SQ - 27

Seat No.	

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S.Y.B. Tech (Mechanical) (Part-II) (Semester-III)(CBCS)
Examination, May 2025
APPLIED THERMODYNAMICS
Sub. Code : 73205/63352/77736

Day and Date : Wednesday-07-05-2025 **Total Marks : 70**

Time : 10.30 a.m. to 1.00 p.m.

Instructions : 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume if necessary suitable data and state clearly.

4) Use of calculator, steam table and Mollier chart is allowed.

Q.1) Solve any two.

A) Write two statements of second law of thermodynamics and explain concept of thermal efficiency and coefficient of performance. **(5)**

B) Derive expression for change of entropy during the process which undergoes change of state from P_1, V_1, T_1 to P_2, V_2, T_2. **(5)**

C) A certain quantity of a perfect gas is heated in reversible isothermal Process from 1 bar and 40^0 C to 10 bar. Find change in entropy/kg. Take R=287J/Kg K. **(5)**

Q.2) Solve any two.

A) Draw the sketch of Rankine cycle steam power plant. Label the Part and describe the working of each component. **(6)**

B) Draw P-V, T-S and H-S diagram for Rankine cycle with superheated steam at steam inlet. **(6)**

C) A steam turbine is supplied with steam at 24 bar and 300^0C and exhaust at 0.05 bar to condenser. The condensate leaves the condenser at 22^0C Find Rankine efficiency by neglecting pump work. **(6)**

Q.3) Solve any two.

A) The following data were obtained from the test of surface condenser **(6)**

1) Condenser vacuum = 711 mm of Hg.

2) Hot well temperature = 32^0C

3) Inlet temperature of circulating water = 12^0C

4) Outlet temperature of circulating water = 28^0C

5) Barometric reading = 760 mm of Hg.

Calculate, 1) Vacuum efficiency, 2) Condenser efficiency

B) State the various components of condensing plant with their function. **(6)**

C) What are the various sources of air leakage into steam condenser? **(6)**
How does it affect the performance of condensing plant?

Q.4) Solve any two.

A) What is the function of the nozzle? Describe types of steam nozzles **(6)**
with neat sketch.

B) Define i) Nozzle efficiency ii) Coefficient of discharge **(6)**
iii) Velocity coefficient iv) Degree of undercooling

C) Steam enters convergent divergent nozzle at 2 MPa and 400^0C with a **(6)**
negligible velocity and mass flow rate of 2.5 kg/s and it exits at pressure of 300 kPa, the flow is isentropic between nozzle entrance and throat. Overall efficiency is 93%. Determine throat and exit areas.

Q.5) Solve any two.

A) Draw velocity triangle for single stage impulse turbine and obtain **(6)**
work done per stage, blade efficiency and axial thrust.

B) Derive expression for condition for maximum diagram efficiency of **(6)**
impulse turbine.

C) A single row impulse turbine develops 132.4 kW at a blade speed of **(6)**
175 m/s using 2 kg. of steam per second. Steam leaves the nozzle at 400 m/s velocity. Coefficient of the blade is 0.9, the steam leaves the blade axially. Determine, i) Nozzle angle, ii) Blade angle at entry and exit.

Q. 6) Solve any two.

A) Explain the turbine troubles like erosion, corrosion, fouling and vibrations. **(6)**

B) Define degree of reaction for reaction turbine and prove that for 50% degree of reaction, the inlet and outlet triangles must be symmetrical. ($\alpha_1 = \beta_2$ and $\alpha_2 = \beta_1$) **(6)**

C) The following data refers to a particular stage of Parson's reaction turbine. Find the isentropic enthalpy drop in stage. **(6)**

1) Speed = 1500 rpm.
2) Mean diameter of rotor = 1 m
3) Stage efficiency = 80%
4) Speed ratio = 0.75
5) Blade outlet angle = 20^0