INDIAN MARITIME UNIVERSITY
(A Central University)
DEPARTMENT OF MARINE ENGINEERING
B.TECH-MARINE ENGINEERING
SEMESTER EXAMINATION-June 2011

:ode:UG/ME/BS/T/226 Sub.name:MARINE HEAT ENGINES & AIRCONDITIONING

: 3 hours Max.marks:100

Part A (3 × 10 = 30 Marks)
Answer all the Questions

Mention the differences between Impulse Turbine & Reaction Turbine.
What is "Compounding"of Turbine?Explain Pressure Compounding.

What are the effects of condenser pressure on the Rankine cycle?

Mention the improvements made to increase the ideal efficiency of Rankine cycle.

Why is CARNOT Cycle not practicable for a Steam Power Plant?

What is the purpose of intercooling in gas turbine plant.

Why a heat engine cannot have 100% efficiency?

What is the difference between air conditioning and refrigeration?

Define the term "Relative humidity" related to psychometry. $\frac{m_v}{(m_v)_s} = \frac{p_v}{p_g}$

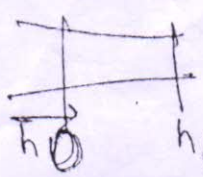
What do you mean by Dry Bulb and Wet Bulb Temperatures?

Part B (14 × 5 = 70 Marks)
Answer any five of the following

The velocity of steam, leaving the nozzle of an impulse turbine is 1000 m/s and the nozzle angle is 20°,the blade velocity is 350 m/s and the blade velocity coefficient is 0.85,assuming no losses due to shock at inlet, calculate for a mass flow of 1.5 kg/s and symmetrical blading. a) Blade inlet angle b) driving force on the wheel c)axial thrust on the wheel d)power developed by the turbine. (14 Marks)

In a simple impulse Steam turbine stage steam enters the nozzle at 15 bar, dry saturated with a velocity of 150 m/s. Nozzle angle is 20° and the steam leaves nozzle at 8 bar and enters into smooth blades. (Assume that Blade Velocity at inlet and exit is same).Considering nozzle velocity co-efficient as 0.9 and blades to be equiangular, determine: a) the blade angles b) the stage efficiency. (14 Marks)

blade velocity = 220 m/s



4. A steam plant working on a simple rankine cycle operated between the temperature of 260°C and 95°C, the steam is dry and saturated, when it enters the turbine and expanded isentropically. Find the Rankine efficiency. (14 Marks)

5. a) In a simple gas turbine plant working on brayton cycle, the inlet air temperature is 30°C and pressure is 1.0 bar, the pressure ratio is 6.25 and the maximum temperature is 827°C.find a)the compressor work b)the turbine work c)the cycle efficiency d)the work ratio. Compare the efficiency with that of carnot cycle operating between the same temperature limits. (10 Marks)

b) Air enters a brayton cycle at 100 Kpa, 300 K. The compression ratio is 8:1 .The maximum temperature in the cycle is 1300 K. find a) air standard efficiency b) compressor and turbine work c) work ratio. (4 Marks)

6. In an constant pressure gas turbine cycle, the air is taken in at 1.02 bar and 300K.the pressure ratio is 6.25,the compression is carried out in 2 stages with perfect intercooling inbetween. The maximum temperature of the cycle is limited to 1073 K. assuming each compressor stage isentropic efficiency as 85% and of turbine 90%.determine the efficiency of the plant and the power generating capacity in high power turbine if the flow of air is 2.3 Kg/s. (14 Marks)

7. An Axial flow compressor comprises a number of similar stages with equal work done/stage and the velocity of flow is uniform throughout the compressor. the following are the data.

Overall stagnation pressure ratio =3.5

Stagnation inlet temperature =60°C

Relative air angle at rotor inlet =130°C.

Relative air angle at rotor outlet =100°C

Blade velocity =185 m/s.

Degree of reaction= 0.5

Overall stagnation adiabatic efficiency =0.87

The data refer to mean blade height and the measurement of angle is done in the same sense.from the blade velocity diagram, calculate a)stagnation outlet temperature b)number of stages. (14 Marks)

8. Atmospheric air at 760 mm of Hg barometric pressure has 25°C dry bulb temperature and 15°C wet Bulb temperature. with the help of psychometric chart ,determine a)relative humidity b)humidity ratio c)dew point temperature d)enthalpy of air per kg of dry air e)partial pressure of vapour f)saturation pressure corresponding to dry bulb temperature of 25°C g)saturation pressure corresponding to the wet bulb temperature of 15°C h)volume of air/kg of dry air. (14 Mar'