B.Tech. Degree VI Semester Examination in Marine Engineering, July 2006
MRE 605 MARINE REFRIGERATION AND AIR CONDITIONING

Time: 3 Hours   Maximum Marks: 100

I   a)   Derive an expression for the volumetric efficiency in terms of clearance factor.   (10)

     b)   A single stage double acting compressor handles $17m^3$ of air per minute, measured at 1 bar and $15°C$. The pressure and temperature at the end of suction are 0.98 bar and $32°C$. The air is delivered at 6.325 bar assuming a clearance factor of 5% and the compression and expansion process follows the law pV^{132}=constant, determine the stroke volume of the compressor at 500 rpm. Also calculate the indicated power in KW of the compressor R=286J/Kg°K. Neglect the effect of piston rod.   (10)

OR

II   a)   Derive an expression for the intermediate pressure for minimum shaft work of a two state compressor with perfect inter cooling.   (10)

     b)   A small single acting compressor has a bore and stroke both of 10 cm and is driven at 350 rpm. The clearance volume is $75cm^2$ and the index of compression and expansion is 1.23. The suction pressure is 0.95 bar and the delivery pressure is 7 bar. Calculate (i) the volume of free air at 1 bar and $20°C$ dealt with per minutes, if the temperature at the start of compression is $30°C$ and (ii) the mean effective pressure of the indicator diagram, assuming constant suction and delivery pressure.   (10)

III   Sketch and describe a typical vapour comparison type refrigeration plant used on board a ship. Enumerate the advantages of this over the other system.   (20)

OR

IV   Write *short notes* on:
-      (i)   Different type of refrigerants used on board and their properties   (6)
-      (ii)   Refrigeration in liquefied Gas carriers   (6)
-      (iii)   Cooling capacity   (4)
-      (iv)   Montreal Protocol   (4)

V   Draw a line diagram of a refrigerant plant meant for maintaining multiple temperatures. Explain with sketches the construction and functions of evaporator and expansion valve.   (20)

OR

VI   Write *short notes* on:
-      (i)   Insulating materials and their application in refrigeration   (7)
-      (ii)   Maintenance of refrigeration plants   (7)
-      (iii)   Defrosting methods   (6)

VII   a)   Explain the following:
-      (i)   Dalton's Law of partial pressure   (4)
-      (ii)   Specific heat and molar heat capacity of gas mixtures   (4)
-      (iii)   Adiabatic Mixing   (4)

     b)   Air flowing at 100Kg/min and dry bulb temperature of $30°C$ and wet bulb temperature of $21°C$ mixes adiabatically with another stream of air flowing at 150Kg/min and dry bulb temperature $21°C$ and relative humidity 50%. Determine specific humidity and enthalpy of the stream after mixing.   (8)

OR

VIII   a)   Explain the following:
-      (i)   Specific humidity   (ii)   Dew point
-      (iii)   Wet bulb temperature   (iv)   Saturated and unsaturated air   (10)

     b)   The DBT and WBT of air are $35°C$ and $25°C$ respectively when barometer reads 74.5 cm of Hg. Find (i) Relative Humidity (ii) Specific humidity (iii) DPT (iv) Density (v) Enthalpy   (10)

IX   Discuss the requirement of air conditioning on board. What are the different types of air conditioning systems found on board? Explain with sketches double duct type air conditioning system fitted on board.   (20)

OR

X   Write *short notes* on:
-      (i)   Ventilation of CO_2 and battery rooms   (6)
-      (ii)   Cooling load calculation of an A/C plant   (7)
-      (iii)   Various types of fans used in A/c plants   (7)

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