

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B. TECH (I&P ENGG.)

END SEMESTER MAKE-UP EXAMINATIONS, JUNE 2018

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.
- A 90N rectangular solid block slides down a 30⁰ inclined plane. The plane is lubricated by a 3mm thick film of oil of relative density 0.9 and viscosity 8 poise. If the contact area is 0.3m², estimate the velocity of the block.
- 1B. Explain the following fluid properties: (i) surface tension and capillarity(ii) bulk 3 modulus (iii)vapor pressure and cavitation
- 1C. A U tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in the level of mercury in the limbs of U-tube is 10cm and the free surface of mercury is in level with the center of pipe.
- **2A.** The velocity vector in an incompressible flow is given by $4 V = (6xt+yz^2)i+(3t+xy^2)j+(xy-2xyz-6tz)k$.
 - (i) Verify whether the continuity equation is satisfied.
 - (ii) Determine the acceleration vector at the point A(1,1,1) at t=1
- 2B. Explain (i) steady and unsteady flow, (ii) uniform and nonuniform flow, 3 (iii) one and two dimensional flow.
- 2C. A rectangular plate 0.6m wide and 1.2m deep lies within a water body such that its plane is inclined at 45⁰ to the horizontal and tope edge is 0.7m below the water surface. Determine the total pressure force on one side of the plate

and the location of the centre of pressure.

- 3A. A 300mm diameter pipe carries water under a head of 20 meters with a 4 velocity of 3.5m/s. If the axis of the pipe turns through 45⁰, find the magnitude and direction of the resultant force at the bend.
- 3B. 3 Explain the steps involved in dimensional analysis using Buckingham's π theorem.
- **3C.** Derive and expression for rate of flow through an orifice meter fixed in a 3 horizontal pipe with usual notations.
- **4A.** Derive expression for shear stress distribution, velocity distribution, average 4 velocity of flow in case of viscous flow inside a circular pipe. Hence derive Hagen Poiseuille formula to determine pressure drop inside the pipe for a given length in a viscous flow. 3
- **4B.** Explain the following:
 - (i) Bluffed body and Streamlined bodies
 - (ii) Major and Minor Losses in flow though pipes.
- **4C.** Water is flowing through a pipe of diameter 30cm at a velocity of 4m/s. Find 3 the velocity of oil flowing in another pipe of diameter 10cm, if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.01 poise and 0.025 poise. Take specific gravity of oil=0.8
- **5A.** A Pelton wheel is having a mean bucket diameter of 1.2m and is running at 4 1100 rpm. The net head on the Pelton wheel is 800m. If the side clearance angle is 14° and discharge through nozzle is $0.12m^{3}/s$, find (i) Power available at the nozzle, (ii) Hydraulic efficiency of the turbine.

5B.	Explain the principle of working of Francis turbine.	3
5C.	Explain the principle of working of reciprocating pump.	3

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