Register Number: ……………………..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Third Semester

CIVIL ENGINEERING

CEE104:Mechanics of Fluids

Time: Three Hours   **Maximum Marks: 100**

Answer all the 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. Surface tension has the unit of
   a) Force per unit area
   b) Force per unit length
   c) Force per unit volume
   d) None

3. The resultant of hydrostatic force acts through a point known as
   a) Centre of gravity
   b) Centre of pressure
   c) Centre of buoyancy
   d) Centre of power

4. Pitot tube is used for the measurement of
   a) pressure
   b) flow
   c) Velocity at a point
   d) discharge

5. Irrotational flow means
   a) The fluid does not rotated while moving
   b) The fluid moves in straight lines
   c) The net rotation of fluid particles about their mass centre is zero
   d) The net rotation of fluid particles about their mass centre is unity

6. Stream lines and path lines always coincide in the case of
   a) Laminar flow
   b) Steady flow
   c) Turbulent flow
   d) Uniform flow

7. Size of a venturi meter is specified by
   a) Pipe diameter
   b) Angle of diverging section
   c) Throat diameter
   d) Both pipe and throat diameter

8. The length of a pipe is 1 km and its diameter is 20 cm.If the diameter of an equivalent pipe is 40 cm ,then its length is
   a) 8 km
   b) 20 km
   c) 32 km
   d) 4 km

9. Mach number is defined as the ratio of
   a) Inertia force to viscous force
   b) Inertia force to elastic force
   c) Inertia force to gravity force
   d) Inertia force to pressure force

10. The dimension for angular velocity in MLT System is
    a) $M^0L^0T^{-2}$
    b) $M^1L^1T^2$
    c) $M^0L^0T^{-1}$
    d) $M^0L^0T^{-3}$

PART B (10 x 2 = 20 Marks)

11. Calculate the density, specific weight of 2 liters of petrol of specific gravity 0.8

12. Find the surface tension in a soap bubble of 50mm diameter when the inside pressure is $3.0N/m^2$ above atmospheric pressure

13. What is manometer? How are they classified?

14. A body of dimensions 0.6X0.6X1.0 m and specific gravity 2.8 is immersed in water. Determine the least force required to lift the body.

15. State the relation between stream function and velocity potential function.

16. A stream function for a two dimensional flow is given by the equation P =2XY.Calcuate the velocity at the point (2, 3).

17. What is a siphon? On what principle it works?

18. Find the head loss due to friction in a pipe of diameter 300mm and length of 50m through which water is flowing at a velocity of 3.2m/sec.

19. In 1:30 model of a spillway, the velocity and discharge are 1.8 m/s and 2.5m³/s. Find the corresponding velocity and discharge in the prototype

20. What do you mean by fundamental units and derived units? Give examples

PART C (5 x 14 = 70 Marks)

21. a) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60cm.The thickness of the oil film is 12.5mm.The upper plate, which moves at 2.5 meter per sec requires a force of 98.1 N

    Determine :
    i. The dynamic viscosity of the oil in poise and
    ii. The kinematic viscosity of the oil in stokes if specific gravity of the oil is 0.95

(OR)

b) Calculate the capillary effect in millimeters in a glass tube of 4mm diameter, when immersed in (i) water and (ii) mercury. The temperature of the liquid is 20^0C and the values of the surface tension of water and mercury at 20^0C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury 1.30°.Take density of water at 20^0C as equal to 998 kg/m^3

22. a) A tank contains water up to a height of 0.5m above the base. An immiscible liquid of sp.gr is filled on the top of water up to 1m height calculate:

(i) total pressure on one side of the tank

(ii) the position of centre of pressure for one side of the tank, which is 2m wide

(OR)

b) A rectangular plane surface 3m wide ad 4m deep lies in water in such a way that its plane makes an angle of 30^0C with the free surface of water. Determine the total pressure force and position of centre of pressure, when the upper edge is 2m below the free surface.

23. a) A 30cm diameter pipe, conveying water, branches into two pipes of diameters 20cm and 15cm respectively. If the average velocity in the 30cm diameter pipe is 2.5m/s.Find the discharge in this pipe. Also determine the velocity in 15cm pipe if the average velocity in 20cm diameter pipe is 2m/s.

(OR)

b) The velocity vector in a fluid flow is given V = $4x^3$i-$10x^2$yj+2tk.Find the velocity and acceleration of a fluid particle at (2,1,3) at time t =1

24. a) A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm 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 30cm of mercury. Find the discharge of water through venturimeter.Take C_d=0.98.

(OR)

b) A 150mm diameter pipe reduces in diameter abruptly to 100mm diameter. If the pipe carries water at 30 liters per second, calculate the pressure loss across the contraction. Take the co-efficient of contraction as 0.6

25. a) A ship 300m long moves in sea-water, whose density is 1030 kg/m^3, A 1:100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30m/s and the resistance of the model is 60N. Determine the velocity of ship in sea-water. Also find the resistance of the ship in seawater. The density of air is given as 1.24kg/m^3.Take the kinematic viscosity of sea-water and air as 0.012 stokes and 0.018 stokes respectively.

(OR)

b) A 7.2m height and 15m long spillway discharge 94m^3/s discharge under a head of 2.0m.If a 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge, if model experiences a force of 7500 N,determine force on the prototype.