Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, September 2014
(2008 Scheme) (Special Supplementary)
08.303 : FLUID MECHANICS AND MACHINES (MPU)

Time : 3 Hours Max. Marks : 100

***Instruction** : Answer **all** questions from Part **A** and **one full** question from **each** Module of Part **B**.*

PART – A

1. Differentiate between Newtonian and Non-Newtonian fluids, citing examples for the same.
2. Explain with the help of a sketch, the Moody's diagram.
3. Distinguish between absolute and gauge pressure.
4. Describe how velocity of a fluid can be measured using a Pitot tube.
5. Draw the velocity triangles for an inward flow reaction turbine and obtain an equation for force per kg of water.
6. Give the comparison between impulse and reaction turbines.
7. What are the factors to be considered while selecting the right type of turbine for hydroelectric power plant ?
8. State Buckingham's Pi-theorem. What is its utility ?
9. Using examples, differentiate between free and forced vertex flows.
10. Explain the working of a hydraulic ram. Define Rankine efficiency.

(10×4=40 Marks)

PART – B

Module – I

11. a) A horizontal shaft of diameter 0.25 m rotates at a speed of 120 rpm, inside a sleeve of length 10 cm. The clearance between the shaft and the sleeve is 1 mm. If it is lubricated with an oil of dynamic viscosity 3.5 poise. Find the power lost in bearing.

    b) A syphon of diameter 200 mm connects two reservoirs having a difference in elevation as 20 m. The total length of the syphon is 800 m and the summit is 5 m above the water level in the upper reservoir. The length of the pipe from the upper reservoir to the summit is 85 m. Determine the discharge through the syphon and also pressure at the summit. Neglect minor losses. The coefficient of friction f = 0.004.

12. a) Determine the differential reading of an inverted U-tube manometer containing oil of specific gravity 0.8 as the manometric fluid when connected across pipes A and B conveying liquids of specific gravities 1.2 and 1.0 and immiscible with the oil. Pressure at A and B are equal and they are located at the same datum level.

    b) A venturimeter is used to measure the flow of water through a 25 cm diameter pipe. The pressure at the inlet is 6 m of water when the flow rate is 140 litres per second. Find the smallest diameter of the throat to ensure that the pressure head does not fall below the atmospheric pressure. Assume cd = 0.98.

Module – II

13. a) A free jet of velocity V strikes against a series of curved semi-circular vanes tangentially. The vanes are moving in the direction of the jet with a velocity equal to 0.6 V. Assuming the relative velocity of water is reduced by 10% by moving over the vanes, show that the vanes have an efficiency of 91.20%.

    b) A Pelton wheel is having a mean bucket of 1 m and is running at 1000 rpm. The net head on the Pelton wheel is 700 m. If the side clearance angle is 15° and discharge through nozzle is $0.1 m^3/s$, determine
        i) Power available at the nozzle and
        ii) Hydraulic efficiency of the turbine.

14. a) A conical draft tube having inlet and outlet diameters 0.8 m and 1.2 m discharges water at outlet with a velocity of 3 m/s. The total length of the draft tube is 8 m and 2 m of the length of draft tube is immersed in water. If the atmospheric pressure head is 10.3 m of water and loss of head due to friction in the draft tube is equal to 0.25 times the velocity head at outlet of the tube, find :
        i) Pressure head at inlet and
        ii) Efficiency of draft tube.

    b) An inward flow reaction type with radial discharge turbine having an overall efficiency of 80% is required to develop 150 kW. The head is 8 m ; peripheral velocity of the wheel is $0.96\sqrt{2gH}$; the radial velocity of flow is $0.36\sqrt{2gH}$. The wheel is to make 150 RPM and the hydraulic losses in the turbine are 22% of the available energy. Determine
        i) the angle of the guide blade at inlet
        ii) the wheel vane angle at inlet
        iii) the diameter of the wheel
        iv) the width of the wheel at inlet

Module – III

15. a) Obtain an expression for minimum starting speed of a centrifugal pump.

    b) A single acting reciprocating pump having 12 cm diameter and 25 cm stroke takes liquid from sump at 2 m below the centre of pump and delivers to tank at 10 m above the centre of pump. The diameter of suction and delivery pipe is 12 m. Only one air vessel is placed to the delivery pipe very near to the pump axis. The separation pressure is 8 kN/m^2 below atmospheric pressure. Take ρ (density of liquid pumped) = 1200 kg/m^3 and f = 0.01, find

    a) maximum speed of the pump without separation.

    b) power required to run the pump.

16. a) What is meant by acceleration head of a reciprocating pump ? Establish an expression for the acceleration head and discuss its effects on the indicator diagram.

    b) A water pump has to deliver 20 litres per second of water when running at 1200 RPM. The inlet vane angle is 30° and exit vane angle is 45°. If the velocity of flow is constant in the impeller, the power supplied to run the pump by the motor is 40 kW. Assuming mechanical efficiency = 0.9. Find the inlet and outlet diameter of the impeller. Take $D_2 = 2D_1$. **(20×3=60 Marks)**