MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

IV SEMESTER B. TECH (IP ENGG.) END SEMESTER EXAMINATIONS, MAY 2019

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 suitable assumed.
- ❖ Draw neat labelled sketches wherever necessary.

1A. A 40-cm X 30-cm X 20-cm block weighing 140 N is to be moved at a constant velocity of 0.9 m/s on an inclined surface upwards. If a 0.5-mm-thick oil film with a dynamic viscosity of 0.012 Pa.s is applied between the block and inclined surface, determine the force F that needs to be applied in the horizontal direction to maintain the motion. **4M**

1B. How are the fluids classified? Explain with example for each type of fluid. **3M**

1C. State and prove Pascal's law. **3M**

2A. A rectangular plane surface 2m wide and 4m deep which has a concentric square hole lies in water in such way that its plane makes an angle of 35^0 with the free surface of water. Determine the total pressure and position of centre of pressure when upper edge is 2.2m below free surface of water. **4M**

2B. Write a short note on the stability of submerged bodies. **3M**

2C. Derive continuity equation for a three dimensional steady incompressible fluid flow. **3M**

3A. A pipe of 250mm diameter conveying $0.4m^3$/s of water has a right angled bend in a horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are 24.5N/cm^2 and 20N/cm^2 respectively. **4M**

3B. Define and explain the significance of Reynold's number and Froude's number. **3M**

3C. Derive and expression for rate of fluid flow through an venturi meter. **3M**

4A. The resisting force of a supersonic plane during flight can be considered as dependent on the length of the aircraft L, velocity V, viscosity μ, mass density ρ, Bulk modulus K. Express the fundamental relationship between resisting force and these variables using Buckingham's PI theorem. **4M**

4B. Explain the concept of lift and drag. **3M**

4C. Derive Darcy-Weisbach equation for calculating the major loss in horizontal pipe flow with constant cross section. **3M**

5A. A Pelton wheel is to be designed for the following specifications. Shaft power = 10500 kW; Head = 360 meters; Speed = 740 r.p.m.; Overall efficiency = 85%; Jet diameter is not to exceed one-fifth of the wheel diameter. Determine the wheel diameter, the number of jets required, and Diameter of the jet. Take K_{v1}=0.975 and K_{u1}=0.43, **4M**

5B. Explain the principle of working of centrifugal pump. **3M**

5C. Derive an expression for force exerted when a jet strikes on curved plate on one end tangentially when the plate is unsymmetrical. **3M**