Roll No. .....

24172

B. Tech 4th Sem. (Mechanical Engg.)

Examination – May, 2012

FLUID MECHANICS

Paper : ME - 208 - F

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complain in this regard, will be entertained after examination.

Note : Question No. **1** is ***compulsory***. Attempt ***five*** questions in total at least ***one*** question from each Section.

1. (a) Differentiate between ideal and real fluid.

(b) Define the term vorticity and circulation.

(c) Write Von -Karman momentum integral equation.

(d) What is difference between streak and path lines.

(e) State the basic principle behind the theory of orifice meter

(f) Enlist the major losses in flow through pipes.

(g) Distinguish between compressible and incompressible flows.

(h) What do you mean by friction coefficient for smooth pipes ?

(i) What are total energy lines ?

(j) Define the term lift and drag. $2 \times 10 = 20$

SECTION – A

2. An open tank 30 m long and 2 m deep is filled with 1.5 m of oil of specific gravity 0.82. The tank is accelerated uniformly from rest to a speed of 20 m/s. What is the shortest time in which this speed may be attained without spilling any oil ? 20

3. Drive the differential equation of continuity in cylindrical coordinates. 20

SECTION – B

4. Explain the principle of venturimeter with a neat sketch and establish a relation for the rate of flow through it.

In a 100 mm diameter horizontal pipe, a venturimeter of 0.5 contraction ratio has been fitted. The head of water on the meter when there is no flow is 3 m (gauge). Find the rate of flow for which the throat

pressure will be 2 m of water absolute. Discharge coefficient for the meter is 0.97. 20

5. (a) Explain the concept propagation of elastic waves due to disturbance in fluid. 7

(b) Air flows with a velocity of 290 m/s through a duct. At a particular section of the duct, the static pressure and temperature are 77 KPa and 390 K. Assuming the flow to be reversible adiabatic, estimate the :

(i) Mach number at the given section and

(ii) Mach number, temperature and velocity at another section where the static pressure is 120 KPa. 13

SECTION – C

6. Two fixed parallel plates kept 7 cm apart have laminar flow of oil between them with a maximum velocity 1.8 m/s. Taking dynamic viscosity of oil to be 2.1 Ns/m^2, Compute :

(i) the discharge per metre width,

(ii) the shear stress at the plates,

(iii) the pressure difference between two points 20 m apart,

(iv) Velocity at 2 cm from the plate,

(v) the velocity gradient at the plates end. 20

7. (a) Give a proof of Hagen-Poiseuille equation for fully developed laminar flow in pipe and hence

show that the Darcy friction coefficient is equal to $16/R_e$ where R_e is Reynolds number. 13

(b) Write notes on flow regimes and Reynolds's number. 7

SECTION – D

8. A cylinder whose axis is perpendicular to the stream of air having a velocity of 30 m/s, rotates at 340 rpm. The cylinder is 2 m in diameter and 10 m long. Find :

(i) the circulation,

(ii) the theoretical lift force per unit length,

(iii) the position of stagnation points,

(iv) the actual lift, drag and direction of resultant force.

Assume :

$$U_c / U_0 = 1.57; C_L = 3.4 \text{ and } C_D = 0.60.$$

Where U_c represents the peripheral velocity due to circulation and for air $\rho = 1.24\ kg/m^3$. 20

9. Water at 40° and atmospheric pressure flows through a smooth pipe of 5 cm ID. The flow is fully developed and is at a rate of 3 litre/s. Calculate :

(i) friction factor,

(ii) pressure drop over a length of 5 m,

(iii) the thickness of laminar sublayer. 20
