

Class Test 1

Total marks=50 Time: 1hour 45 minutes

- ✓ 1. Consider the case of a hydraulic turbine. Draw a neat sketch to show the power, specific work and the various losses occurring at different stages. Using the diagram, define and explain the various efficiencies. 2+3=5
- ✓ 2. Consider the case of a pump. Draw a neat sketch to show the power, specific work and the various losses occurring at different stages. Using the diagram, define and explain the various efficiencies. 2+3=5
3. Derive and define: (a) flow coefficient, head coefficient and power coefficient; (b) unit speed, unit flow rate and unit power; (c) specific flow rate and specific power. 3+3+2=8
- ✓ 4. Derive the non-dimensional specific speed for pump and for turbine. What is the significance of this number? 2+2+1=5
- ✓ 5. Write down the steady flow energy equation for pump and turbine and show the processes in  $h-s$  plane. Define total enthalpy, total temperature and total pressure. For a compressor, define the efficiency of a compressor when it is (a) intermediate stage; (b) last stage; (c) first stage; (d) single stage. Show the processes on the  $h-s$  plane. For a thermal turbine, define the efficiency of a turbine when it is (a) intermediate stage; (b) last stage. Show the processes on the  $h-s$  plane. 2+3+4+2=11
- ✓ 6. For a multistage compressor, show that stage efficiency is more than the overall efficiency. For a multistage turbine, show that the overall efficiency is more than the stage efficiency. 2+2=4
- ✓ 7. A compressor working in  $m$  stages has initial pressure  $p_1$  and final pressure  $p_{m+1}$ . All the stages are having equal pressure ratio. The compressor overall efficiency and the stage efficiency are given by  $\eta_c$  and  $\eta_s$ . Find out the overall efficiency of the compressor in terms of the stage efficiency, stage pressure ratio and the number of stages. (6 marks)
8. A turbine working in  $m$  stages has initial pressure  $p_1$  and final pressure  $p_{m+1}$ . All the stages are having equal pressure ratio. The turbine overall efficiency and the stage efficiency are given by  $\eta_t$  and  $\eta_s$ . Find out the overall efficiency of the turbine in terms of the stage efficiency, stage pressure ratio and the number of stages. (6 marks)