



## GUJARAT UNIVERSITY

## B.E. Sem IV (Mech./Auto.) (Old) Examination

## Fluid Mechanics

Tuesday, 24th June, 2008]

[Time : 3 Hours

Max. Marks : 100

- Instructions :** (1) Attempt **all** questions.  
 (2) Answer to the two sections must be written in **separate** answer books.  
 (3) Figures to the right indicate **full** marks.  
 (4) Assume suitable data if necessary.

## SECTION I

- 1 (a) What is difference between dynamic viscosity and kinematic viscosity? State their units of measurements. 8  
 (b) What do you mean by dimensionless numbers? Name any four dimensionless numbers. 8

## OR

- 1 (a) The resistance  $R$  to motion of a completely submerged body depends upon the length of body  $L$ , velocity of flow  $V$ , mass density of fluid  $\rho$  and kinematic viscosity  $\nu$ . By dimensional analysis prove that. 8

$$R = \rho V^2 L^2 \phi \left( \frac{VL}{\nu} \right).$$

- (b) Define surface tension, prove that the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by  $p = \frac{4\sigma}{d}$ . 8
- 2 (a) What do you mean by single column manometers? How are they used for measurement of pressure? 8

## OR

- (a) Define meta-centric height. Derive expression for meta-centric height of a floating body. 8  
 (b) Define the equation of continuity. Obtain an expression for continuity for three-dimensional flow. 8
- 3 Attempt any **three** : 18  
 (a) Explain the terms : path line, streak line, stream line, stream tube.  
 (b) Show that in case of forced vortex flow, the rise of liquid level at the ends is equal to fall of liquid level at the axis of rotation.  
 (c) Define pressure. Obtain expression for the pressure intensity at a point in a fluid.  
 (d) How will you determine the meta-centric height of a floating body experimentally? Explain with neat sketch.  
 (e) Distinguish between :  
 (i) Steady and unsteady flow.  
 (ii) Uniform and non-uniform flow.  
 (iii) Compressible and incompressible flow.

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### SECTION II

- 4 (a) Explain the principle of venturimeter with a neat sketch. Derive the expression for rate of flow of fluid through it. 16
- (b) What is Euler's equation of motion? How will you obtain Bernoulli's equation from it.
- 5 (a) Derive an expression for Hagen-poiseulli's formula. 8
- OR**
- (a) A shaft 150 mm diameter runs in a bearing of length 300 mm with a radial clearance of 0.04 mm at 40 r.p.m. Find viscosity of oil, if power required to overcome viscous resistance is 220.725 W. 8
- (b) Derive an equation for velocity of sound waves moving in a compressible fluid. 8
- OR**
- (b) Define and explain terms : Mach number, Mach cone, Mach angle. 8
- 6 Attempt any three : 18
- (a) Define an orifice-meter. Derive equation for discharge through an orifice meter.
- (b) What are different methods of determining co-efficient of viscosity of a liquid? Describe any one method in detail.
- (c) Explain the phenomenon of water hammer.
- (d) Derive Darcy-Weisbach equation.
- (e) State Buckingham's  $\pi$  theroem. Why it is considered superior over Rayleigh's method.
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