigeration system over air refrigeration system.	[2M]
	c)	Give the designation for Dichloro-tetrafluro-ethane refrigerant.	[2M]
	d)	Which component of the simple vapour-absorption system replaces the compressor of a vapour-compression system?	[3M]
	e)	How do SHF and GSHF differ from one another?	[2M]
	f)	Explain why 'heat pump' is most efficient when used for heating purposes?	[3M]

PART -B

2.	a)	Discuss the advantages and disadvantages of air-refrigeration system. Explain the necessity of cooling aircrafts?	[5M]
	b)	An ice plant is working on a reversed Carnot cycle produces 15 tons of ice per day. The ice is formed at 0^0 C and water supplied is also at 0^0 C. The heat is rejected to atmosphere at 25^0C. The heat pump used to run the plant is coupled to a Carnot engine receives heat from a source at 220^0 C and it rejects the heat to atmosphere. The fuel Calorific value, 44.5 MJ/kg is used for supplying the heat. Determine the following (i) power developed by the engine and (ii) fuel used/hr. Take enthalpy of fusion of ice=334.5 kJ/kg.	[9M]
3.	a)	Draw the refrigerator cycle on T-s diagram when the refrigerant is dry and saturated at the end of compression and find an expression for the COP in terms of temperature and entropies.	[6M]
	b)	A vapour compression machine is used to maintain a temperature of -23^0 C in a refrigerated space. The ambient temperature is 37^0 C. The compressor takes in dry saturated vapour of F-12 refrigerant. A minimum 10^0 C temperature difference is required at the evaporator as well as the condenser. There is no sub-cooling of the liquid. If the refrigerant flow rate is 1 kg/min, find (i) Tonnage of the refrigerant; (ii) Power requirement and (iii) COP of the cycle.	[8M]
4.	a)	Discuss the essential properties of a good refrigerant?	[5M]
	b)	What points are considered in selecting a condenser for a refrigeration system?	[4M]
	c)	Where air-cooled condensers are preferred over water-cooled condensers? Give examples with specific reasons.	[5M]
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5. a) Make a comparative list between vapour absorption system and a compression system. [5M]
   b) For a steam jet refrigeration system, the steam enters the nozzle at 8 bar just dry saturated state. The condenser pressure is 0.07 bar and flash chamber is to be maintained at 5^0 C. The make-up water enters the flash chamber at 35^0 C. Taking nozzle, entrainment and compressor efficiencies are η_n=0.94, η_e=0.75 and η_c=0.65 respectively, compute (i) amount of steam per kg of vapour formed in the flash chamber, (ii) COP, and (iii) volume of vapour leaving the flash chamber per ton per hour. [9M]

6. a) Define the term 'effective temperature' and explain its importance in air-conditioning system. Describe the factors which affect effective temperature? [5M]
   b) A mini-cold storage is required to preserve 20 tons of fish at 260 K. There are two attendants, four 40 W bulbs and one 200 W blower. The meat is to be processed to the storage condition in 36 hours. The cold storage size is 8 x 4 x 3 m high. The overall heat transfer coefficients for the walls and ceiling are 4 and 2 kJ/m^2-h-K. The ambient condition is T_{db}=318 K and T_{wb}=302 K. The heat release due to respiration is 60 kJ/ton-h. The ventilation air is 20 m^3/ton-h. Calculate the capacity of the refrigeration system to be procured. Make suitable assumptions. [9M]

7. a) Explain the importance of `throw` and `drop` in locating the grill. [7M]
   b) Write short notes on axial flow fans and centrifugal fans. [7M]

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Code No: R1632033 **R16** SET - 2

III B. Tech II Semester Regular Examinations, April/May- 2019

REFRIGERATION & AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	Discuss the necessity and application of refrigeration.	[2M]
	b)	Discuss the effect of superheating on the performance of vapour compression refrigeration cycle.	[2M]
	c)	Give the designation for Defluro-monochloro-methane refrigerant.	[2M]
	d)	What type of refrigeration system is commonly used in ships and why?	[3M]
	e)	Show the humidification and heating processes on a psychrometric chart.	[3M]
	f)	Discuss the factors affecting grill performance.	[2M]

