BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : III**
BRANCH: CIVIL **SESSION : MO/2022**

SUBJECT: CE203 FLUID MECHANICS

TIME: 3:00 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) State the Newton's law of viscosity. Derive the dimension of viscosity. [2]

Q.1(b) Derive the expression for internal pressure inside a liquid droplet. [3]

Q.1(c) Through a very narrow gap of height *h*, a thin plate of large extent is pulled at a velocity V. On one side of the plate is oil of viscosity μ_1 and on the other side oil of viscosity μ_2. Calculate the position of the plate so that the shear force on the two sides of the plate is equal. [5]

Q.2(a) With the help of a sketch, briefly describe the U-tube differential manometer. [2]

Q.2(b) Briefly discuss the experimental method of determination of metacentric height. [3]

Q.2(c) Values of ϕ for the following flows are given. Determine the corresponding values of ψ. [5]

i. $\phi = 3xy$

ii. $\phi - 4(x^2 - y^2)$

Q.3(a) What do you understand by kinetic energy correction factor? [2]

Q.3(b) Differentiate between venturimeter and orificemeter. [3]

Q.3(c) A cylinder 1.2 m diameter is rotated about its axis in air having a velocity of 128 km/hr. A lift of 5886 N per metre length of cylinder is developed on the body. Assuming ideal fluid flow theory, find the rotational speed of cylinder and location of the stagnation points. Assume $\rho = 1.236\ kg/m^3$. [5]

Q.4(a) Briefly explain the concept of specific energy in open channel flow. [2]

Q.4(b) A channel has vertical walls 1.2 m apart and a semicircular invert. If the centreline depth is 0.9 m and the bed slope is 1 in 2500, find the discharge. Assume *C* = 54. [3]

Q.4(c) A horizontal rectangular channel 4 m wide carries a discharge of 16 m^3/s. Determine whether a jump may occur at an initial depth of 0.5 m or not. If a jump occurs, determine the sequent depth to this initial depth. Also determine the energy loss in the jump. [5]

Q.5(a) Derive the expression for work done in a single acting reciprocating pump. [2]

Q.5(b) With the help of a sketch, explain the components of a Francis turbine. [3]

Q.5(c) A Pelton wheel has to be designed for the following data. [5]

$P = 8000\ HP,\ H = 300\ m,\ N = 550\ rpm,$

$\frac{d}{D} = \frac{1}{10}$, $and\ \eta_o = 85\ \%$

Find number of jets, diameter of jet, diameter of wheel, and quantity of water required.

Assume $C_v = 0.98\ and\ K_u = 0.46$

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