

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April-May 2015

B. Tech in Mechanical Engineering, Semester VI



Roll No.....

ME 602: Refrigeration & Air-conditioning

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. You may use your own Psychrometric chart and steam table in original form published in books.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	In a refrigerating machine, heat rejected is heat absorbed; (a) equal to (b) less than (c) greater than (d) any of these.	
ii.	Air refrigerator works on; (a) Carnot cycle (b) Rankine cycle (c) Reversed Carnot cycle (d) Bell-Coleman cycle (e) both (a) and (b), (f) both (c) and (d).	
iii.	The sub-cooling is a process of cooling the refrigerant in vapour compression refrigeration system (a) before compression (b) after compression (c) before throttling (d) after throttling.	
iv.	A domestic refrigerator capacity may be approximately (a) 1 ton (b) 0.1 ton (c) 1.5 ton (d) 10 ton.	
v.	The refrigerant, commonly used in vapour absorption system, is (a) Water (b) ammonia (c) freon (d) aqua-ammonia (e) Sulphur di-oxide.	
vi.	A vapour absorption system; (a) gives noisy operation (b) gives quiet operation (c) requires little power consumption (d) cools below 0°C.	
vii.	The C.O.P. of the steam jet refrigeration system varies from; (a) 0.1 to 0.2 (b) 0.4 to 0.6 (c) 3 to 5 (d) 6 to 10.	
viii.	A good refrigerant should have (a) low specific heat ratio (γ) (b) high latent heat (c) high thermal conductivity (d) all of the above.	
ix.	Effective temperature depends on (a) only dry bulb temperature (b) dry bulb temperature and wet bulb temperature (c) dry bulb temperature and relative humidity (d) dry bulb temperature, wet bulb temperature and air motion.	
x.	The relative humidity, during cooling and dehumidification of moist air (a) increases (b) decreases (c) can increase or decrease (d) remains constant.	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	What is main characteristic feature of an air-refrigeration system?	
ii.	What is the difference between 'Wet compression' and 'Dry compression'?	
iii.	Discuss briefly heating and dehumidification.	
iv.	What is "Effective room sensible heat factor".	
Q.3A	State the functions of the following parts of a simple vapour compression system: (i) Compressor (ii) Condenser, (iii) Expansion valve, and (iv) Evaporator	05
Q.3B	What is multistage compression? State the advantages and disadvantages of multistage compression.	05



Q.4A	State merits and demerits of an air refrigeration system.	05																		
Q.4B	What are the advantages of compound compression with intercooler over single stage compression?	05																		
Q.5A	Describe the working of a steam jet refrigeration system with the help of a neat sketch.	05																		
Q.5B	Explain with a neat sketch a Bootstrap cycle of air-refrigeration system.	05																		
Q.6A	Enumerate the desirable properties of an ideal refrigerant.	05																		
Q.6B	Derive an expression for specific humidity and show that it is function of vapour pressure and barometric pressure of air.	05																		
OR																				
Q.6B	The air supplied to a room of a building in winter is to be at 17°C and have a relative humidity of 60%. If the barometric pressure is 1.01325 bar, find: (i) the specific humidity, and (ii) the dew point under these conditions.	05																		
Q.7A	Explain the different methods of improving the C.O.P. of a simple vapour compression refrigeration cycle.	05																		
Q.7B	Explain briefly 'Effective temperature chart' and 'Comfort chart'.	05																		
OR																				
Q.7B	Explain briefly with a neat diagram 'Practical vapour absorption system'.	05																		
Q.8A	A refrigeration plant of 150 tons capacity uses R-22 as refrigerant. The condensing and evaporating pressures are 11.82 bar & 1.64 bar. The refrigerant enters the condenser dry-saturated state and it leaves the condenser, sub cooled by 10°C. Actual C.O.P. is 80% of the theoretical. Find theoretical and actual C.O.P. Take C_p (vapour) = 0.55 kJ/kg-K, C_p (liquid) = 1.19 kJ/kg-K. Take the following properties of R-22.	10																		
<table><tr><td>p (bar)</td><td>T_s (°C)</td><td>h_f (kJ/kg)</td><td>h_g (kJ/kg)</td><td>s_f (kJ/kg-K)</td><td>s_g (kJ/kg-K)</td></tr><tr><td>1.64</td><td>-30</td><td>116.1</td><td>393.1</td><td>0.8698</td><td>1.803</td></tr><tr><td>11.82</td><td>+30</td><td>236.7</td><td>414.5</td><td>1.125</td><td>1.712</td></tr></table>		p (bar)	T_s (°C)	h_f (kJ/kg)	h_g (kJ/kg)	s_f (kJ/kg-K)	s_g (kJ/kg-K)	1.64	-30	116.1	393.1	0.8698	1.803	11.82	+30	236.7	414.5	1.125	1.712	
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Q.9A	Explain the difference between summer air-conditioning and winter air-conditioning.	10																		
Q.9B	Discuss the effect of the following on the performance of a vapour compression system: (i) effect of suction pressure (ii) effect of delivery pressure (iii) effect of superheating (iv) effect of sub-cooling of liquid.	10																		
OR																				
Q.9B	An air-conditioned auditorium is to be maintained at 27°C DBT and 55% RH. The ambient condition is 39°C DBT and 28°CWBT. The total sensible heat load is 120,000 kJ/h and the total latent heat load is 45,000 kJ/h. 70 percent of the return air is recirculated and mixed with 30 percent of make-up air after the cooling coil. The condition of air leaving the coil is 16°C. Determine: Room sensible heat factor, condition of air entering the auditorium, amount of make-up air, apparatus dew point, By-pass factor of the cooling coil.	10																		