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Total No. of Questions : 09]

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Paper ID [ME209]

(Please fill this Paper ID in OMR Sheet)

B. Tech. (Sem. - 3rd)

APPLIED THERMODYNAMICS - I (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) Explain the difference between Impulse & Reaction turbines.
- b) Define stage efficiency and overall efficiency.
- c) Define Dalton's law of partial pressure. How it is applicable on steam condensers.
- d) Write note on Labyrinth packing, why it is used in steam turbines.
- e) Discuss the effects of air leakage in condensers.
- f) Write note on Isothermal and polytropic efficiency of reciprocating compressors.
- g) Differentiate between water tube and fire tube boilers.
- h) What is reheat cycle discuss?
- i) What is function of economiser in boiler?
- j) What is Degree of Reaction? Explain?

Section - B

(4 × 5 = 20)

- Q2) What is difference of water tube and fire tube Boilers? Which of these is used in high pressure boilers and why?

- Q3) A single stage compressor with double acting draws in $17\text{m}^3/\text{min}$ of air at 01 bar and 15°C . The pressure and temperature at the end of suction are 0.98 bar and 30°C . Delivery pressure is maintained at 6.5 bar. Assuming a clearance factor of 5% and expansion and compression to follow the law $PV^{1.31} = C$. Calculate the stroke volume of compressor neglect the effect of rod.
- Q4) Compare the Jet Condensers with surface condensers.
- Q5) A steam power plant has the range of operation from 40 bar dry saturated to 0.05 bar. Determine
- The Cycle efficiency.
 - Work ratio and specific fuel consumption for (i) Carnot's cycle (ii) Rankine cycle.
- Q6) Derive an expression for critical pressure ratio for adiabatic friction less expansion of steam from a given initial velocity.

Section - C

(2 × 10 = 20)

- Q7) Steam at a pressure of 10 bar and dryness fraction of 0.98 is discharged through a convergent divergent nozzle to a back pressure of 0.1 bar. The mass flow rate is 10 kg/kw-hr. If the power developed is 200 kW determine.
- Pressure at throat.
 - Number of nozzels required if each nozzle has a throat of rectangular cross section of 5 mm × 10 mm if 10% of overall isentropic enthalpy drop reheats by friction in the divergent portion.
- Q8) What is degree of Reaction in Reaction turbines. Derive an expression for it and show that for 50% degree of Reaction the power output is maximum.
- Q9) Write short notes on the followings :-
- Effect of friction on the performance of nozzle.
 - Explain Reheat factor.
 - Lamont Boiler.
 - Boiler Efficiency.

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