

INDIAN MARITIME UNIVERSITY

Time Bound Assignment September/October 2020

B Tech (ME) Arrear Examinations

Marine Heat Engine and Air Conditioning

UG11T3406

Date: 30/09/2020

Maximum Marks: 70

Time: 3 Hrs

Pass Marks: 35

INSTRUCTIONS

1. Draw neat sketches wherever necessary
2. Figures to the right indicates full marks
3. Use of no programmable calculators is allowed
4. Use steam table, Psychometric chart, P- h charts etc wherever necessary.
5. Assume suitable data if required and mention that in the solution.

Part – A (compulsory)

Answer the following (10x2=20 Marks)

1. What is a. Nozzle b. Reheat factor
2. Write difference between impulse and reaction steam turbine
3. Write the different effects of impurities in the feed water.
4. Define boiler thermal efficiency
5. Classify gas turbine
6. Mention the different methods to improve gas turbine efficiency
7. Define 1 ton of refrigeration and refrigeration effect.
8. Discuss the effect of Sub-cooling on Coefficient of performance of with the help of P- h diagram.
9. Define a. Dry bulb temperature and b. Humidity
10. Sketch following processes on Psychometric chart a. Sensible heating and b. Cooling and dehumidification

Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

11. A single row impulse turbine has a mean blade speed of 215 m/sec. Nozzle entry angle is at 30 degree to the plane of rotation of the blades.

The steam velocity from the nozzle is 550 m/sec. There is a 15% loss of relative velocity due to friction across the blades. The absolute velocity at the exit is along the axis of the turbine. The steam flow through the turbine is at a rate of 700 Kg/h.

- (a) Draw combined (inlet and outlet) velocity diagram and determine **(2marks)**
- (b) Inlet blade angle **(2marks)**
- (c) Exit angle of the blade **(2marks)**
- (d) The absolute velocity of the steam at exit **(2marks)**
- (e) The power output of the turbine **(2marks)**
12. A) Discuss the velocity compounding of the steam turbine **(5marks)**
- B) Explain degree of reaction and write it's formula **(5marks)**
13. A) A boiler evaporates 8.2 kg of water per kg of coal fired from feed water at 40 deg. Celsius when working at 10 bar (abs). Find the Equivalent evaporation from and at 100 deg. Celsius per kg of coal fired when
- I) Steam is 0.95 dry **(2.5marks)**
- II) Steam is dry and saturated **(2.5marks)**
- (Note: Use the steam table)
- B) Explain single effect evaporator **(5marks)**
14. A) Draw block diagram and T-s diagram for gas turbine with intercooling arrangement and mention different processes. **(5marks)**
- B) Discuss the simple vapour absorption refrigeration system **(5marks)**
15. In a constant pressure open cycle gas turbine air enters at 1 bar and 20°C and leaves the compressor at 5 bar. Using the following data: Temperature of gases entering the turbine = 680°C, pressure loss in the combustion chamber = 0.1 bar, isentropic efficiency of compressor = 85%, isentropic efficiency of turbine= 80%, efficiency of combustion = 85%, $\gamma = 1.4$ and $C_p = 1.024$ kJ/kg K for air and gas,
- Draw correct T- s diagram **(2marks)**
- and Find following parameters:
- (i) The quantity of air circulation if the plant develops 1065 kW **(4marks)**

- (ii) Heat supplied per kg of air circulation **(2marks)**
 (iii) The thermal efficiency of the cycle **(2marks)**
 Mass of the fuel may be neglected.

16. 200 cubic meter of air per minute at 15°C DBT and 75% R.H. is heated until its temperature is 25°C. (Use Psychometric chart provided)

Show process on the Psychometric chart along with the values of different parameters used in solution **(4marks)**

and Find following:

- (i) R.H. of heated air **(2marks)**
 (ii) Wet bulb temperature of heated air **(2marks)**
 (iii) Heat added to air per minute **(2marks)**

17. The vapour compression refrigeration plant works between pressure limits of 5.3 bar and 2.1 bar. The vapour is superheated at the end of compression and its temperature is 37 deg. Celsius. The vapour is Superheated by 5 deg. Celsius before entering into the compressor. If the specific heat of the super heated vapour is 0.63 KJ/kgK. Find the Coefficient of performance of the plant. Use following property table.

(10marks)

Pressure, bar	Saturation temperature, deg. Celsius	Liquid heat, KJ/Kg	Latent heat, KJ/ Kg
5.3	15.5	56.15	144.9
2.1	-14.0	25.12	158.7

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