Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH (INDUSTRIAL & PRODUCTION ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE/JULY 2016

SUBJECT: FLUID MECHANICS AND MACHINERY [MME 2214]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Define the following for a fluid:
a) Bulk modulus b) vapour pressure c) cavitation **(03)**

1B. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25m of its length from the tank the pipe is 150mm diameter and its diameter is suddenly enlarged to 300mm. The height of water level in the tank is 8m above the centre of pipe. Considering all losses of head which occur, determine the rate of flow. Take f=0.01 for both sections of the pipe. **(04)**

1C. Draw the arrangement of manometer to measure gauge pressure and vacuum pressure and write the expression for same. **(03)**

2A. Define Pascal's law and prove it with help of a sketch. **(03)**

2B. The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft L, velocity V, air viscosity μ, air density ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force using Buckingham Pi theorem. **(04)**

2C. A rectangular plane surface is 2 m wide and 3 m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and a) coincides with water surface b) 2.5 m below the free water surface. **(03)**

3A. Derive the fundamental dimensions for following quantities:
i) kinematic viscosity ii) work iii) discharge **03**

3B. Sketch and explain the stability conditions for submerged objects in a static fluid. **03**

3C. Prove that the shear stress varies linearly across a section in case of a flow between two parallel plates. Also prove that the velocity varies parabolically. **04**

4A. Water flows through a pipe of diameter 30 cm. The pipe is inclined and a venturimeter is inserted in the pipe. The diameter of venturimeter at the throat is 15 cm. The difference of pressure between the inlet and throat of the venturimeter is measured by a liquid of specific gravity 0.8 in an inverted U-tube which gives a reading of 40 cm. The loss of head between the inlet and throat is 0.3 times kinetic head of the pipe. Find the discharge. **03**

4B. Derive an expression for work done/s/unit weight of liquid/s in case of pelton wheel. **04**

4C. Distinguish between the following **03**
i. Local acceleration and convective acceleration
ii. Laminar and Turbulent flow
iii. Sub critical and super critical flow

5A. The space between two square flat plates is filled with oil. Each side of the plate is 60 cm. The thickness of oil film is 12.5 mm. The upper plate which moves at 2.5 m/s requires a force of 98.1 N to maintain the speed. Determine: **04**
i) The dynamic viscosity of oil in poise
ii) The kinematic viscosity of the oil in stokes if the specific gravity of the oil is 0.95

5B. List the assumptions made in obtaining the Bernoulli's equation for a fluid flow. **02**

5C. The internal and external diameters of the impeller of a centrifugal pump are 200mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. **04**