

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

MEC106: FLUID MECHANICS AND MACHINERY

(Common to Aeronautical Engineering & Mechanical Engineering)

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Poise is the unit of
 - a. mass density
 - b. kinematic viscosity
 - c. viscosity
 - d. velocity gradient
2. The resultant hydrostatic force acts through a point known as
 - a. centre of pressure
 - b. centre of buoyancy
 - c. centre of gravity
 - d. centroid
3. The flow rate through a circular pipe is measured by
 - a. Thermometer
 - b. Both venturi meter and orifice meter
 - c. orifice meter only
 - d. tachometer
4. For the laminar flow through a pipe, the shear stress over the cross section
 - a. varies inversely as the distance from the centre of the pipe
 - b. varies directly as the distance from the surface of the pipe
 - c. varies directly as the distance from the centre of the pipe
 - d. remains constant over the cross section
5. Reynolds number is defined as the ratio of
 - a. Inertia force to gravity force
 - b. viscous force to gravity force
 - c. viscous force to elastic force
 - d. inertia force to viscous force
6. Modern Francis turbine is an
 - a. Impulse turbine
 - b. radial flow impulse turbine
 - c. axial flow turbine
 - d. Mixed flow reaction turbine
7. Kaplan turbine is an
 - a. impulse turbine
 - b. radial flow impulse turbine
 - c. axial flow reaction turbine
 - d. radial flow reaction turbine
8. The boundary layer takes place for
 - a. ideal fluids
 - b. real fluids
 - c. pipe flow only
 - d. flow over flat plate only
9. Total energy line represents the sum of
 - a. Pressure head and kinetic head
 - b. kinetic head and datum head
 - c. pressure head and datum head
 - d. pressure head, kinetic head and datum head

10. Air vessel in a reciprocating pump is used to
- a. obtain a continuous supply of water at uniform rate
 - b. reduce suction head
 - c. increase the delivery head
 - d. reduce cavitation

PART B (10×2=20 Marks)

- 11. Define specific gravity of a fluid.
- 12. Define Newtonian and Non-newtonian fluids.
- 13. Define continuity equation.
- 14. Define turbulent flow.
- 15. Write Euler's equation of motion and explain the terms involved.
- 16. What is a pitot-tube?
- 17. What is a draft tube?
- 18. Define specific speed of a turbine.
- 19. What is a reciprocating pump?
- 20. Define slip of a reciprocating pump.

PART C (5×14=70 Marks)

21. a) The space between two square flat parallel plates of size 60cm is filled with oil. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m/s requires a force of 98.1 N to maintain that speed.

Determine:

- (i) The dynamic viscosity of the oil in poise
- (ii) The kinematic viscosity of the oil in stokes if the specific gravity of the oil is 0.95.

(OR)

- b) (i) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 r.p.m., determine the viscosity of the fluid.
22. 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.

(OR)

- b) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take $C_d=0.98$.
23. a) Determine the wall shearing stress in a pipe of diameter 100 mm which carries water. The velocities at the pipe centre and 30 mm from the pipe centre are 2 m/s and 1.5 m/s respectively. The flow in pipe is given as turbulent.

(OR)

- b) Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m through which water is flowing at a velocity of 3 m/s using (i) Darcy formula (ii) Chezy's formula for which $C=60$. Take ν for water = 0.01 stoke.
24. a) A Pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The Pelton wheel develops 95.6475 KW shaft power. The velocity of the buckets = 0.45 times the velocity of the jet, overall efficiency = 0.85 and co-efficient of velocity is equal to 0.98.

(OR)

- b) A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6 m. If the speed ratio = 2.09, flow ratio = 0.68, over all efficiency 86% and the diameter of the boss is $1/3$ the diameter of the runner, find the diameter of the runner, its speed and the specific speed of the turbine.
25. a) Find the rise in pressure in the impeller of a centrifugal pump through which water is flowing at the rate of $0.01 \text{ m}^3/\text{s}$. The internal and external diameters of the impeller are 15 cm and 30 cm respectively. The widths of the impeller at inlet and outlet are 1.2 cm and 0.6 cm. The pump is running at 1500 r.p.m. The water enters the impeller radially at inlet and impeller vane angle at outlet is 45° . Neglect losses through the impeller.

(OR)

- b) A centrifugal pump with 1.2 m diameter runs at 200 r.p.m. and pumps 1880 litres/s, the average lift being 6 m. The angle which the vanes make at exit with the tangent to the impeller is 26° and the 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, the inner diameter of the impeller being 0.6 m.