PART -B

2.	a)	Explain the factors considered in selecting the refrigeration system for aircrafts.	[5M]
	b)	An aircraft flying at a speed of 900 km/hr at an altitude 8000 m where the ambient pressure and temperature are 0.341 bar and 263 K. The pressure ratio of the main compressor is 5. The cabin pressure maintained is 1.01325 bar and temperature is 27^0 C. Determine the following if the air flow rate is 2 kg/sec. (i) power required for pressurization of cabin excluding ram work. (ii) Additional power to run the refrigeration plant. (iii) Refrigeration capacity in TOR. Assume ramming, compression and expansions are isentropic.	[9M]
3.	a)	Why a throttle valve is used in vapour compression refrigerator rather than an expansion cylinder to reduce the pressure between the condenser and evaporator?	[4M]
	b)	A simple saturation cycle using F-12 refrigerant is designed for taking a load of 10tons. The refrigerator and ambient temperatures are 0^0 C and 30^0C respectively. A minimum temperature difference of 5^0 C is required in evaporator and condenser 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 a single cylinder, single acting compressor if it runs at 300 rpm with volumetric efficiency=0.9.	[10M]
4.	a)	Discuss briefly the factors affecting the choice of refrigerants commonly used in refrigerating plants.	[5M]
	b)	Explain the working of Flooded evaporator with neat sketch. Specify the fields of their applications.	[9M]
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5. a) Compare between a two-fluid and three-fluid vapour absorption system. [5M]
   b) In a steam jet refrigeration the dry saturated motive steam is supplied at 6 bar. The amount of motive steam per unit mass of flash vapour is 2 kg/kg. The quality of vapour at the beginning of compression is 0.90. The condensing and flash vapour temperatures are 40^0 C and 5^0 C, respectively. The compression efficiency is 0.78. Obtain the tonnage of the system for 0.8 kg/s of motive steam and volume of vapour handled by the ejector. [9M]

6. a) Define the ``human comfort`` and explain the factors which affect human comfort. [6M]
   b) A window air conditioner is required for an office size 5 x 3 x 4 m high. The structure load is estimated to be 6000 kJ/h. There are 10 persons doing moderate work. There is no smoking. The ambient and inner conditions are T_{db}=310 K, Ø=50% and T_{db}=395 K and T_{wb}=290 K, respectively. There are five 40 W tube lights. Obtain the capacity of the air conditioner. [8M]

7. a) Explain the use of ``heat-pump`` for heating and cooling cycle with neat diagrams. [7M]
   b) Discuss different methods of humidifying the air? [7M]

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Code No: R1632033 **R16** SET - 3

III B. Tech II Semester Regular Examinations, April/May- 2019

REFRIGERATION & AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	Draw the p-v and T-s diagram of Bell-coleman cycle.	[2M]
	b)	Distinguish between dry and wet compression. What are the advantages of one over the other?	[2M]
	c)	Give the designation for Monochloro-tetrafluro ethane refrigerant.	[2M]
	d)	What are the advantages and limitations of steam-jet refrigeration system?	[3M]
	e)	Show the cooling of the dehumidification processes on the psychrometric chart.	[3M]
	f)	What are the advantages and disadvantages of the backward-blade fan over forward blade fan?	[2M]

