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Total No. of Questions : 09]

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Paper ID [ME209]

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B.Tech. (Sem. - 3rd)

APPLIED THERMODYNAMICS (ME - 207/209)

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

Q1) *(10 × 2 = 20)*

a) Discuss the main guiding principles in choosing a particular type of steam boiler?

b) What is function of Fusible plug, Explain its location?

c) What is difference between Rankine Cycle and Modified Rankine cycle.

d) How velocity of steam increases in convergent- divergent nozzels

e) Explain the difference between impulse and Reaction turbines

f) Explain the degree of Reaction in steam turbine.

g) Discuss the main functions of incorporating a condenser in an engine plant.

h) What are sources of air leakage into the condenser. How its pressure is determined.

i) What is function of Intercooler used in reciprocating air compressor?

j) Enlist Boiler mountings and accessories.

Section - B

(4 × 5 = 20)

Q2) Draw the sketch of stirling Boiler and explain its working.

Q3) In Rankine cycle steam leaves the boiler and enters turbine at 4 MPa, and 400°C. The condenser pressure is 19 KPa. Determine the Rankine cycle efficiency and Cornot efficiency for the same temperature limits.

Q4) Steam approaches a nozzel with velocity of 250 m/sec, pressure of 3.5 bar and dryness fraction of 0.95. If the isotropic expansion in the nozzel proceeds till the pressure of the exit is 2 bar. Determine the change in enthalpy and dryness fraction of steam using the Mollier's diagram. Calculate also exit velocity from the nozzel and area of exit of nozzel for flow of 0.75 kg/s.

Q5) Explain the Reheat factor, why its magnitude is always greater than unity?

Q6) A three stage air compressor draws 10 m^3/min of air at 1 bar and 20 °C and delivers the same at 60 bar and 20° C. The index of compression is 1.3. The air while passing through the intercoolers and after cooler suffers a pressure loss of 3% and is cooled to the initial temperature. Determine the shaft power required to drive the compressor if mech. efficiency is 85%

Section - C

(2 × 10 = 20)

Q7) Steam at 50 bar, 400°C expands in Rankine engine to 0.34 bar. For 150 kg/sec of steam: Determine

(i) The power developed.

(ii) The Thermal efficiency.

(iii) Specific steam consumption.

(a) For the Rankine Cycle (b)For Rankine engine. For the actual engine with same specifications the break steam rate is 4.75 kg/kW-hr and the driven electric generator has an electrical mech. efficiency of 94% Determine

(i) The break thermal efficiency

(ii) The internal efficiency.

(iii) The power in kW.

(iv) The Exhaust dryness fraction of steam. (use steam tables).

Q8) Steam expands through nozzel from 5 bar and dry saturated to a back pressure of 0.2 bar. Mass flow is 2 kg/sec. Calculate the exit and the throat areas under the following conditions.

(a) Isentropic expansion with negligible velosity.
(b) Isentropic expansion with initial velocity of 100 m/sec
(c) Friction loss at any pressure amounts to 10% of total heat drop up to that pressure and initial velocity negligible.

Q9) Write note on the followings:

(a) Physical concept of critical pressure ration in nozzels.
(b) Principal of Reaction turbines.
(c) High pressure & Low pressure boilers.
(d) Pressure ratio in reciprocating compressors.