INDIAN MARITIME UNIVERSITY
(Central University, Government of India)

May/June 2016 End Semester Examinations
B.Tech. (Marine Engineering)

Fourth Semester – Marine Heat Engine & Air Conditioning
(UG11 T1406/ T2406)

Date : 20.06.2016 **Max. Marks: 100**
Time: 3 Hrs **Pass Marks : 50**

Part-A **(3 x 10 = 30 Marks)**
Compulsory Question

1) a) Explain the term "compounding" in steam turbines.
b) Discuss the advantages of employing multistage system gas turbine with intercooling and reheating.
c) In a refrigeration system, explain the use of multiple evaporators.
d) What is thermostatic expansion valve?
e) What do you understand by dry and wet compression with respect to refrigeration system? Which is preferred and why?
f) How does the actual vapour compression refrigeration cycle differ from the ideal one? Explain with Ts and Ph Diagrams.
g) Explain the difference between Impulse Turbine & Reaction Turbine.
h) Explain Carnot Vapour Power Cycle. Give its limitations.
i) Explain Sensible Heating and Sensible Cooling on a Psychometric Chart.
j) Explain the effect of increase in condenser pressure of a Power plant operating on Rankine Cycle.

Part-B **(14 x 5 =70 Marks)**
Answer any Five Questions

2) a) Explain the main deviations to simple saturated cycle in actual practice regarding refrigerating cycle.
b) Briefly explain the effect of sub-Cooling the liquid in refrigeration cycle. (7+7)

3) Sketch a brief arrangement the refrigerating System of a Ship. How different required temperatures are maintained in different fridge room? (14)

4) An air conditioning system is designed under the following conditions.
Outdoor Condition: 30 °C DBT, 75 % R.H
Required In Door Condition: 22 °C DBT, 70 % R.H
Amount of free air circulated: 3.3 m^3/s
Coil Dew Temperature 14 °C
The required condition is achieved first by cooling and dehumidification and then by heating. Estimate (a) the capacity of the cooling coil. (b) the capacity of the heating coil (c) the amount of water vapour removed in Kg/Sec. (14)

5) In a single stage Simple Impulse Turbine, steam flows at a rate of 5kg/s. The rotor diameter is 1.2 m and runs at 3000 rpm. Nozzle angle is 18°. Blade speed ratio is 0.4, velocity co-efficient is 0.9. Outer angle of blade is 3° less than inlet angle.
Determine:
a) the blade angles
b) the Power developed (8+6)

6) A centrifugal Compressor delivers free air of 18kg/min. Air is sucked at static state of 1 bar, 27° C with inlet velocity of 50 m/s. The total head pressure ratio is 4 and isentropic efficiency of compressor is 0.75.
The mechanical efficiency of motor attached is 0.9.
Take Cp = 1.005 kj/kg K for Air y = 1.4

Determine:
a) Total Head Temperature of Air at exit of compressor
b) Brake Power required to drive the compressor (8+6)

7) A steam power plant operates on ideal Rankine Cycle. Steam Enters HP Turbine at 20 MPa, 500°C and leaving the LP Turbine as 90% dry. Considering the Condenser Pressure as 0.005 MPa and Reheat Temperature as 500°C,

Determine:
i) Reheat Pressure
ii) Thermal Efficiency of the plant (6+8)

8) In a reaction stage of a steam turbine the nozzle angle is 20° and absolute velocity of steam at the inlet to the moving blades is 240m/s. The blade velocity is 210 m/s. If the blading is designed for 50% reaction,

Determine:
i) the blade angle at the inlet and the exit
ii) the diagram power for steam flow of 1 kg/s
iii) the diagram efficiency (4+5+5)

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