

Code: 9A01404

B.Tech II Year II Semester (R09) Supplementary Examinations May/June 2017

FLUID MECHANICS & HYDRAULIC MACHINERY

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) Determine the intensity of shear of an oil having viscosity = 1 poise. The oil is used for lubricating the clearance between a shaft of diameter 10 cm and its journal bearing. The clearance is 1.5 mm and the shaft rotates at 150 r.p.m.
(b) What are manometers? Explain a U-tube manometer with sketch.
- 2 (a) Derive the continuity equation for one dimensional flow.
(b) A 300 mm diameter pipe carries water under a head of 20 m with a velocity of 3.5 m/s. If the axis of the pipe turns through 60° , find the magnitude and direction of the resultant force at the bend.
- 3 A pipe having a length of 6 km and diameter 0.70 m connects two reservoirs A and B, the difference between their water levels is 30 m. Half-way along the pipe there is a branch through which water can be supplied to a third reservoir C. Taking $f = 0.024$ determine the rate of flow of reservoir B when no water is discharged to reservoir C and the quantity of water discharged to reservoir C is $0.15 \text{ m}^3/\text{s}$. Neglect minor losses.
- 4 (a) A jet of water 60 mm in diameter strikes a curved vane at its centre with a velocity of 18 m/s. The curved vane is moving with a velocity of 6 m/s in the direction of the jet. The jet is deflected through an angle of 165° . Assuming the plate to be smooth find the thrust on the plate in the direction of jet, power of the jet and efficiency of the jet.
(b) Derive the expression for force exerted by a jet on a stationary flat plate held normal to the jet.
- 5 (a) The following data relate to a proposed hydro-electric station. Available head = 28 m, catchment area = 420 sq.km, rainfall = 140 cm/yr, percentage of total rainfall utilized = 68%, penstock efficiency = 94%, turbine efficiency = 80%, generator efficiency = 84% and load factor = 44%. Calculate the power developed.
(b) Give the concept of pumped storage plants.
- 6 A Francis turbine with an overall efficiency of 76% is required to produce 150 kW. It is working under a head of 8 m. The peripheral velocity = $0.25\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.95\sqrt{2gH}$. The wheel runs at 150 r.p.m and the hydraulic losses in the turbine are 20% of the available energy. Assuming radial discharge find the guide blade angle, the wheel vane angle at inlet, diameter of the wheel at inlet and width of the wheel at inlet.
- 7 (a) Define specific speed of a turbine. Also derive the expression for the same.
(b) How do you draw iso efficiency curves of a turbine?
- 8 (a) Write about indicator diagrams.
(b) Expand and explain the term NPSH.
