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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, December 2015
(2008 Scheme)
08.303 : HYDRAULIC MACHINES AND HEAT ENGINES (E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

1. Write notes on Newtonian and Non-Newtonian fluids.
2. What is the significance of Reynold's number ?
3. Describe a Prandtl Pitot Tube. What for it is used ?
4. What is the role of surge tank in hydroelectric power plant installation ?
5. Explain the terms 'velocity of whirl' and 'velocity of flow'.
6. Distinguish between a Rotodynamic pump and a Positive displacement pump.
7. What are different heads and efficiencies of a centrifugal pump ?
8. Derive an expression for the specific speed of a turbine and explain its practical utility.
9. Define indicated thermal efficiency and explain its importance.
10. What is advantage of regeneration in gas turbines ? **(10×4=40 Marks)**

P.T.O.

PART – B

Answer **any one** question from **each** Module. **All** questions carry **equal** marks.

Module – I

11. a) If the velocity profile of a fluid over a plate is parabolic with vertex 20 cm from the plate, where the velocity is 120 cm/s. Calculate the velocity gradients and shear stresses at a distance of 0, 10, and 20 cm from the plate, if the viscosity of the fluid is 8.5 poise.

    b) A U tube differential manometer connects two pressure pipes A and B. Pipe A contains carbon tetra chloride having a specific gravity 1.59 under a pressure of 11.77 N/cm^2 and pipe B contains oil of specific gravity 0.8 under a pressure of 11.77 N/cm^2. The pipe A lies 2.5 m above pipe B, find the difference of pressure measured by mercury as fluid filling U tube.

12. a) Derive Darcy-Weisbach equation for turbulent flow through a circular pipe of constant diameter.

    b) Find the diameter of a pipe of length 2250 m when the rate of flow of water through the pipe is 0.27 m^3/s and head loss due to friction is 6 m. Take C = 50 in Chezy's formula.

Module – II

13. a) Explain the working of a Francis turbine with the aid of a neat sketch.

    b) Determine the overall efficiency of a Kaplan turbine developing 2850 kW under a head of 5.2 m. It is provided with a draft tube with its inlet (diameter 3 m) set 1.8 m above the tail race level. A vacuum gauge connected to the draft tube indicates a reading of 5.2 m of water. Assume draft tube efficiency as 75%.

14. a) Derive an expression for the minimum starting speed of a centrifugal pump. Explain the need for multistaging of centrifugal pumps.

    b) A single acting reciprocating pump has a bore of 75 mm diameter and a stroke of 150 mm. It draws water from the sump whose water level is 3 m below the pump axis, through a pipe 30 mm in diameter and 4.25 m in length. The pump delivers water to a tank through a 15 m long pipe, 25 mm in diameter to a height of 12 m above the pump axis. If separation occurs at 2.5 m (absolute), find the maximum speed of the pump. Take atmospheric pressure head = 10.3 m of water.

Module – III

15. a) Explain the working of a four stroke cycle diesel engine. What are the advantages of four stroke engine over two stroke engine ?

    b) The power output of an IC engine is measured by rope brake dynamometer. The diameter of the brake pulley is 700 mm and the rope diameter is 25 mm. The load on the tight side of the rope is 50 kg mass and spring balance reads 50N. The engine running at 900 rpm. Consumption of fuel is 4 kg/hr. The calorific value of the fuel is 44000kJ/kg. Assume g = 9.81 m/s^2. Calculate
    i) Brake specific fuel consumption and
    ii) Brake thermal efficiency.

16. a) Derive a expression for the optimum pressure ratio for maximum specific work output of a gas turbine plant.

    b) In a gas turbine plant, air is taken at 300 K and 1 bar. It is compressed to 5 bar. The maximum temperature in this cycle is limited to 1000K. The gases are first expanded to 2.5 bar and then they are reheated to 1000 K and then expanded to 1 bar and then exhausted to the atmosphere. Assuming the flow of air as 1.2 kg/s, determine the power developed by the plant and the thermal efficiency. Neglect the fuel mass. The isentropic efficiency of the compressor is 80% and isentropic efficiency of each stage of turbine is 90%. Assume suitable data. **(3×20=60 Marks)**