

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
EndTermExamination

B.Tech. [II Year]/[III sem.]/[2013-2014]

Course Name: Fluid Flow Operations

Max Marks: 40

Course Code: CHE302

Time: 03.00 hr

Instructions:

1. Attempt all sections.
2. Attempt any **four** questions from Section B

Section A

(10 Marks)

➤ Q 1.

(i) The head loss in a sudden pipe expansion from area A_1 to area A_2 and from velocity V_1 to velocity V_2 is given by

- (a) $(1 - A_1/A_2)^2 \cdot V_1^2/2g$
- (b) $(1 - A_1/A_2)^2 \cdot V_2^2/2g$
- (c) $(1 - A_2/A_1)^2 \cdot V_1^2/2g$
- (d) $(1 - A_2/A_1)^2 \cdot V_2^2/2g$

(ii) Metacentric height for small values of angle of heel is the distance between

- (a) Centre of gravity and centre of buoyancy
- (b) Centre of gravity and metacentre
- (c) Centre of buoyancy and metacentre
- (d) Free surface and centre of buoyancy

(iii) Equation of continuity is based on the principle of conservation of

- (a) Mass
- (b) Energy
- (c) Momentum
- (d) None of the above

(iv) The major loss of energy in long pipes is due to

- (a) Sudden enlargement
- (b) Sudden contraction
- (c) Gradual contraction and enlargement
- (d) Friction

(v) Coefficient of discharge of an orifice is -----and of venturimeter is-----.

Q 2. (i) Define the following dimensionless numbers:

- (a) Reynolds number (b) Mach number (c) Euler number
- (d) Froude number (e) Weber number

(ii) Explain Newton's law of viscosity and differentiate between dynamic and kinematic viscosity.

Section B**(20 Marks)**

Q 3. (i) State Buckingham's π theorem.

(ii) The resistance R experienced by a partially submerged body depends upon the velocity V , length of the body L , viscosity of the fluid μ , density of the fluid ρ and gravitational acceleration g . Obtain an dimensionless expression of R using Buckingham's π theorem.

Q 4. What is Bernoulli's theorem? Derive the Bernoulli's equation from Euler's equation.

Q 5. Derive Navier-stokes equation of motion.

Q 6. (i) Derive an expression for Darcy-Weisbach formula to determine the head loss due to friction. Give the expression for relation between friction factor and Reynolds number for laminar and turbulent flow.

(ii) A horizontal pipe of diameter 30 cm carrying water is abruptly reduced to a diameter of 20 cm. if the discharge through the pipe is 40 litres/sec, find the loss of head due to contraction. Also find the pressure loss across the contraction. Assume the coefficient of contraction as 0.62.

Q 7. Derive an expression of conservation of energy for integral control volume.

Section C**(10 Marks)**

Q 8. Derive an expression for velocity profile and shear stress distribution for a fully developed laminar flow between infinite stationary parallel plates.

Q 9. An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the Orificemeter gives readings of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Coefficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe.