UNIT II FLUID KINEMATICS AND DYNAMICS

PART – A

1. What are the types of fluid flows?
2. Differentiate steady and unsteady flow?
3. Differentiate uniform and non – uniform flow?
4. Differentiate laminar and turbulent flow?
5. Differentiate compressible and incompressible flow?
6. Differentiate rotational and irrotational flow?
7. Differentiate one dimensional and two dimensional flow?
8. Differentiate local and convective acceleration?
9. Define velocity potential function?
10. Define stream function?
11. What is equipotential line?
12. Give the relation between stream function and velocity potential function?
13. State Bernouillie's equation.
14. Give the Euler's equation of motion.
15. Write the expression rate of flow through venturimeter.
16. For what purpose orifice meter is used? Define it?
17. Define pitot tube and give its working principle?
18. State momentum equation and impulse momentum equation?
19. What do you mean by vorticity?
20. Differentiate forced and free vertex flows with examples?

21. Write the equation for motion for vertex flow and forced vortex flow.
22. What are the assumptions made in deriving Bernouillie's equation and state its applications.
23. Write the expression for rate of floe through venturimeter.

PART – B

1. Derive continuity equation from principle of conservation of mass.
2. The velocity component for a two dimensional incompressible flow are given by u =3x – 2y and v = -3y – 2x. Show that the velocity potential exists. Determine the velocity potential function and stream function.
3. Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one – third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. find the volume rate of flow in AB, the velocity in CD, the velocity in BC and the diameter of CE.
4. A fluid flow field is given by $V = x^2yi+y^2zj – (2xyz+yz^2)k$ prove that it is a case of possible steady incompressible flow. Calculate the velocity and acceleration at the point (2, 1, 3).
5. Derive the continuity equation for a three dimensional incompressible flow.
6. Derive the Euler's equation of motion and deduce that to Bernouillie's equation.
7. The water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper and 300 mm at the lower end, at the rate of 50 litres /s. the pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2.
8. An oil of sp .Gr. 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. the oil mercury differenyial manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter, Take $C_D = 0.98$.
9. 250 litres/s of water is flowing in a pipe having a diameter of 300 mm. of the pipe is bent by 135^o, find the magnitude and direction of the resultant force on the bend. The pressure of water flowing is 39.24 N/cm^2.
10. A vertical wall is of 8 m height. A jet of water is coming out from a nozzle with a velocity of 20 m/s. The nozzle is situated at a distance of 20 m from the vertical wall. Find the angle of projection of the nozzle to the horizontal so that the jet of water just clears the top of the wall.

.

pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both sections of the pipe.

5. A pipe line, 300 mm in diameter and 3200 m long is used to pump up 50 kg per second of oil whose density is 950 kg/m^3 and whose kinematic viscosity is 2.1 stokes. The centre of the pipe line at the upper end is 40 m above than that at the lower end. The discharge at the upper end is atmospheric. Find the pressure at the lower end and draw the hydraulic gradient and the total energy line.
6. A siphon of diameter 200 mm connects two reservoirs having a difference in elevation of 15 m. The total length of the siphon is 600 mm and the summit is 4 m above the water level in the upper reservoir. If the separation takes place at 2.8 m of water absolute, find the maximum length of siphon from upper reservoir to the summit. Take f = 0.004 and atmospheric pressure = 10.3 m of water.
7. The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm and 400 mm respectively, is 12m. Determine the rate of flow of water if co – efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering: (i) minor losses also (ii) neglecting minor losses.
8. A main pipe is divided into two parallel pipes which again forms one pipe. The length and diameter for the first parallel pipe are 2000 m and 1.0 m respectively, while the length and diameter of 2^{nd} parallel pipe are 2000 m and 0.8 m. Find the rate of flow in each parallel pipe, if total flow in the main is 3 m^3/s. The co efficient of friction for each parallel pipe is same and equal to 0.005.
9. A pipe of diameter 20 cm and length 2000 m is connects two reservoirs, having difference of water levels as 20 m. determine the discharge through the pipe.

   If an additional pipe of diameter 20 cm and length 1200 m is attached to the last 1200 m length of the existing pipe, find the increase in the discharge. Take f = 0.015 and neglect minor losses.

10. A pipe line 60 cm diameter bifurcates at a Y- junction into two branches 40 cm and 30 cm in diameter. If the rate of flow in the main pipe is 1.5 m^3/s and mean velocity of flow in 30 cm diameter pipe is 7.5 m/s, determine the rate of flow in the 40 cm diameter pipe.
11. A pipe line of length 2000 m is used for power transmission. If 110.3625 kW power is to be transmitted through the pipe in which water having a pressure of 490.5 N/cm^2 at inlet is flowing. Find the diameter of the pipe and efficiency of transmission if the pressure drop over the length of pipe is 98.1 N/ cm^2. Take f = 0.0065.
12. Find the maximum power transmitted by a jet of water discharging freely out of nozzle fitted to a pie = 300 m long and 100 mm diameter with co efficient of friction as 0.01. the available head at the nozzle is 90 m.