Sub Code:KME302

Paper Id: 140322 Roll No:

B. TECH.
(SEM-III) THEORY EXAMINATION 2019-20
FLUID MECHANICS & FLUID MACHINES

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10= 20**

a.	2 liter petrol weighs 14 N. Calculate the specific weight, mass density, specific volume and specific gravity of petrol with respect to water.
b.	Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2 above atmospheric pressure.
c.	What do you understand by Euler's number?
d.	State Bernoulli's theorem.
e.	What is Water Hammering?
f.	A square flat plate of dimension 1.5 m moves at 50 km/hr in stationary air of density 1.15 kg/m^3. If the coefficient of drag and lift are 0.15 and 0.75 respectively, determine the lift and drag force.
g.	Find the force exerted by a jet of water of diameter 75 mm on a stationary flat plate, when the jet strikes the plate normally with a velocity of 20 m/s.
h.	Differentiate between turbine and pump.
i.	How will you classify the turbines?
j.	Define slip, percentage slip and negative slip of a reciprocating pump.

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a.	Develop a formula for capillary rise of a fluid having surface tension σ and contact angle θ between: (i) Two concentric glass tubes of radii r_o and r_i (ii) Two vertical glass plates set parallel to each other having a gap t between them.
b.	The velocity potential for a two dimensional flow is $\Phi = x(2y-1)$ Determine the velocity at the point P(4, 5). Also obtain the value of stream function at P.
c.	Determine the displacement thickness, momentum thickness, shape factor and energy thickness of the following velocity profiles in the boundary layer on a flat plate. $u/U_0 = (y/\delta)^{1/7}$ where u is the velocity at a height y above the surface and U_0 is the free stream velocity.
d.	Define the term governing of turbine. Describe with neat sketch the working of an oil pressure governor.
e.	What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump?

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SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a)	A 30 cm diameter pipe conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s.
(b)	What is pitot tube? How will you determine the velocity at any point with the help of pitot tube?

4. Attempt any *one* part of the following: 10 x 1 = 10

(a)	If the velocity field is given by $u = x + y$ and $v = x^3 - y$ Find the circulation around a closed contour defined by $x = 1$, $y = 0$, $y = 1$ and $x = 0$.
(b)	The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham π-theorem, obtain the expression for Δp.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a)	A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2 find (i) Pressure gradient, (ii) Average velocity and, (iii) Reynolds number of the flow.
(b)	Describe the phenomenon of boundary layer formation over a smooth flat plate.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a)	A pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 liters/s under the head of 30 meters. The buckets deflect the jet through an angle of 160°. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98.
(b)	With the help of neat sketch explain the working of kaplan turbine.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a)	Define specific speed of a centrifugal pump. Derive an expression for the same.
(b)	Discuss the effect of accelaration in suction and delivery pipes on indicator diagram.