

## Assignment - II

CPE  
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1) Steam with a velocity of  $700 \text{ m/s}$  is directed upon the blades of a single stage impulse turbine at an angle  $20^\circ$  to the direction of motion. The average diameter of the blade ring is  $1200 \text{ mm}$ . The blade angles at inlet and exit are the same and equal to  $35^\circ$ . Determine (i) the speed of the turbine, (ii) the absolute vel. of steam leaving the blades, (iii) torque on the turbine rotor when the steam flow rate is  $6 \text{ t/h}$ . Base your calculation on shockless entry of steam and frictionless flow over the blades.

2) Steam issues from the nozzles at angle of  $22^\circ$  at a velocity of  $450 \text{ m/s}$ . The friction factor is  $0.86$ . For a single stage turbine designed for maximum efficiency, Calculate -  
(i) the blade velocity.  
(ii) the moving blade angles for equiangular blades  
(iii) the blade efficiency  
(iv) the stage efficiency if nozzle efficiency is  $94\%$ .  
(v) power developed for a mass flow rate of steam of  $5 \text{ kg/s}$ .

3) The following data refer to a particular stage of a Parson's reaction turbine. Speed of the turbine = 2000 rpm, Mean diameter of the rotor = 1.2 m, Stage efficiency = 83%, Blade outlet angle =  $20^\circ$ , speed ratio = 0.72.

Determine the available isentropic enthalpy drop in the stage.

4) The angles at inlet and discharge of the blading of a 50% reaction turbine are  $36^\circ$  and  $22^\circ$  respectively. The speed of rotation is 3000 rpm and at a particular stage, the mean ring diameter is 0.45 m and the steam condition is at 1.7 bar pressure and 0.95 dry. Determine, (i) the required height of blading to pass 4 kg/s of steam, and (ii) the power developed by the ring.

5) A Parson's turbine develops 1250 kW at 500 rpm and consumes 8.2 kg of steam per kWh, steam is supplied at 12 bar and  $280^\circ\text{C}$  and the isentropic efficiency of expansion is 86%. The blade angles are  $37^\circ$  and  $20^\circ$  at inlet and outlet resp. Find the blade height and the drum diameter at a stage where the pressure is 1.5 bar. Blade height to drum diameter ratio of 12 is recommended.

Determine also the power developed