

5

BE-Mech-sem-VII-Rev

RAC
(3 Hours)

QP Code : 8454

[Total Marks: 100]

Instructions to the candidates, if any :-

N. B. :

- (1) Question 1 is compulsory.
- (2) Attempt any 4 questions out of remaining 6 questions.
- (3) Clearly mention the assumptions made if any.
- (4) Use of Refrigerant, Psychometric charts and tables, steam table are permitted

Q. No.	Marks
Q 1	Attempt any FOUR
a)	A Carnot refrigerator works between the temperature limits of -5°C and 23°C . Calculate the power required to run the refrigerator in case it produces 1000 kg of ice per hour at -5°C . Surrounding temperature is 23°C . Assume reversible heat transfer, specific heat of ice as 2kJ/kg K and that of the water as 4.187kJ/kg K and latent heat of freezing as 335kJ/kg . 05
b)	What are pressure losses in air distribution ducts? Explain them in brief. 05
c)	What is multistage compression? State advantages and disadvantages of multistage compression. 05
d)	State merits and demerits of an air refrigeration system. 05
e)	Discuss Why refrigerators are so selected that evaporator pressures and condenser pressures are greater than atmospheric pressure? 05
Q2	a) A class room of 60 seating capacity has to be air conditioned. Outdoor conditions are 32°C DBT and 22°C WBT. Required comfort conditions are 22°C DBT and 55 % RH. The quantity of outdoor air supplied is $0.5\text{m}^3/\text{min}/\text{student}$. The comfort conditions are achieved first by chemically dehumidifying the air and then cooling by coil. Find i) DBT of the air leaving dehumidifier, ii) Capacity of the dehumidifier, iii) Capacity of cooling coil in tons of refrigeration, iv) Required surface temperature of the cooling coil if the bypass factor of the cooling coil is 0.3. 10
	b) Differentiate Central, District and Unitary air conditioning systems. 10
Q3	a) Explain the working of two stage compression with water intercooler and subcooler used for vapour compression system. 10
	b) Draw a neat diagram of LiBr-Water absorption system and explain its working. List the major field of applications of this system. 10
Q4	a) A vapour compression system using R12 works between -15°C and 35°C on the evaporator and condenser sides respectively. Using P-h chart determine: i. COP, ii. Mass flow rate of refrigerant per TR, iii. Piston displacement per TR using volumetric efficiency of 80 %, iv. Heat rejected in the compressor per TR, and v. Ideal COP 12

b) Discuss desirable thermodynamic properties of refrigerants. Explain numbering system s of refrigerants with example. 08

Q5 a) Following data is recorded for a reduced ambient air refrigeration system: 12

Ram air pressure and temperature	1.1 bar, 293 K
Pressure of air at exit of compressor	3.3 bar
Isentropic efficiency of compressor	80%
Effectiveness of heat exchanger	0.8
First cooling turbine exit pressure of 85% of internal efficiency	0.8 bar
Cabin pressure and temperature	1.01 bar, 25°C
Isentropic efficiency of second cooling turbine	84%
Refrigerating load required	25 tons

Find

- i) Mass flow rate of air in kg/min
- ii) Compressor power
- iii) COP

b) What do you understand by Wet Compression? How it can be avoided? Explain any one method. 08

Q6 a) Describe a psychrometric process where sensible heat removal and latent heat gain are same. 10

b) A 12 cm long duct passes air at the rate of $1.3\text{m}^3/\text{s}$. If the friction factor is 0.005 calculate the pressure drop in the following cases. i) When duct is circular of diameter 270 mm. ii) when the duct is 270 mm square section 10

Q7 a) How to estimate cooling load of a college library. Hence define RSHF, GSHF and explain how to draw RSHF and GSHF lines. Clearly state the assumptions made if any. 10

b) Write short notes on ANY TWO of the following 10

- i) Thermal insulation of air conditioning system
- ii) Global warming and refrigerants
- iii) Dry ice manufacturing and its applications
- iv) Evaporating cooling systems