00393

Printed Pages—3 **CE—507**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0009 **Roll No.** | | | | | | | | | | |

B.Tech.

FIFTH SEMESTER EXAMINATION, 2005-2006

FUNDAMENTALS OF FLUID MECHANICS

Time : 2 Hours *Total Marks : 50*

FIFTH

Note : *(i) Answer ALL questions.*

(ii) Give illustrations wherever required.

(iii) Assume missing data suitably, if any and state assumptions made.

(iv) Be precise in your answer.

1. Attempt ***any four*** of the following questions : **(3x4=12)**

(a) Explain the Newtonian and Non-Newtonian type of fluids with examples.

(b) What is meant by Velocity Potential function ? State its properties.

(c) The stream function for two-dimensional flow is given as $\psi = x(y^2 - a^2) - x^3/3$. Show that this is a possible case of fluid flow and state whether it is rotational or irrotational flow.

(d) A wooden cylinder of 0.9 m dia. floats in water. What should be its maximum height in order that it may float upright with longitudinal axis vertical ? Assume specific gravity of wood as 0.62.

(e) State Hydrostatic Pressure equation. With the help of hydrostatic pressure equation derive an expression for the buoyant force acting on a submerged body.

(f) A Newtonian fluid is filled in the clearance between a shaft and a concentric Sleeve. The sleeve attains a speed of 0.50 m/s when a force of 50 N is applied to the sleeve parallel to the shaft. Determine the speed when a force of 220 N is applied.

2. Attempt ***any four*** of the following questions : **(3x4=12)**

(a) What is a Cippoletti weir ? Prove that the discharge through it is equal to the discharge of Trapezoidal weir.

(b) What is meant by kinetic energy correction factor and momentum correction factor ? Prove that for viscous flow through a circular pipe the kinetic energy correction factor is equal to 2.

(c) Using Buckingham's π -Theorem, prove that the velocity through a circular orifice is given by $V = \sqrt{2gH}\ \phi\ (D/H,\ \mu/\varrho VH)$, where H is head causing the flow, D is the diameter of the orifice, μ the dynamic viscosity, ϱ is the mass density and g is acc. due to gravity.

(d) In 1:25 model of a spillway, the velocity and discharge are 2.0 m/s and 3.2 m^3/s. Find out the corresponding velocity and discharge in the proto-type.

(e) State and derive Hagen Poisuille's formula ?

(f) A horizontal pipe of dia. 120 mm is carrying glycerin at the rate of 0.012 m^3/s. Determine required power per kilometer to overcome the viscous resistance to flow of glycerin in the pipe. Take dynamic viscosity of glycerin as 9 poise.

Attempt ***any two*** of the following questions : **($6\frac{1}{2}$ x2=13)**

(a) Explain Energy thickness and derive an expression for the same.

(b) The velocity profile of a boundary layer flow is given by $u/U = 2(y/\delta) - (y/\delta)^2$, where notations have their usual meaning. Determine the displacement and momentum thickness.

(c) Obtain the condition for maximum transmission of power in a pipe line.

Attempt ***any two*** of the following questions : **($6\frac{1}{2}$ x2=13)**

(a) What is meant by separation of boundary layer ? What are the required conditions for boundary layer to separate ? Is it a desirable phenomena ? If not then write two methods of controlling boundary layer separation.

(b) A pipe of 0.4 m dia. and 3000 m long conveys water with the velocity of 1.8 m/s. A valve at the downstream end is expected to be closed in 10 seconds. Estimate the water hammer pressure if the value of velocity of pressure wave is 1200 m/s.

(c) What is a surge tank ? Explain different types of surge tanks.

- o O o -