SV-74

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Seat No.	

S.E. (Mechanical) (Part-II) (Semester - III) (Revised) Examination, April - 2018

APPLIED THERMODYNAMICS

Sub. Code : 63352

Day and Date : Thursday, 26 - 4 - 2018 **Total Marks : 100**

Time : 2.30 p.m. to 5.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicates full marks.**
3) **Assume suitable data if necessary.**
4) **Use of steam table & Mollier chart are allowed.**
5) **Use of non-programmable calculator is allowed.**

Q1) a) Explain equivalence of Kelvin-Planck and Clausius statement of second law. **[8]**

OR

b) Explain Available energy, Unavailable energy and Dead state. **[8]**

c) State and prove Clausius Inequility. **[8]**

Q2) a) Draw P - V, T - V and P - T diagram for water - steam pure substance. **[8]**

OR

b) Write note on Reheat and Regenerative steam power cycles. **[8]**

c) A simple Rankine cycle steam power plant operates between temperatures of 260°C to 95°C. The steam is supplied to the turbine at a dry saturated condition. In the turbine, it expands in isentropic manner. Determine the efficiency of Rankine cycle, net work done and SSC. **[8]**

Q3) a) Classify boilers and compare between water tube and fire tube boilers. **[8]**

OR

b) Classify steam condensers and compare between surface and jet condensers. **[8]**

P.T.O.

c) During a trial on a steam condenser, the following observations were made [10]

Condenser Vacuum	680 mm of Hg
Barometer reading	764 mm of Hg
Mean condenser temperature	36.2°C
Hot well temperature	30°C
Condensate formed per hour	1780 kg
Circulating cooling water inlet temperature	20°C
Circulating cooling water outlet temperature	32°C
Quabtity of cooling water	1250 kg/min

Determine:

i) Condenser Vacuum corrected to standard barometer
ii) Vacuum Efficiency
iii) Under cooling of condensate
iv) Condenser efficiency
v) Condition as steam as it enters the condenser

Take the specific heat of water as 4.186 kJ/kgK

Q4) a) What is the effect of friction on the flow through a steam nozzle? Explain with the help of h - S diagram. [8]

OR

Derive an expression for mass of steam discharged through nozzle.

b) A convergent divergent nozzle is to be designed when pressure of entering steam is of 15 bar with dryness fraction of 0.97. The exit pressure is 0.2 bar. The mass flow rate is 9 kg/kw. hr. If the power developed is 220 kw determine: [9]

i) Throat pressure
ii) The number of nozzles required if each nozzle has a throat of rectangular C/S of 4 mm × 8 mm.

Take frictional heating as 78.96 kJ/kg.

Q5) a) Explain with the help neat sketch a single stage impulse turbine. Also explain the pressure and velocity variations along the axial direction. Draw combined velocity triangle of impulse turbine. **[9]**

b) A simple impulse turbine has one ring of moving blades running at 150 m/s. The absolute velocity of steam at exit from the stage is 85 m/s at an angle of 80° from the tangential direction. Blade velocity ci-efficient is 0182 and the rate of steam flowing through the stage is 2.5 kg/s. If the blades are equiangular, determine **[8]**

i) Blade angles

ii) Nozzle angle

iii) Axial thrust

iv) Absolute velocity of steam at inlet

Q6) a) Explain the term reheat factor why it's magnitude is always greater then unity? **[8]**

OR

Which are the different governing methods of steam turbine. Explain any one of them.

b) In a Parson's reaction turbine of 50% degree of reaction running at 1500 rpm, the available enthalpy drop for an expansion is 62.8 kJ/kg. If the mean diameter of the rotor is 1 m. Find number of rows of moving blades required. The blade outlet angle is 20° and speed ratio is 0.7. Assume stage efficiency as 80%. **[8]**