Q. Code: 594150

B.E./B.TECH. Degree Examination, December 2020

Third Semester

MR16305 - Marine Steam Engines

(Use of Steam Tables and Mollier diagram are permitted)

(Regulation 2016)

Time: Three hours | Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. If we __________ the superheat at constant pressure then the cycle efficiency ___________.

   a. decrease, increases b. increase, decreases c. increase, increases d. decrease, decreases

2. Indicator diagram is used to determine the following

   a. speed b. temperature c. volume of cylinder d. M.E.P

3. Which of the following is true for steam flow through nozzle?

   a.The flow is assumed to be adiabatic b. steam loses its pressure and heat

   c.The work done is equal to the adiabatic heat drop d. All of the above

4. In reaction turbine the fixed blade

   a.alter the direction of steam b. allow steam to expand to a larger velocity

   c.functions as same of nozzle d. All of the above

5. What do you infer from the value of specific steam consumption?
6. Differentiate between theoretical and actual indicator diagram.
7. Brief the effect of friction on properties of steam while flowing through nozzle.
8. State the difference between free and forced convection.

PART B - (4 X16 = 64 marks)

09. (a) Compare binary vapour power cycle and simple vapour power cycle in detail and discuss their merits and demerits. **(16)**

(OR)

(b) Compare the Rankine efficiency of a high pressure plant operating from 80 bar and 400 ^{0}C and a low pressure plant operating from 40 bar and 400 ^{0}C, if the condenser pressure in both cases is 0.07 bar. **(16)**

10. (a) Define MEP and derive an expression for the same with usual notations. Also discuss the reasons for low thermal efficiency in reciprocating steam engines. **(16)**

(OR)

(b) Steam at 10 bar and 0.9 dry is supplied to an engine which expands it adiabatically to the release pressure of 1.2 bar, when the pressure falls at constant volume to the exhaust pressure of 0.2 bar. Calculate steam consumption in kg/kWh, MEP and heat removed in condenser per kg of steam. **(16)**

11. (a) A convergent-divergent nozzle for a steam turbine has to deliver steam under a supply condition of 15 bar with 100°C superheat and a back pressure of 0.2 bar. If the outlet area of the nozzle is 9.7 cm^2, determine using steam tables, the mass of steam discharged per hour. If the turbine converts 70% of the total enthalpy drop into useful work, determine the power delivered by the turbine. Neglect the effect of friction in the nozzle. Take Cp of superheated steam as 2.3 kJ/kg K. **(16)**

(OR)

(b) Discuss the changes in properties of steam while flowing through convergent divergent nozzle sections mainly at entry, throat and exit. Also derive an expression for exit velocity of steam. **(16)**

12. (a) The rotor of an impulse turbine is 50 cm diameter and runs at 10,000 r.p.m. The nozzles are at 20° to the plane, of the wheel, and the steam leaves them at 500 m/sec. The blades outlet angle are 30° and the friction factor is 0.8. Calculate the power developed per kg of steam per second and the diagram efficiency. **(16)**

(OR)

(b) The wall of a refrigerated van is of 2.0 mm of steel sheet at outer surface, 10 mm plywood at inner surface and 1.5 cm of glass wool in between. Calculate the rate of heat flow, if the temperature of the inside and outside surfaces are -10 ^{0}C and 30 ^{0}C. Take k(steel) = 23.2 W/mK, k(glass wool)= 0.014 W/mK and k(plywood)=0.052 W/mK **(16)**