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B037411(037)

B. Tech. (Fourth Semester) Examination, April-May 2022

(AICTE Scheme)

(Mechanical Engineering Branch), Automobile Engg Branch

APPLIED THERMODYNAMICS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. From each question part (a) is compulsory each are 4 marks and attempts any* ***two*** *parts from (b), (c) and (d) each are 8 marks. Use of steam table and mollier diagram is permitted.*

Unit-I

1. (a) Explain main parts of a reciprocting engine with neat sketch.

(b) Compare Otto, diesel and dual cycle for same compression ration and for same mxaimum, temperature and pressure.

(c) Explain dual cycle. Derive the exprssion for efficiency.

(d) For an Otto cycle minimum temperature is T_1 maximum temperature is T_3. For maximum work output find out the value of compression ratio r.

Unit-II

2. (a) Draw P-V and T-S diagram for both single and multi stage compressor with and without clearance vol.

(b) Derive expression for min. work required for multi-stage reciprocating compressor.

(c) A double stage compressor with complete inter-cooling takes air at 15°C, clearance volume and pressure ratio are 10% and 2 respectively. Find swept volume of high pressure cylinder corresponding to 50 litre swept volume of low pressure cylinder.

(d) For a two stage compressor with complete inter-cooling, show that

$P_2 =$

Unit-III

3. (a) Define :

(i) Work Ratio

(ii) Specific steam consumption

(b) Explain Rankine cycle in with P-V, T-S and H-S diagram. Derive the expression for efficiency also.

(c) Explain Binary vapour cycle.

(d) Steam power station have the following details

Steam at boiler outlet 150 bar 550°C

Reheat at 40 bar to 550°C, condensed at 0·1 bar

Find quality at turbine exhaust, cycle efficiency and steam rate.

Unit-IV

4. (a) Write down the different sources of air leakage into the condenser.

(b) Explain the classification and working of condenser.

(c) A steam turbine develops 2500 kW using 15000 kg of steam per hour which is supplied at 30 bar 300°C. The exhuast steam is condensed at a vacuum of 725 mm of mecury while the barometer reading is 758 mm of mercury. The condensate is removed at

a temp of 28°C and the temperature of circulating waer increases from 7 to 27°C. Find : dryness fraction of steam at condenser entry, mass of circulating water/hr and the cooling ratio min. amount of cooling water required per kg of steam, overall thermal efficiency.

(d) A barometric jet condenser handles 4500 kg. of steam per hour which is 0·96 dry. The condenser maintains 65 cm. mercury vacuums when the barometer indicate 76 cm. mercury. The cooling water enters the condeser at 15°C and mix. Of condensate and cooling water leaves the condenser at 40°C. Assuming no under cooling find-the minimum height of tail pipe above the level of hot well and the amount of cooling water required.

Unit-V

5. (a) Explain stagnation properties.

(b) Prove that

$$= \left(M^2 - 1\right)$$

(c) Explain Dimensional Velocity M^* with derivation of required expression.

(d) Explain Fanno lines in detail.