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VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. II Year (Mech. Engg.) I-Semester Supplementary Examinations, May/June-2017

Fluid Dynamics

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 X 2=20 Marks)

1. Differentiate between ideal and real fluids.
2. Viscosity of water at 20°C -----.
3. Define flownet and write its uses.
4. Write the relation between absolute pressure, gauge pressure and atmospheric pressure.
5. List out minor losses in pipes.
6. Show that $f = 64/R_e$ where f is friction factor and R_e is Reynolds number.
7. Define displacement thickness and energy thickness.
8. Differentiate between pressure drag and friction drag.
9. Differentiate between adiabatic and isothermal process.
10. Define Mach number and classify the flows based on it.

Part-B (5 × 10 = 50 Marks)
(All bits carry equal marks)

11. a) Define viscosity and derive Newton's law of viscosity.
 b) The velocity components in a 2D flow field for an incompressible fluid are as follows:
 $u = y^3/3 + 2x - x^2 y$ and $v = xy^2 - 2y - x^3/3$ obtain an expression for the stream function ψ
12. a) Explain differential U - tube manometer with neat sketch.
 b) In a smooth pipe of uniform diameter 25 cm, a pressure of 50 kPa was observed at section 1 which was at elevation 10.00 metres at another section 2 at elevation 12.00 metres. The pressure was 20 kPa, velocity was 1.25 m/sec. Determine the direction of flow and the head loss between these two sections. The fluid in the pipe is oil of specific gravity 0.89.
13. a) Derive Hagen Poiseuille's equation for Laminar flow through circular pipes.
 b) A smooth pipe of diameter 80 and 1000 m long is carrying water at 8 litre per second. If kinematic viscosity is 0.015 Stokes for water and $f = 0.0791/(Re)^{1/4}$. Calculate:
 i) Loss of height ii) Wall shear stress iii) Shear stress at 20mm from pipe wall .
14. a) Find the ratio of displacement thickness to momentum thickness and momentum thickness to energy thickness for the velocity distribution in the boundary layer given by $u/U = 2(y/\delta) - (y/\delta)^2$.
 b) A 2 m wide and 5.0 long plate when towed through water at 20°C experiences a drag of 30.08 N on both sides. Determine the velocity of the plate and the length over which the boundary layer is laminar.

- 15. a) Derive the equation in compressible flow for velocity of wave $C^2 = KRT$, form fundamentals.
- b) Calculate the stagnation pressure, temperature and density on the stagnation point on the nose of a plane, which is flying at 800 kmph through still air having a pressure 8.0 N/cm² and temperature -10⁰C. Take R = 287 J/Kg and k = 1.4.
- 16. a) Write the properties of velocity potential function.
- b) A pipe contain an oil of specific gravity 0.8. A differential manometer connected at the two points A and B of a pipe shows the difference in mercury levels as 20 cm. Find the difference of pressure at two points.
- 17. Write short notes on *two* of the following:
 - a) Reynolds experiment
 - b) Boundary layer controlling measures
 - c) Stagnation temperature.

11. a) Define viscosity and derive Newton's law of viscosity.

b) The velocity components in a 3D flow field for an incompressible fluid are as follows:
 $u = y^2z - 2x - x^2y$ and $v = x^2y - 2y - x^2z$. Obtain an expression for the stream function w .

12. a) Explain differential U-tube manometer with neat sketch.

b) In a smooth pipe of uniform diameter 25 cm, a pressure of 30 kPa was observed at section 1 which was at elevation 10.00 metres at another section 2 at elevation 12.00 metres. The pressure was 20 kPa, velocity was 1.25 m/sec. Determine the direction of flow and the head loss between these two sections. The fluid in the pipe is oil of specific gravity 0.88.

13. a) Derive Hagen Poiseuille's equation for laminar flow through circular pipes.

b) A smooth pipe of diameter 80 mm and 1000 m long is carrying water at 8 litre per second. If kinematic viscosity is 0.012 stokes for water and $T = 0.0791(N/m^2)^{0.2}$. Calculate:
 (i) Loss of height (ii) Wall shear stress (iii) Shear stress in 1000 mm pipe wall.

14. a) Find the ratio of displacement thickness to momentum thickness in the boundary layer. The ratio to energy thickness for the velocity distribution in the boundary layer is given by $u/U = 2y/\delta - (y/\delta)^2$.

b) A 2 m wide and 2.0 long plate when towed through water at 20⁰C experiences a drag of 300N. In one half side. Determine the velocity of the plate and the length over which the boundary layer is laminar.