PART -B

2.	a)	With the help of a neat sketch, explain Boot-strap air cycle refrigeration system.	[7M]
	b)	An air refrigeration system working on Bell-coleman cycle operates between 1 bar and 7 bar. The temperature maintained in the cooler is 13^0 C. The air leaving the compressor is cooled to 37^0 C. The compression follows the law $pv^{1.3}$=C and the expansion follows the law $pv^{1.35}$=C. Find (i) theoretical COP (ii) Mass flow rate of air required to manufacture ice at 0^0 C when water supplied at 30^0 C at a rate of 5 tons/day. Take latent heat of ice=335 kJ/kg.	[7M]
3.	a)	Under what circumstances the superheating of vapour before coming to compressor is more objectionable? Mention the ways to prevent it.	[5M]
	b)	A NH_3 vapour compression refrigerator has a single cylinder, single acting compressor with bore 12.7 cm and stroke 15.2 cm and speed of 240 rpm. The cycle is working between 1.6 bar and 13.9 bar. The volumetric efficiency of the compressor is 80% and mechanical efficiency of the system is 90%. The vapour is dry saturated leaving the evaporator and liquid has 32^0 C leaving the condenser. Find the mass flow rate, COP and power required to run the compressor.	[9M]
4.	a)	Differentiate between physical and thermodynamic properties of a refrigerant. Explain what are more important properties in giving specific examples?	[6M]
	b)	Explain the working of evaporative condenser with neat diagram and explain its advantages and disadvantages over others. Give three examples of its use with proper reasoning.	[8M]
5.	a)	Draw a neat compact diagram of lithium bromide water absorption refrigeration system and explain its working. List out the major fields of applications of this refrigeration system?	[6M]
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b) A steam jet system is meant for air conditioning a conference room for 50 persons. Each person releases about 600 kJ/h of energy. The heat transfer through the structure is given to be 60,000 kJ/h. Obtain the amount of vapour evaporated from the chiller if this is maintained at 281 K(=8^0C) and make-up water is available at 308 K(=35^0C). Assume the quality of vapour leaving the chiller to be 0.95. [8M]

6. a) A room whose size is 4 x 3 x 4 m is at a temperature 298 K. The wet bulb temperature of the room was found to be 293 K. Find the amount of water vapour associated with the air. [6M]

b) A cold storage ware-house dimensions are 10m x 15m x 10m high. It is used to store 50 tons of potato at 274 K. There are six persons doing moderate work. There are ten 60 W bulbs. Obtain the refrigeration system capacity for the same for 20 hour operation. The ventilation air is 30 m^3/h. [8M]

7. a) Make the arrangement of ``heat-pump`` when it is used for year-round air-conditioning. [7M]

b) Write short notes on grills and registers. [7M]

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Code No: R1632033 **R16** SET - 4

III B. Tech II Semester Regular Examinations, April/May- 2019

REFRIGERATION & AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Discuss the advantages of dense air refrigerating systems over open air refrigerating systems. [2M]
   b) Discuss the effect of sub-cooling on the performance of vapour compression refrigeration cycle? [3M]
   c) Give the designation for Trifluro-dichloro-ethane refrigerant. [2M]
   d) Is it proper to compare COP's of the vapour-absorption and vapour-compression systems obtained on the basis of different forms of energy? [3M]
   e) What is a by-pass factor? Explain its usefulness? [2M]
   f) Explain the advantages and disadvantages of viscous filters over dry filters. [2M]

PART -B

2. a) With the help of a neat sketch, explain Boot-strap evaporative cooling air cycle refrigeration system. [7M]
   b) In a Bell- coleman cycle, air is drawn into the compressor at -5^0 C and 1 bar and compressed isentropically to 5 bar and then cooled to 15^0 C and then expanded in the expansion cylinder to 1 bar pressure following the law $pv^{1.2}$=C. Find the capacity of the refrigeration plant in TOR and COP of the system? [7M]

3. a) In a vapour compression refrigerator, the working fluid is superheated at the end of compression and is under cooled in the condenser before throttling. Sketch a working cycle on temperature entropy diagram. [5M]
   b) It is proposed to replace R-12 by R-134 a refrigerant to reduce the green house effect in a refrigeration plant of 9 TOR capacity when it is running between 0^0 C and 40^0 C and on a standard refrigeration cycle. Compare (i) mass flow (ii) compressor input and (iii) COP for the two refrigerants suggested. [9M]

4. a) Write short note on ozone layer depletion and global warming. [7M]
   b) Where centrifugal compressors are preferred over reciprocating compressors in refrigeration systems? Describe the advantages and disadvantages of centrifugal over reciprocating compressors. [7M]

