7E4063

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B.Tech. (Sem. VII) (Main) Examination, January - 2010
Mechanical Engineering
(7ME4 Steam Turbines & Steam Power Plants)

Time : 3 Hours]                              [Total Marks : 80
                                             [Min. Passing Marks : 24

*Attempt overall five questions. All questions carry equal marks.*
*(Schematic diagrams must be shown whenever necessary. Any data*
*you feel missing may suitably be assumed and stated clearly. Units*
*of quantities used / calculated must be stated clearly.)*

Use of following supporting material is permitted during examination.

*(Mentioned in form No. 205)*

1. **Steam Tables & Mollier diagram**          2. _____**Nil**_____

1    What is the need .of compounding of impulse turbines? Explain
     velocity and pressure compounding. Show that in a 2-row velocity
     compounding. the ratio of work done by first row and second row
     is 3 : 1.

                                                                    16

OR

1    What do you understand by term reaction? Define degree of
     reaction and derive the following expression for maximum efficiency
     in 50% reaction turbine..

     $$\eta = \frac{2\cos^2 \alpha_1}{1 + \cos^2 \alpha_1},$$

     where $\alpha_1$ is nozzle angle at inlet.                      16

2    With the help of diagram explain throttle governing. Show that
     throttling losses increase with drop in pressure in throttle valve,
     also discuss the reduction in throttling loss in nozzle governing.

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OR

2  Compare steam to blade speed ratio, maximum efficiency, enthalpy drop in a stage for simple impulse, 2-row cartis and 50% reaction turbine. Discuss the length of rotor or no. of stages and diameter of rotor for same output by the above three turbines.

16

3  Explain ideal regenerative feed heating cycle. Show that the efficiency of this cycle is equal to carnot cycle operating between same temperature reservoirs. Why this cycle is not being used in practice ? Draw T-S diagram for this cycle.

16

## OR

3  Steam at 150 bar and 550°C enters into a steam turbine. After expansion to 45 bar, the steam is reheated to 550°C and sent to another turbine. Two open heaters are placed optimally. The condenser pressure is 0.1 bar. Determine efficiency.

16

4  With the help of diagram explain mixed pressure turbine and derive expression for its efficiency.

16

## OR

4  Explain the criterion used for selection of site for a coal based power plant and a hydro power plant.

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5  Derive expression for need of air to burn a typical coal in the boiler. Justify the need of excess air for complete combustion of coal. With the help of diagram show the optimum value of excess air required.

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## OR

5  Explain electrostatic precipitator (ESP) and bag-house used for collection of ash in a coal based power plants.

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