BT-MRE-II(R/S)-09.21-0543 Reg. No. | | | | | | | | |

B

B.Tech. Degree II Semester Regular/Supplementary Examination in Marine Engineering September 2021

19-208-0202 APPLIED THERMODYNAMICS

(2019 *Scheme*)

Time: 3 Hours Maximum Marks: 60

(5 × 15 = 75)

I. (a) State Clausius and Kelvin Plank Statement for second law of Thermodynamics. Give examples. (5)

(b) Prove that COP of heat pump is equal to COP of Refrigerator +1. (5)

(c) A Carnot heat engine cycle works at maximum and minimum temperature of 1000°C and 40°C respectively. Calculate the thermal efficiency and work done if heat supplied is 1010 KJ. (5)

OR

II. (a) State and explain Carnot theorem and the corollaries of Carnot theorem. (7)

(b) An engineer claimed that he made an engine operating between 500°C and 300°C and got 50% efficiency. Is his claim true or false? Why? (8)

III. (a) What are boiler mountings and accessories? List the boiler mountings and accessories used in a boiler. (7)

(b) Draw neat sketch of a Benson boiler and explain its work. (8)

OR

IV. (a) Explain the methods of increasing the thermal efficiency of a Rankine cycle. (7)

(b) In a Rankine cycle the steam at inlet to turbine is saturated at a pressure of 35 bar and exhaust pressure is 0.2 bar. Determine: (8)

(i) The pump work.

(ii) The turbine work.

(iii) The Rankine efficiency.

(iv) The condenser heat flow.

(v) The dryness fraction at the end of expansion.

Take a flow rate of 10kg/sec.

V. (a) What is critical pressure ratio and its significance? (5)

(b) What is the effect of friction on steam flow through the nozzle? (5)

(c) What is supersaturated steam flow? Explain it with HS diagram. (5)

OR

VI. (a) Explain the difference between impulse and reaction turbine. (7)

(b) The following data refers to a single stage impulse turbine. (8)

Steam velocity	= 800 m/s
Blade speed	= 300m/s
Nozzle angle	= 20°C
Blade outlet angle	= 25°C

Neglecting effect of friction, calculate the power developed by the turbine for steam flow rate of 25 kg/s. Also calculate the axial thrust on bearings.

(P.T.O.)

VII. (a) Differentiate between constant volume and constant pressure cycles. (7)

(b) In an air standard Otto cycle the condition of air at the beginning of compression is 1 bar, 300 K. The temperatures at the beginning and end of burning are 400°C and 1000°C respectively. Determine the compression ratio and the thermal efficiency. (8)

OR

VIII. (a) Explain the following: (7)

(i) Indicated power.

(ii) Brake power.

(iii) Friction power.

(iv) Mechanical efficiency.

(v) Thermal efficiency.

(b) In a Morse test with a four cylinder, four stroke petrol engine the following results were obtained. (8)

Brake Power with all cylinders working	= 24.25 KW
Brake Power with No.1 cut off	= 16.53 KW
Brake Power with No.2 cut off	= 17.2 KW
Brake Power with No.3 cut off	= 17.34 KW
Brake Power with No.4 cut off	= 17.8 KW

Estimate the indicated power of the engine and its mechanical efficiency .

IX. (a) Define Dalton's law of Partial pressure and Amagat's law of partial Volume. (7)

(b) Two vessels A and B both containing nitrogen are connected by a valve which is opened to allow both gases to mix and achieve an equilibrium temperature of 27°C. Before mixing the following information is known about the gases in the two vessels. (8)

Vessel A p =1.5 Mpa, t = 50°C, Content = 0.5 kgmol

Vessel B p = 0.6 Mpa, t = 20°C, Content = 2.5 kgmol

Calculate the final equilibrium pressure and the amount of heat transferred to the surroundings. Take Cp/Cv = 1.4.

OR

X. (a) Define and explain Specific humidity, Relative humidity, dew point. (8)

(b) A certain gas has Cp = 1.968 and Cv = 1.507 kJ/kgK, find its molecular weight and gas constant. (7)

***