5. a) Explain the Electrolux refrigeration system with a neat sketch. What is the purpose of hydrogen in it? [7M]
   b) A steam jet refrigeration system receives dry saturated steam at 6 bar. It expands through a nozzle down to flash chamber pressure meant to chill water at 5^0 C. Taking nozzle, entrainment and compressor efficiencies as η_n=0.92, η_e=0.6 and η_c=0.75, obtain (i) amount of water to be evaporated, and motive steam per ton of cooling and (ii) COP. Assume the condenser temperature 35^0 C and make-up water at 30^0 C. [7M]
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6. a) Air with $T_{db}=30^0$ C contains 15 grams of moisture/kg of dry air. Calculate (i) dew point, (ii) relative humidity, (iii) degrees of saturation and (iv) specific humidity. Also find as to what would be the enthalpy of this air. [7M]
   b) 1,000 m^3 of air at $T_{db}=40^0$ C and relative humidity, Ø=40% is processed to $T_{db}=20^0$ C and Ø=50%. Obtain cooling load and moisture removed/hr. [7M]

7. a) Give few industrial examples where heating and cooling is simultaneously required and explain why ``heat-pump`` is more suitable for such applications. [7M]
   b) Discuss different methods of humidifying the air? [7M]

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Code No: R1632033 **R16** SET - 1

III B. Tech II Semester Supplementary Examinations, November - 2019

REFRIGERATION AND AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **FOUR** Questions from **Part-B**

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PART – A (14 Marks)

1	a)	What is refrigeration? Define one ton of refrigeration.	[2M]
	b)	Mention the advantages of vapour compression refrigeration system over air refrigeration system.	[2M]
	c)	What are essential properties of a good refrigerant?	[3M]
	d)	Define and write the expression for entrainment efficiency in steam jet refrigeration system.	[2M]
	e)	Explain in brief, an adiabatic saturation process. Represent the same on a psychrometric chart.	[3M]
	f)	Explain the features required for the proper selection of a fan for a given application.	[2M]

PART – B (56 Marks)

2	a)	An air refrigeration system operating on Bell Coleman cycle takes in air from cold room at 260 K and compresses it from 1.0 bar to 5.5 bar. The index of compression being 1.25. The compressed air is cooled to 300 K. The ambient temperature is 20^0C. Air expands in an expander where the index of expansion is 1.35. Calculate: (i) C.O.P. of the system (ii) Quantity of air circulated per minute for production of 1500 kg of ice per day at 0^0C from water at 20^0C. (iii) Capacity of the plant in terms of kJ/s. Take cp = 4.18 kJ/kg K for water, cp = 1.005 kJ/kg K for air, Latent heat of ice = 335 kJ/kg.	[7M]
	b)	Explain Bootstrap aircraft refrigeration system.	[7M]
3	a)	What is the effect of sub cooling and super heating in vapor compression process and show it in T-S and h-s diagram?	[7M]
	b)	An ammonia ice plant operates between a condenser temperature of 30^0C and an evaporator temperature of -20^0C. It produces 10 tons of ice per day from water at 25^0C to ice at -10^0C. Assuming simple saturation cycle, determine: i) the capacity of refrigerating plant ii) mass flow rate of refrigerant and iii) COP of the cycle.	[7M]
4	a)	How condensers and evaporators are classified? Explain any one of the condenser and evaporators with the help of neat sketch.	[7M]
	b)	How water, Freon-11, Freon-12 and CCl4 are designated as refrigerants? Explain.	[7M]
5	a)	What are the merits and demerits of steam jet refrigeration system and name few applications?	[7M]
	b)	With a neat sketch explain the working of Vortex tube refrigerator.	[7M]

6 a) The following data apply to an air conditioning system: [9M]
Room sensible heat = 41778 kJ/hr; room latent heat = 41778 kJ/hr; inside design condition= 28^0C, 50% RH, outside design condition=35^0C, DBT, 27.6 WBT. Return air from the room is mixed with the outside air before entering the cooling coil in the ratio of 4:1. Return air from the room is mixed with the cooling air, i.e. after the cooling coil in the ratio of 1:4. Cooling coil by pass factor is 0.1. The air may be reheated if necessary before supplying to the conditioned space. Assume ADP as 12^0C and determine:
i) Supply air conditions into the room
ii) Refrigeration load due to the reheat
iii) Total refrigeration capacity
iv) The quantity of fresh air supplied.

b) What is an effective temperature? State and explain the factors which govern optimum effective temperature? [5M]

