

(3 HRS)

(Total Marks 80)

- Note:** 1. Q.No.1 is compulsory.  
2. Attempt any three questions out of remaining five questions.  
3. Assume any data if required stating clearly.

**Q.No.1** Attempt **any four** questions **5x4=20**

- (a) Derive the equation of impact of jets on flat stationary vanes
- (b) Draw the neat sketch of velocity triangle for tangential flow turbine.
- (c) Define with neat sketch Centrifugal Pump. What are its main parts.
- (d) Differentiate between (i) Uniform & Non-Uniform flow (ii) Steady & Unsteady flow
- (e) Derive conditions for most economical rectangular channel section.

**Q.No.2.(a)** Drive the expression for force exerted by jet on hinged plate **10**

- (b) A jet of water of diameter 75 mm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of the jet. The jet is deflected through an angle of  $165^\circ$ . Assume the plate is smooth. Find (i) Force exerted on the plate in the direction of jet (ii) Power of the jet (iii) Efficiency of the jet **10**

**Q.No.3 (a)** What are types of Draft Tube. Explain Draft tube theory. **10**

- (b) A Kaplan turbine runner is to be designed to develop 9000 kW. The net available head is 6 m. If the speed ratio is 2.0 and flow ration is 0.68, overall efficiency is 86% and the diameter of hub is  $1/3$  the dia of the runner. Find the dia of the runner, its speed and the specific speed of the turbine. **10**

**Q.No.4 (a)** A three stage centrifugal pump has impeller diam 40 cm and 2 cm wide at outlet. The vanes are curved back at the outlet at  $45^\circ$  and reduce the circumferential area by 10%. The manometric efficiency is 90% and overall efficiency is 80% . Determine the head generated by the pump when running at 1000 rpm, delivering 50 lit/sec. What should be the shaft horse power ? **10**

- (b) (i) Explain Hydraulic Press **5x2=10**  
(ii) Write short notes on Hydraulic Ram

**Q.No.5(a)** Derive the conditions for most economical trapezoidal channel **10**

- (b) A sewer line is to be laid at the slope of 1 in 8000 to carry a max discharge of 500 lit/sec, when depth of water is 75% of vertical diameter. Find the dia of this pipe. Take Manning's  $N=0.020$  **10**

**Q.No.6 (a)** Derive the expression for Gradually Varied Flow with assumptions. **10**

- (b) A sluice gate discharges water into a horizontal rectangular channel with a velocity 8 m/s and depth of flow is 0.5 m. The width of the channel is 6 m. Determine whether the hydraulic jump will occur, and if so, find its height and loss of energy per kg. Also determine the horse power lost in the hydraulic jump **10**