Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(MAHE, MANIPAL)

SECOND SEMESTER B.S.(ENGG.) DEGREE EXAMINATION-APRIL / MAY 2018

SUBJECT: FLUID MECHANICS (ME 122)

(2013 BATCH)

(BRANCH: MECHANICAL)

Friday, 27 April 2018

Time: 03 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Missing data, if any, may be suitably assumed.**

1A) Distinguish between
(a) Gauge pressure and absolute pressure
(b) Mach number and weber number
(c) Hydraulic gradient and energy gradient line
(d) Uniform and non uniform flow
(e) Stability criteria for a submerged and for a floating body (10)

1B) Two coaxial cylinders 10 cm and 9.75 cm in diameter and 2.5 cm high have their both ends open and have a viscous fluid in between. A torque of 1.2 N-m is produced on the inner cylinder when the outer one rotates at 90 rpm. Determine the coefficient of viscosity of the fluid. (10)

2A) Explain with necessary diagrams how will you determine the forces on a curved plane submerged in a liquid (10)

2B) Find the total pressure and center of pressure on a triangular plate of base 2 m and height 3 m which is immersed in water in such a way that plan of the plate makes an angle of 60° with the free surface of water. Base of the plate is parallel to water surface and at a depth of 2.5 m from the water surface. (10)

3A) With usual notations derive an expression to determine the metacentric height of a floating body. (10)

3B) In a two dimensional incompressible flow, velocity components are given by u = x - 4y and v = – y – 4x. Show that velocity potential exists and determine its form. Find also the stream function (10)

4A) Derive Euler's equation for the fluid flow and hence deduce Bernoulli's equation. List the assumptions made (10)

4B) Water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end at the rate of 50 L/s. Pipe has a slope of 1in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2 (10)

5A) With usual notations derive an expression to determine the discharge through an orifice meter. (10)

5B) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0.8. Discharge of oil through the venturimeter is 60 L/s. Find the reading of the oil-mercury differential manometer. Take Cd = 0.98 (10)

6A) Discuss the different forms of energy losses for a pipe flow. Derive an expression for loss of head due to sudden enlargement. (10)

6B) Determine the difference in the elevations between water surfaces in two tanks which are connected by horizontal pipe of diameter 300 mm and length 400 m. the rate of flow through the pipe is 300 L/sec. Consider all losses and take value of friction factor as 0.032 (10)

7A) Derive Hagen Poiseuille equation for the viscous flow through a circular pipe. (10)

7B) Oil of relative density 0.9 and dynamic viscosity 2.5 poise is pumped through a 100 mm diameter pipe 500 m long at the rate of 2L/s. Find

(a) Reynolds' number for the fluid flow.
(b) Calculate the pressure required at the pump if the outlet end which is free is at 20 m above the pump level.

What should be the power input if the overall efficiency of the pump set is 65%? (10)

8A) The discharge Q from a centrifugal pump is dependent upon the pump speed (N), diameter of the impeller (D) head (H), acceleration due to gravity (g) density of the fluid (ρ) and viscosity (μ). Show by Buckingham's π theorem

$$\frac{Q}{D^2\sqrt{gD}} = \phi\left(\frac{N\sqrt{D}}{\sqrt{g}}, \frac{H}{D}, \frac{\mu D^2}{\rho Q}\right)$$

(10)

8B) A reducer bend having an outlet diameter 15 cm discharges freely. The bend connected to a pipe of 20 cm diameter has a deflection of 60° and lies in the horizontal plane. Determine the magnitude and direction of the resultant force on the anchor block supporting the pipe when a discharge of $0.3m^3$ /sec passes through the pipe (10)