7 a) What is the function of a filter and how are filters classified? [7M]

b) An air-conditioned auditorium is to be maintained at 27^0C DBT and 60% RH. The ambient condition is 40^0C DBT and 30^0C WBT. The total sensible heat load is 100 000 kJ/h and total latent heat load is 40000 kJ/h. 60% of the return air is re-circulated and mixed with 40% of makeup air after cooling coil. The condition of air leaving the cooling coil is at 18^0C. Determine i) RSHF, ii) The condition of air entering the auditorium, iii) The amount of make-up air, iv) ADP and v) BPF of cooling coil. [7M]

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Code No: R1632033 **R16** SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, October/November - 2020

REFRIGERATION AND AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**
4. Refrigeration and Psychrometric tables and charts allowed.

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PART –A (14 Marks)

1. a) Write the Refrigeration needs of Air crafts. [2M]
   b) What is the effect of the sub cooling of liquid on the COP? [2M]
   c) What are the causes of ozone depletion? [2M]
   d) Under what situation in the steam jet refrigeration system recommended? [3M]
   e) What is the need for Ventilation? [3M]
   f) List out the drawbacks of axial flow fans. [2M]

PART –B (56 Marks)

2. a) Give a brief description of an ideal cycle of air refrigeration. [6M]
   b) A refrigerating system working on the Bell-Coleman cycle receives air from the cold chamber at -5^0C and compresses it from 1 bar to 4.5 bar. The compressed air is then cooled to a temperature of 37^0C before it is expanded in the expander. Calculate the COP of the system when compression and expansion are: (i) isentropic and (ii) follow the law $pv^{1.25}$=constant. [8M]

3. A vapor compression refrigeration system operating between pressure limits of 7.5 bar and 1.5 bar. The vapor enters the compressor at a temperature of - 8^0C and the liquid leaving the condenser is at 12^0C. For a refrigerating effect of 2 kW, determine COP. Find the power rating of the compressor motor considering a mechanical efficiency of 85%. The enthalpies at 1.5 bar and 7.5 bar are 1692 kJ/kg and 1919 kJ/kg respectively. Liquid enthalpy is 474 kJ/kg at the end of condensation. [14M]

4. a) What is refrigerant? Can water be used as a refrigerant? Explain the limitations. [7M]
   b) Why centrifugal compressors are preferable as compared to reciprocating compressors? What are their relative advantages? Explain. [7M]

5. a) Explain, with the help of a neat diagram, the working of the Ammonia-Water absorption system. [7M]
   b) Explain the working principle and components of the thermoelectric refrigerating system. [7M]

6. a) Explain the difference between comfort air-conditioning and industrial air-conditioning. [4M]
   b) A cinema hall of seating capacity 1500 persons have been provided with an air-conditioned plant with the following data: Outdoor conditions=40^0C DBT and 20^0C WBT; Required indoor conditions=20^0C DBT and 60% RH; Amount of outdoor air supplied=0.3 m^3 /min/person. If the required condition is achieved first by adiabatic humidifying and then by cooling, find: (i) The capacity of the cooling coil and surface temperature of the coil if the by-pass factor is 0.25; and (ii) The capacity of the humidifier and its efficiency. [10M]

7. What are the different types of fans used in air-conditioning systems? Discuss their applications with their relative advantages and disadvantages. [14M]

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Code No: R1632033 **R16** SET - 1

III B. Tech II Semester Supplementary Examinations, April - 2021

REFRIGERATION AND AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Sketch Bell column cycle on P-V diagram. [2M]
   b) What are the disadvantages of wet compression? [2M]
   c) List out the properties of ideal refrigerant. [2M]
   d) Write the principle of thermoelectric refrigeration. [3M]
   e) Write any two major requirements of human comfort. [3M]
   f) What is the difference between grill and register used in air conditioning system? [2M]

PART –B (56 Marks)

2. a) 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. Air coming out of compressor is cooled to 30^0C before entering the expansion cylinder. Expansion and compression follow the law $p.v^{1.35}$ = constant. Determine C.O.P. of the system. Take $\gamma = 1.4$ and $C_p = 1$ kJ/kg –k for air. [8M]
   b) Explain Boot strap evaporative cooling air refrigeration system. [6M]

