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

May/June 2015 End Semester Examinations

SEMESTER – III, B.TECH (MARINE ENGINEERING)

APPLIED THERMODYNAMICS - II (T 2303 / T 1303)

Date:13.06.2015 **Max.Marks:100**
Time:-3 Hrs **Pass Marks:50**

PART – A (3 x10 = 30 Marks)
(Compulsory Questions)

1. a) What is Mach Number and its value for subsonic, sonic and supersonic flow?

   b) What is Stoichiometric Air Fuel ratio and Excess air?

   c) What is velocity and Pressure Compounding in Turbine?

   d) With the help of a Reversed carnot cycle, derive an expression for the COP_{ref} and $COP_{heatpump}$.

   e) What is fourier law of heat conduction?

   f) Define higher and lower calorific value.

   g) What are the difference between a nozzle and a diffuser.

   h) What is diagram efficiency of a Turbine ?

   i) What is one tonne refrigeration?

   j) What is Prandtl Number and Nusselt Number?

PART – B (5 x14 = 70 Marks)
(Answer any five of the following)

2. The analysis of a supply of gas is as follows: H2 49.4% ; CO 18% : CH4 20% ; C4H8 2% ; O2 0.4% ; N2 6.2% ; CO2 4% calculate **(14)**
   i) The Stoichiometric A/F ratio
   ii) The wet and dry analysis of the products of combustion if the actual mixture is 20% weak

3. a) A refrigerator has working temperatures in the evaporator and condenser coils of -30°C and 32°C respectively. What is the maximum COP possible? If the actual refrigerator has COP of 0.75 of the maximum calculate the required power input for a refrigerating effect of 5 KW. **(7)**

   b) What are the effect of decrease of evaporator pressure and increase of condenser pressure in a vapour compression refrigeration cycle **(7)**

4. a) What are the difference between impulse and reaction turbine?

   b) The velocity of steam leaving the nozzles of an impulse turbine is 900 m/sec and the Nozzle is 20°. The blade velocity is 300 m/sec and the blade velocity co-efficient is 0.7. Calculate for a mass flow rate of 1 kg/s, the symmetrical blading-
   i) The blade inlet angle. ii)The driving force on the wheel.
   iii)The axial thrust iv)The diagram power v) The diagram efficiency

   (4+10)

5. a) Derive an expression for heat flow through a cylinder.

   b) For a dimensionless group prove that Nusselt Number(Nu) is a function of Pandte Number(Pr) and Reynolds number(Re).

   (4+10)

6. a) What is nozzle efficiency?

   b) Dry saturated steam at a pressure of 11 bar enters a convergent divergent nozzle and leaves at a pressure at 2 bar. If the flow is adiabatic and friction less determine
   i) The exit velocity of steam. ii)Ratio of cross section at exit and at the throat. Assume the index of adiabatic expansion to be 1.135

   (2+12)

7. a) With a neat sketch describe the vapour compression refrigeration cycle.

   b) A vapour compression refrigerator works between the pressure limits of 60 bar and 5 bar. The working fluid is just dry at the end of compression and there is no under cooling of the liquid before the expansion valve. Determine:
   1) C.O.P. of the cycle; and
   2) Capacity of the refrigerator if the fluid flow is at the rate of 5 kg/min.

Pressure (bar)	Saturation temp (K)	Enthalpy (kJ/kg)		Entropy (kJ/kg K)	
		Liquid	Vapour	Liquid	Vapour
60	295	151.96	293.29	0.554	1.0332
25	261	56.32	322.58	0.226	1.2464

(4+10)

8. a) Classify Heat Exchangers .

   b) A cold room has one of the walls 5mx2.5m made of bricks12cm thick insulated externally by cork slabbing 8cm thick .cork is protected externally by2.5cm wood. Estimate the heat filtration through the walls in 24 hours, if the interior of the cold room is maintained at a temp of o0c and the outside temp. is 200c.Thermal conductivities of brick, cork and wood are 0.93, 0.044 and 0.175W/mk. What will be the interface temperature?

(4+10)

9. Write short notes on the following **(4X3 ½)**

   i) Mixture strength

   ii) Methods of improving COP.

   iii) Difference between convection and conduction.

   iv) Thermal conductivity of insulating materials.

****