CBCS SCHEME

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21MR43

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fluid Mechanics and Machinery

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the working of a U tube differential manometer with a neat diagram. **(06 Marks)**

b. Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid. **(10 Marks)**

c. Define : (i) Buoyancy
(ii) Metacentre **(04 Marks)**

OR

2 a. Derive the three dimensional continuity equations in the Cartesian co-ordinates. **(08 Marks)**

b. A stream function represents 2-D fluid flow, $\psi = 2xy$. Find the velocity at a point P(3, 4). Check whether the flow is rotational. Find the velocity potential function ϕ. **(06 Marks)**

c. Explain the following :
(i) Steady and Unsteady flow.
(ii) Uniform and Non uniform flow.
(iii) Laminar and Turbulent flow. **(06 Marks)**

Module-2

3 a. State the assumptions made in deriving the Euler's equation of motion. Hence obtain Bernoullies equation from Euler's equation with a neat sketch. **(12 Marks)**

b. A pipeline carrying oil of specific gravity 0.8 changes in diameter from 300 mm at position A to 500 mm diameter at position B which is 5 m at a higher level. If the pressure at A and B are 20 N/cm^2 and 15 N/cm^2 respectively and discharge is 150 litres/sec. Determine the loss of head and direction of flow. **(08 Marks)**

OR

4 a. What is Venturimeter? Derive an expression for the discharge through venturimeter. **(08 Marks)**

b. An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and down stream of the meter give readings of 19.62 N/cm^2 and 9.81 N/m^2 respectively C_d for the meter is 0.6. Find the discharge of water through the pipe. **(06 Marks)**

c. Explain assumptions and limitations made in Bernoullies equation. **(06 Marks)**

Module-3

5 a. Derive Hagen-Poiseuille equation for viscous flow through a circular pipe. **(10 Marks)**

b. An oil of viscosity 10 Poise flow between two parallel fixed plates which are kept at a distance of 50 mm apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2 m be 0.3 N/cm^2. The width of the plates is 200 mm. **(10 Marks)**

OR

6 a. Derive Darcy's equation for head loss through pipe. **(08 Marks)**

b. Derive an expression for drag and lift with usual notations. **(08 Marks)**

c. Define the following terms :

(i) Boundary layer.

(ii) Boundary layer thickness. **(04 Marks)**

Module-4

7 a. Derive Eulers equation of first form of turbo-machines with a neat velocity diagram. **(10 Marks)**

b. Define the following :

(i) Degree of freedom.

(ii) Utilization factor.

(iii) Turbo machine.

(iv) Impulse turbine.

(v) Reaction turbine. **(10 Marks)**

OR

8 a. With neat sketch, explain the principle components of a turbo-machine. **(10 Marks)**

b. A Pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The Pelton wheel developing 130 HP (95.55 kW). The velocity of buckets is 0.45 times the velocity of the jet. Overall efficiency is 0.85 and co-efficient of velocity is equal to 0.98. Find the diameter of the jet, diameter of the wheel and number of buckets on the wheel. **(10 Marks)**

Module-5

9 a. With neat sketch, explain the terminology of centrifugal pump. **(10 Marks)**

b. A centrifugal pump with 1.2 m diameter runs at 200 rpm and pumps 1880 lit/s, the average lift being 6 m. The angle which the vanes makes at exit with the tangent to the impelles is 26° and radial velocity of flow is 2.5 m/s. Determine the manometric efficiency and the least speed to start pumping against a head of 6 m, inner dia of impeller being 0.6 m. **(10 Marks)**

OR

10 a. Derive an expression for work done by a centrifugal pump per kg of water. **(07 Marks)**

b. Derive an expression for minimum starting speed for a pump. **(07 Marks)**

c. Explain about multistage pumps. **(06 Marks)**

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