

INDIAN MARITIME UNIVERSITY
(A Central University, Govt. of India)

May/June 2015 End Semester Examinations

SEMESTER – II, B.TECH (MARINE ENGINEERING)

APPLIED THERMODYNAMICS - I (T 2203 / T 1203)

Date: 11.06.2015
Time: -3 Hrs

Max.Marks:100
Pass Marks:50

PART – A
(Compulsory Questions)

(3 x10 = 30 Marks)

1. a) State Kelvin Planck statement of second law of thermodynamics.
b) Explain entropy. Write down the unit in SI system
c) What is Specific Steam Consumption & Efficiency Ratio w.r.t. a steam engine?
d) Draw the Block Diagram of a Regenerative vapour cycle.
e) What are the four basic components of a steam power plant?
f) What do you mean by hypothetical indicator diagram?
g) What is the meaning of perfect intercooling in an air compressor?
h) Define Volumetric Efficiency of an air compressor.
i) Define Relative humidity and Percentage Saturation
j) Explain a psychometric chart.

PART – B
(Answer any five of the following)

(5 x14 = 70 Marks)

2. a) State Carnot's Theorem **(3)**
b) Two heat engines operating in series are giving out equal amount of work.
If the total work is 50 kW and the reservoirs are at 1000 K and 250 K, find out
(i) the intermediate temperature, (ii) the efficiency of each engine.
(iii) the heat extracted from the source. **(5+4+2)**

3. a) What is a Reversible process? State the nature of the process. (4)
- b) A chamber is partitioned into equal compartments. On one side there is oxygen at 0.85 bar and 14 °C . On the other side is also oxygen but at 0.1 Bar and 14 °C . The chamber is insulated and has a volume of 7500 cm³. Find the change in entropy of the system, when the partition is removed , considering the final temperature remain constant. (10)
4. Steam at a pressure of 15 bar and at temperature of 300 °C is supplied to a steam turbine working on the Rankine Cycle . If the exhaust takes place at 0.15 bar , evaluate
a) Rankine efficiency b) Specific Steam Consumption, (10+4)
5. A single cylinder, double acting steam engine is required to develop 60 kW and the following assumptions are made: (7+2+5)
- | | |
|-----------------------|------------------------|
| Boiler Pressure- | 1.25 MN/m ² |
| Back Pressure - | 0.13 MN/m ² |
| Cut-off | at 0.3 Stroke |
| Diagram Factor - | 0.82 |
| Mechanical Efficiency | 78%, |
| Mean Piston Speed | 3 m/sec |
| Stroke | 1.25 times Bore |
- Determine (a) the bore of the cylinder,
(b) the piston stroke,
(c) the speed of the engine.
6. A three stage single acting reciprocating air compressor has a L.P. cylinder of 450 mm bore and 300 mm stroke. The clearance volume of the LP cylinder is 5% of the swept volume . Intake pressure and temperature are 1 bar and 18 °C respectively, while the delivery pressure is 15 bar.
Intermediate pressures are ideal and intercooling is perfect. The compression and expansion index can be taken as 1.3. Estimate (7+7)
(a) the intermediate pressures,
(b) the work done per kg of air , Take R= 0.29 kJ/kgK
7. a) State Dalton's Law of Partial Pressure (3)
- b) An exhaust Gas is analysed and is found to contain by volume 78% N₂, 12% CO₂ and 10 % O₂ . What is the corresponding gravimetric analysis?
Calculate the Molar Mass of the Mixture and the density if the temperature is 550 °C and the total Pressure is 1 bar. (6+5)
8. Air with a relative humidity of 0.7 is at a temperature of 25 °C.
The Barometric pressure is 998 mbar. For this air, determine
a) the Dew Point
b) the mass of condensate formed per kg of dry air if the air is cooled to 14 °C. (7+7)
