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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech II Year II Semester Examinations, May-2013

Mechanics of Fluids and Hydraulic Machines

(Common to ME, MIE, MIM)

Time: 3 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

1.a) Differentiate between:

- i) Liquids and Gases
- ii) Cohesion and Adhesion
- iii) Real fluid and Ideal fluid
- iv) Compressible and Incompressible fluids.

b) In a stream of glycerin in motion, the velocity gradient at a certain point is 0.30 meters per sec per meter. Calculate the shear stress at the point if the mass density of the liquid is 1275 kg/m^3 and the kinematic viscosity is $6.30 \times 10^{-4} \text{ m}^2/\text{sec}$.

[15]

2.a) What is Stream tube? What are its characteristics?

b) A pipe AB branches into two pipes from B. One pipe C has a diameter of 150 mm and the other pipe D has a diameter of 200 mm. The diameter at A is 450 mm and at B is 300 mm. The velocity of water at A is 2 m/s. If the velocity in pipe D be 4 m/s, determine the discharge through pipe AB, the velocity at B and velocity at C.

[15]

3.a) Explain the terms: hydraulic gradient and equivalent pipe with the help of a neat sketch.

b) A 10 cm by 6 cm orifice meter is used to measure the discharge of bromine. If the pressure difference across the orifice plate is 18250 N/m^2 , determine the discharge in lit/m. Assume $C_d = 0.64$. Specific gravity of bromine = 3.1.

[15]

4.a) Explain the laminar and turbulent boundary layers.

b) Find the frictional drag on one side of the plate 200 mm wide and 500 mm long placed longitudinally in a stream of crude oil ($G=0.925$ and kinematic viscosity = 0.9 stoke) flowing with undisturbed velocity of 5m/sec. Also, find the thickness of boundary layer and the shear stress at the trailing edge of the plate.

[15]

5. A jet of water having a velocity of 60m/sec is deflected by a vane moving at 25m/sec in a direction at 30° to the direction of jet. The water leaves the vane normally to the motion of the vane. Draw the inlet and outlet velocity triangles and find out the vane angles for no shock at entry and exit. Take the relative velocity at the exit as 0.8 times the relative velocity at the entrance.

[15]

- 6.a) Describe the theory of a draft tube with the help of a neat sketch.
- b) Design a single jet Pelton wheel to develop a power of 600 KW under a head of 180 m while running at 320 rpm. Assume $K_u = 0.45$, $C_v = 0.985$ and overall efficiency = 85%. Calculate the jet diameter, wheel diameter and number of buckets. Give a fully dimensional sketch of the bucket. [15]
- 7.a) Define the term 'Governing of a turbine'. Describe with a neat sketch, the working of an oil pressure governor for a pelton wheel.
- b) Give the range of specific speed values of the Kaplan, Francis turbine and Pelton wheels. What factors decide whether Kaplan, Francis, or a Pelton type turbine would be used in a hydroelectric project? [15]
- 8.a) What is NPSH. Discuss the significance of NPSH in pump settings.
- b) A centrifugal pump delivers water against a net head of 14.5m and design speed of 1000 rpm. The vanes are curved back to an angle of 300 with periphery. The impeller diameter is 300 mm and outlet width 50 mm. Determine the discharge of the pump if the manometric efficiency is 95%. [15]

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