BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER: VII**
BRANCH: MECHANICAL **SESSION: MO 24**

SUBJECT: ME401 REFRIGERATION AND AIR CONDITIONING

TIME: 3 HOURS **FULL MARKS: 50**

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Steam table and Psychrometry charts will be provided in the Examination room.

			CO	BL
Q.1(a)	With neat sketch, explain the construction of Regenerative air- refrigeration system. Also show the various processes in T-s diagram.	[5]	1	3
Q.1(b)	The cockpit of a jet plane is maintained at 25°C using air-cycle refrigeration system. The ambient air temperature and pressure are –15°C and 0.35 bar respectively. The pressure ratio of the jet compressor is 3. The plane moves at a speed of 1000 km/hr. The air is passed through a heat exchanger after compression and cooled to its original condition entering into the jet plane. The pressure loss in heat exchanger is 0.1 bar. The pressure of the air leaving the cooling turbine is 1.06 bar and the air-pressure in the cabin is 1.013 bar. The cooling load in the cockpit is 70 kW. Determine: (i) Stagnation temperature and pressure(ii) Mass flow rate of air circulated through the cabin (ii) Volume handled by the compressor and expander (iii) Net power delivered to the refrigeration system (iv) The C.O.P. of the system	[5]	1	4
Q.2(a)	Analyse why the Carnot VCRS cycle is practically not possible. Explain its limitations by comparing with the real cycle.	[5]	2	3
Q.2(b)	A F-12 vapour compression refrigeration system has a condensing temperature of 50°C and evaporating temperature of 0°C. Th refrigeration capacity is 7 tons. The liquid leaving the condenser is saturated liquid and compression is isentropic. Determine: a. The refrigeration flow rate b. Compressor power required c. The heat rejected in the plant d. COP of the system Take Enthalpy at the end of isentropic compression = 210 kJ/kg. Use properties of F-12 as listed in the table.	[5]	2	2
Q.3(a)	Explain in detail the advantages of the Vapour Absorption Refrigeration System (VARS) over the Vapour Compression Refrigeration System (VCRS). Explain why the absence of a mechanical compressor is an important advantage of VARS.	[5]	3	3
Q.3(b)	With suitable sketch, explain the construction and working of Steam jet refrigeration system. List its advantages and disadvantages.	[5]	3	2
Q.4(a)	The sling-psychrometer reads 40°C DBT and 28°C WBT. Calculate the followings: 1. Specific humidity 2. Relative humidity 3. Dew-point temperature 4. Enthalpy of the mixture per kg of dry air. Assume atmospheric pressure to be 1.03 bar.	[5]	4	4
Q.4(b)	30 m^3 of air at 15°C DBT and 13°C WBT are mixed with 12 m^3 of air at 25°C DBT and 18°C WBT. The barometric pressure is 1.013 bar. Determine the DBT and WBT of the resulting mixture. Solve the problem using psychrometric chart.	[5]	4	4
Q.5(a)	What is IQF technique. List its advantages.	[5]	5	2
Q.5(b)	With neat sketch, explain the construction and working of Ice plant.	[5]	5	2

Saturation temperature, °C	Pressure, bar	h_f, kJ/kg	h_g, kJ/kg	s_f, kJ/kgk	s_g,kJ/kg
50	12.199	84.868	206.298	0.3034	0.6792
0	3.086	36.022	187.397	0.1418	0.6960

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