3. a) State the effects of suction pressure and discharge pressure on performance of vapour compression system. [6M]
   b) A simple saturation cycle using F12 is designed for taking a load of 10 tons. The refrigerator and ambient temperatures are -1^0C and 30^0C respectively. A minimum temperature difference of 5^0C is required in evaporator and condenser 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 acting compressor if it runs at 300 r.p.m. with volumetric efficiency = 0.9. [8M]

4. a) What is an azeotrope? Give some examples to indicate its importance. [7M]
   b) Explain why refrigerant R22 cannot be used with Hermetically sealed compressors? [7M]

5. a) List out the merits and demerits of thermo-electric refrigeration system over other refrigeration systems. What are the major fields of its applications? [7M]
   b) With a neat diagram, explain the working of Vortex tube refrigerator. [7M]

6. a) Define room sensible heat factor. How room sensible heat factor line is drawn on the psychrometric chart? [6M]
   b) The air at 35^0C DBT and 25^0C WBT is passed through a cooling coil at the rate of 280 m^3/min. The air leaves the cooling coil at 26.5^0C DBT and 50% relative humidity. Find: i) Capacity of the cooling coil in tonnes of refrigeration; ii) Wet bulb temperature of the leaving air; iii) Water vapor removed per minute; iv) Sensible heat factor. [8M]

7. a) Suggest the different constructional features used in heat pump to improve the overall EPR. [7M]
   b) Describe a centrifugal fan with the help of a neat sketch. [7M]

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Code No: **R1632033** **R16** SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, August-2021

REFRIGERATION AND AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**
4. Use of refrigeration and air-conditioning tables and charts allowed.
5. Use of psychometric chart is allowed.

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PART –A **(14 Marks)**

1. a) Define Unit of refrigeration. [2M]
   b) What is the effect of super heating of vapor on the COP? [2M]
   c) Why global warming is increasing day-by-day? [2M]
   d) What are the refrigerant and absorbent in Li-Br and water absorption system? [3M]
   e) What do you understand by effective room sensible heat factor? [3M]
   f) List out the advantages and disadvantages of viscous filters over dry filters? [2M]

PART –B **(56 Marks)**

2. a) What are the factors to be considered for the refrigeration system for an aeroplane? Explain briefly. [4M]
   b) An air refrigerator working on the principle of Bell-Coleman cycle. The air into the compressor is at 1 atm at -10^0C. It is compressed to 10 atm and cooled to 40^0C at the same pressure. It is then expanded to 1 atm and discharged to take cooling load. The air circulation is 1 kg/s, the isentropic efficiency of the compressor = 80%, the isentropic efficiency of the expander = 90%. Find the following: [10M]
      i) Refrigeration capacity of the system;
      ii) C.O.P of the system, Take $\gamma = 1.4$, $C_p = 1.00$ kJ/kg ^{0}C.

3. A refrigeration system operates with R12 refrigerant. The evaporator and condenser temperature are at -5^0C and -35^0C respectively. The actual suction to the compressor is at 15^0C. If superheating of refrigerant vapour from -10^0C to 20^0C does not add any refrigerating effect: [14M]
      i) Determine the percentage increase in volume flow rate per ton of refrigeration compared with the saturation cycle;
      ii) Compare the COP for saturated and superheated cycles; and
      iii) Determine the power required per TR.

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4. List the commonly used refrigerants in practice and explain in detail desirable chemical properties of refrigerants. [14M]

5. Explain the various components of steam jet refrigeration system and clearly discuss the function of each component. Compare the steam jet refrigeration system with vapor compression refrigeration system. [14M]

6. a) Which type of air cleaner would be selected for removing very small particles of dirt and smoke from the air? Explain the working principle of this cleaner. [7M]

   b) Explain in detail about heat pump circuits. [7M]

7. a) What is an effective temperature? State and explain the factors which govern optimum effective temperature. [7M]

   b) Atmospheric air having DBT=16^{0}C and RH=25% is passed through a furnace and then through a humidifier to maintain a final DBT of 30^{0}C and 50% R.H. Find the heat and moisture added to the air during the process. Also calculate the sensible heat factor of the process. [7M]

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