



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



IV SEMESTER B.TECH (INDUSTRIAL & PRODUCTION ENGINEERING) END SEMESTER EXAMINATIONS, MAY 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 suitable assumed.
- Derive the expression for Newton's law of viscosity with the help of a neat sketch.
 (03)
- 1B. Prove that the shear stress varies linearly across a section in case of a circular pipe. Also prove that velocity varies parabolically. (04)
- 1C. A differential manometer is connected at the two points A & B as shown in fig. (Q1C). At B air pressure is 7.848 N/cm² (absolute). Find the absolute pressure at A.
- **2A.** If velocity distribution of fluid over a plate is given by $u = (3/4)y y^2$ in which 'u' is the velocity in m/s at a distance 'y' meter above the plate, determine the shear stress at y=0.12m and y=0.25 m. Take the dynamic viscosity as 0.863 Pa s (03)
- **2B.** A body of dimensions 2 m x 1m x 3 m weighs 3924 N. Find its weight in air. What will be its specific gravity?
- **2C.** Using Buckingham's theorem show that the discharge Q consumed by an oil ring is given by

$$Q = Nd^{3}\phi \left[\frac{\mu}{\rho Nd^{2}}, \frac{\sigma}{\rho N^{2}d^{3}}, \frac{w}{\rho N^{2}d}\right]$$

N=rotational speed, d=internal diameter of ring, μ viscosity, ρ density, σ is the surface tension and w is the specific weight of the oil.

- **3A.** Define hydrostatic law. Obtain the expression for same.
- **3B.** Obtain the expression for total pressure force and centre of pressure for a vertical surface submerged in a static fluid. (03)

(03)

(04)

(03)

- 3C. A Pelton wheel is to be designed for the following specifications: Shaft power=11.772 kW; Head=380 m; speed=750 rpm; overall efficiency= 86%; Jet diameter is not to exceed 1/6th of wheel diameter. (04) Determine the number of jets required.
- **4A.** Derive the continuity equation for three dimensional fluid flow. **(03)**
- **4B.** Derive an expression for work done /sec /unit weight of liquid/sec in case of centrifugal pump.
- 4C. A pipe diameter of 300 mm conveying 0.3 m³ /sec water has a right angled bend in horizontal plane. Find the force exerted on the bend if the pressure at the inlet and outlet of the bend are 25 N/cm² and 30 N/cm² respectively.
- 5A. An oil of viscosity 0.1Ns/m² and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and length 300 m. The rate of flow of the fluid through the pipe is 3.5 litre/s. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall.
- **5B.** With a neat sketch, explain the construction and working of a reciprocating pump. (02)
- 5C. Find the discharge of the water flowing through a pipe of 30 cm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and throat is measured by a liquid of specific gravity 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of pipe.



(04)