B.E/B.Tech Degree Examination, December 2020

Third Semester

CE18302 Mechanics of Fluids

(Regulation 2018)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. A floating body with its center of gravity at 'G' center of Buoyancy at 'B' and metacenter at 'M' is stable when
   a. G lies above B
   b. B lies above M
   c. B lies below M
   d. G lies below M
2. The Bernoulli equation is based on the principal of Law of conservation of
   a. Mass
   b. Energy
   c. Momentum
   d. Force
3. Reynolds Number is the ratio of inertia force to
   a. Surface tension
   b. Viscous Force
   c. Gravitational Force
   d. Pressure Force
4. The diameter of pipe is 200mm. The velocity of flow through the pipe is 4 m/s. The discharge through the pipe is
   a. 127.6 liters per second
   b. 126.6 liters per second
   c. 130.6 liters per second
   d. 125.6 liters per second
5. Determine the Bulk modulus of elasticity of fluid, if pressure of the liquid is increased from 70 N/cm^2 to 130 N/cm^2. The volume of the liquid decreases by 0.15 per cent.
6. Water is flowing through a pipe of 5cm diameter under a pressure of 29.43 N/cm^2 and with mean velocity of 2 m/s. Find the total energy per unit weight of the water at a cross-section, which is 5m above the datum line.
7. Find the head loss due to friction in a pipe of diameter 0.3m and length 50m, through which the water is flowing at a velocity of 3 m/s. Take f= 0.00256.

8. The time period (t) of a pendulum depends upon the length L and acceleration due to gravity g. Derive an expression for time period.

PART B - (4 X16 = 64 marks)

09. (a) The dynamic viscosity of oil used for lubrication between a shaft and sleeve is 6 poise. The shaft of diameter 0.4m and rotates at 190 r.p.m. Calculate the power lost in the bearing for a sleeve length of 90mm. Take the thickness of the oil film as 1.5mm. **(16)**

(OR)

(b) Determine the total pressure on a circular plate of diameter 1.5m which is placed vertically in water in such a way that the center of the plate is 3m below the free surface of water. Find the position of center of pressure also. **(16)**

10. (a) A fluid flow field is given by $V= x^2y\ i + y^2z\ j -(2xyz+yz^2)\ k$. Prove that it is a case of possible steady incompressible fluid flow. Calculate the Velocity and Acceleration at the point (2, 1, 3). **(16)**

(OR)

(b) A 45° degree bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600mm and 300mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is $8.829 N/cm^2$ and rate of flow of water is 600 litres/sec. **(16)**

11. (a) The pressure difference Δp in a pipe of diameter D and length L due to viscous flow depends on velocity v, viscosity μ and density ρ. Using Buckingham's theorem, obtain expression for pressure difference Δp **(16)**

(OR)

(b) A spillway model is to be built to a geometrically similar scale of 1/50 across a flume of 600mm width. The prototype is 15m high and maximum head on it's expected to be 1.5m. **(16)**

i. What is height of model?

ii. If the flow over the model at a particular head is 12 litres per second, what is flow per meter length of the prototype expected?

iii. If the negative pressure head in the model is 200mm, what is the negative pressure head in prototype?

12. (a) Three pipes of 400mm, 200mm and 300mm diameter have length of 400m, 200m and 300m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16m. If coefficient of friction for these pipes is same and equal to 0.005, determine the discharge through the compound pipe neglecting the minor losses. **(16)**

(OR)

(b) A pipe of diameter 0.4 m and of length 2000m is connected to a reservoir at one end. The other end of the pipe is connected to a junction from which two pipes of length 1000 m and diameter 0.3 m run in parallel. These parallel pipes are connected to reservoir at the other end which is having level of water 10m below the water level of the above reservoir. Determine the total discharge, if f =0.015. Neglect minor Losses. **(16)**