

GUJARAT TECHNOLOGICAL UNIVERSITY**BE SEM-III Examination May 2012****Subject code: 130101****Subject Name: Fluid Mechanics****Date: 10/05/2012****Time: 02.30 pm – 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) (i) What is the difference between dynamic viscosity and kinematic viscosity? State their units. **03**
- (ii) Obtain an expression for capillary rise of liquid? **04**
- (b) Calculate the pressure exerted by 5 kg of nitrogen gas at a temperature of 10°C if the volume is 0.4 cubic meter. Molecular weight of nitrogen is 28. Assume ideal gas laws are applicable. Take universal gas constant (MR) = 8314 Nm/kg-mole-K **07**
- Q.2** (a) (i) What is compressibility? Derive an expression for it? **03**
- (ii) Describe vertical single column manometer? How will you measure the fluid pressure with it? **04**
- (b) Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3 m below the free surface of water. Find the position of centre of pressure also. **07**
- OR**
- (b) A pontoon of 15696 kN displacement is floating in water a weight of 245.25 kN is moved through a distance of 8 m across the deck of pontoon which tilts the pontoon through an angle of 4° find the metacentric height of the pontoon. **07**
- Q.3** (a) (i) Define the terms metacentre, metacentric height and absolute pressure. **03**
- (ii) What do you mean by equipotential line and a line of constant stream function? **04**
- (b) An open circular cylinder of 15 cm diameter and 100 cm long contains water up to a height of 80 cm. Find the maximum speed at which the cylinder is to be rotated about its vertical axis so that no water spills. **07**
- OR**
- Q.3** (a) (i) State Bernoulli's theorem. **03**
- (ii) Derive an expression for the discharge through a venturimeter. **04**
- (b) A horizontal Venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of sp.gr 0.8. The discharge of oil through venturimeter is 60 Liters/Second. Find the reading of the oil mercury differential manometer take $C_d = 0.98$. **07**
- Q.4** (a) (i) What are the advantages of triangular notch over rectangular notch? **03**
- (ii) Find an expression for the discharge over a rectangular notch. **04**
- (b) Derive an expression for Hagen Poiseuille's theorem. **07**

OR

- Q.4** (a) (i) Define Kinetic Energy correction factor and momentum correction factor. **03**
(ii) Show that the value of the co-efficient of friction for viscous flow through a circular pipe is given by $f = 16/Re$ where $Re =$ Reynolds number. **04**
- (b) Explain Dash pot mechanism and its utility. **07**
- Q.5** (a) (i) What is meant by geometric, kinematic, and dynamic similarities? **03**
(ii) State Buckingham's Π theorem method.. What do you mean by repeating variables **04**
- (b) Calculate the stagnation pressure temp. and density on the stagnation point on the nose of the plane which is flying at 800 km/hr through still air having a pressure 8 N/square cm (abs) and temp. $-10^\circ C$. Take $R = 287 J/Kg -K$, $\gamma = 1.4$ **07**

OR

- Q.5** (a) (i) Define Mach Number and Mach cone **03**
(ii) Prove that the velocity of sound waves in a compressible fluid is given by $C = \sqrt{k/\rho}$. **04**
 $K =$ Bulk modulus.
 $\rho =$ Mass Density.
- (b) Derive an expression for area velocity relationship for a compressible fluid in the form with usual notation **07**
 $dA/A = (dV/V)[M^2 - 1]$

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