Code No: R1631351 **R16** SET - 1

III B.Tech I Semester Regular Examinations, October/November-2018

THERMODYNAMICS AND REFRIGERATION SYSTEMS

(Agriculture Engineering)

Time: 3 hours Max.Marks:70

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

PART-A

1. a) What is a thermodynamic system? [2M]
   b) State Clausius theorem. [2M]
   c) Name the various processes involved in the production of low temperatures. [3M]
   d) Explain the concept of Heat pump with a schematic diagram.. [3M]
   e) List the demerits of wet compression? [2M]
   f) List four aspects to be considered in selection of a refrigerant. [2M]

PART-B

2. a) Differentiate between path function and point function with examples. [7M]
   b) A domestic food freezer maintains a temperature of -15^0C. The ambient air temperature is 30^0 C. If heat leaks into the freezer at the continuous rate of 1.75 kJ/s what is the least power necessary to pump this heat out continuously? [7M]

3. a) What is a spark ignition Engine? What is the air standard cycle of such an engine. What are its four processes? [7M]
   b) An engine working on the Otto cycle is supplied with air at 0.1 MPa, 35^0C. the compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency, and the mean effective pressure. (For air, c_p=1.005, c_v=0.718 and R=0.287 kJ/kgK). [7M]

4. a) i) What is refrigerating effect? ii) What is a tonne of refrigeration? [7M]
   b) A Refrigerant-12 vapour compression plant producting 10 tonnes of refrigeration operates with condensing and evaporating temperatures of 35^0 C and -10^0 C respectively. A suction line heat exchanger is used to sub cool the saturated liquid leaving the condenser. Saturated vapour leaving the evaporator is superheated in the suction line heat exchanger to the extent that a discharge temperature of 60^0C is obtained after isentropic compression. Determine [7M]
   i) the sub cooling achieved in the heat exchanger,
   ii) the refrigerant flow rate in kg/s,
   iii) the cylinder dimensions of the two –cylinder compressor, if the speed is 900 rpm, stroke-to-bore ratio is 1.1, and the volumetric efficiency is 80%,
   iv) the COP of the plant, and
   v) The power required to drive the compressor in kW.

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5. a) Explain the working of Bell-Coleman Refrigerator. [7M]
   b) In a Bell-Coleman refrigeration plant, the air is drawn from cold chamber at 1 bar and 10^0 C, and compressed to 5 bar. The same is cooled to 25^0 C in the cooler before expanding in the expansion cylinder to cold chamber pressure of 1 bar.
   i) Determine the theoretical COP of the plant and the theoretical net refrigeration effect/kg of air. The compression and expansion be assumed isentropic. Assume γ=1.41, Cp=1.009 kJ/kg^{0}K. [7M]
   ii) If the compression and expansion laws followed are $pv^{1.35}$=c and $pv^{1.3}$ = c respectively, how will the result be modified.

6. a) Explain the vapour absorption refrigeration cycle with the help of p-h diagram. [7M]
   b) A Freon-12 installation has the following data: [7M]

Capacity	15 ton
Evaporator temperature	-10^0C
Condenser temperature	30^0C
Temperature of refrigerant superheated as gas in evaporator	-5^0C
Temperature of refrigerant sub-cooled as liquid in condenser	-25^0C
Compressor particulars: number of cylinders	2

Bore= 1.5 times stroke
r.p.m. = 960
Determine:
i) Refrigerating effect/kg,
ii) Mass of refrigerant circulating/min,
iii Theoretical power,
iv) Co-efficient of performance,

7. a) i) What do you understand by DBT? [3M]
   ii) Explain the process of cooling and humidification. [4M]
   b) The barometer for atmospheric air reads 750 mm Hg; the dry bulb temperature is 33^0C; wet bulb temperature is 23^0C. Determine [7M]
   i) the relative humidity
   ii) the humidity ratio
   iii) the dew point temperature and
   iv) Density of atmospheric air.

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