Gujarat University

B. E. Sem. VI Civil

CE 603 Fluid Mechanics-II

Q. 1 Describe different types of fluid flow. Give practical example of each type.

Q. 2 Develop continuity equation in 3-D flow. State assumptions made.

Q. 3 Develop continuity equation in cylindrical polar co-ordinate.

Q. 4 The velocity vector in a fluid flow is given by
$V = 2x^2i - 10x^2y^2j + (3xyz + z^2)k + 2t$
Determine acceleration of fluid particle at (1, 1, -2) at time t = 2.

Q. 5 Show that stream function exists only for possible case of fluid flow.

Q. 6 Prove that, 'If velocity potential function exists, the flow should be irrotational'.

Q. 7 Show that the equipotential lines are orthogonal to the streamliners at all points of intersections.

Q. 8 Define Vorticity. Develop an expression for vorticity in x, y and z direction.

Q. 9 Derive Bernoulli's equation from Euler's equation of motion.

Q. 10 For a forced vortex flow in a open tank, prove that fall of liquid level at centre is always equal to rise of liquid level at the ends.

Q. 11 An open circular cylinder of 15 cm diameter and 100 cm long contains water upto a height of 60 cm. The cylinder is rotated about it's vertical axis with a speed of 900 r.p.m. Find the quantity of liquid left in the cylinder.

Q. 12 Derive Hagen-Poiseuille equation and state assumption made.

Q. 13 For viscous flow through a circular pipe, prove that the velocity distribution across the section is parabolic.

Q. 14 For laminar flow through a circular pipe plates; show that ratio of maximum velocity to average velocity is 2.

Q. 15 For laminar flow through a parallel pipe plates; show that ratio of maximum velocity to average velocity is 1.5.

Q. 16 For viscous flow, develop relationship between shear stress and pressure gradient.

Q. 17 In a pipe of 200 mm diameter, the maximum velocity of laminar flow is 1.5 m/s. Find (i) the average velocity and the radius at which it occurs and (ii) the velocity at 40 mm from the wall of the pipe.

Q. 18 A fluid of SP gr 1.02 was made pass through an accurate tube length 35 cm and bore 0.1 cm under a head of 18 cm. A discharge 40 cm^3 was collected in a period of 400 seconds. Find the dynamic viscosity of the fluid.

Q. 19 Derive an expression for velocity distribution for turbulent flow in smooth pipes.

Q. 20 Derive an expression for velocity distribution for turbulent flow in rough pipes.

Q. 21 A 300 mm diameter pipe is carrying water. If the velocities at the pipe centre and at a point 100 mm from the pipe centre are respectively 3.0 m/s and 2.5 m/s. Determine the wall shearing stress. Assume flow to be turbulent.

Q. 22 Discuss the phenomenon of boundary layer separation.

Q. 23 Derive the differential equation of gradually varied flow with assumptions made in it.

Q. 24 Derive the geometrical conditions for the most economical section of a trapezoidal channel.

Q. 25 Explain normal depth, critical depth, alternate depths and conjugate depths.

Q. 26 What is meant by dimensionless number? Enlist and explain any two of them.

Q. 27 What is undistorted and distorted model? What are the advantages of using distorted model?

Q. 28 State Buckingham's π theorem. Why it is considered superior over Rayleigh method for dimension analysis?

Q. 29 Obtain the Von-Karman momentum integral equation for boundary layer flow.

Q. 30 Show that for an optimal (efficient) trapezoidal channel (i) top width is equal to twice the length of one of the sloping sides and (ii) hydraulic mean depth is half the depth of flow.

Q. 31 Classify open channel flow and explain each in brief.

Q. 32 Explain different types of hydraulic similarities that must exist between a prototype and its model.

Q. 33 A 12 m wide rectangular channel carries a discharge of 30 m^3/s with a bed slope of 1:5000, the depth of flow at a section is 1.5 m. Find the type of water surface profile.

Q. 34 The discharge of water through a rectangular channel with 6 m width and 2 m depth of flow is 18 cumecs. Calculate (i) specific energy of flowing water (ii) critical depth (iii) critical velocity and (iv) minimum specific energy

Q. 35 A sluice gate discharges water into a horizontal rectangular channel with a velocity of 8 m/s with a depth of flow 0.5 m. The width of channel is 6 m. Determine whether hydraulic jump will occur and if so find its height and loss of energy.

Q. 36 Derive an expression for the momentum thickness (θ) and energy thickness (δ^{**}) of boundary layer flow.

Q. 37 A trapezoidal channel has side slopes of 1 horizontal to 2 vertical and the slope of the bed is 1 in 1500. The area of the section is 50 sqmt. Find the optimum dimensions of the channel. Also determine the discharge if C = 50.

Q. 38 What is difference between back water curve and drop down curve. Find the slope of the free water surface in a rectangular channel of width 20 m and depth of flow 5 m. The discharge through the channel is 60 cumecs. The bed slope of the channel is 1 in 4000. Take C = 60.

Q. 39 Classify different types of hydraulic jump as per USBR. Water flows at the rate of 2 cumecs along a channel of rectangular section 2m in width. Calculate the critical depth. If a hydraulic jump formed at a point where the u/s depth is 0.25 m what would be the rise in water level and power lost in the jump.

Q. 40 Find the width and depth of a rectangular channel to convey a discharge of 1.5 m/s at a velocity of 0.5 m/s. Take Chezy’s constant equal to 60 and the channel bed slope equal to 0.00012.