Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: FLUID MECHANICS [CIE – 2101]

REVISED CREDIT SYSTEM

(/ /2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	What is meant by pressure distribution diagram? State its applications.	**02**
1B.	(i) State the "Newton's law of viscosity"; (ii) Derive the "Newton's equation of viscosity" with a neat definition sketch.	**04**
1C.	Water flows through pipe A and B as shown in **Fig.Q1C**. The pressure difference of these two points is to be measured by multiple tube manometers. Oil with specific gravity 0.88 is in the upper portion of inverted U-tube and mercury in the bottom of both bends. Determine the pressure difference.	**04**
2A.	Derive the expressions for the rotation components for a 3D flow	**04**
2B.	A conical tube is fixed vertically with its larger diameter at the top and forms a part of the pipe line carrying kerosene (sp. gr. 0.80). The velocity at the smaller end is 3.0 m/sec, and at the larger end is 1.5 m/sec. The tube is 2.0 m long. At the bottom of the tube the pressure is 50 kPa. The head loss in the tube is assumed to be 0.35 times the difference in the velocity heads at the two ends. Estimate the pressure at the top of the tube when the flow is upwards.	**02**
2C.	The velocity components in a two dimensional incompressible flow are: $\mathbf{u = y^3 + 6x - 3x^2y;}$ **and,** $\mathbf{v = 3yx^2 - 6y - x^3.}$ (i) Is the flow continuous? (ii) Is the flow irrotational? (iii) If flow is irrotational, find both potential function and stream function; If not find only the stream function.	**04**
3A.	Derive the expressions for the velocity distribution in Laminar flow in a circular pipe. Sketch the shear stress distribution and velocity distribution across the section.	**04**

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3B.	Two reservoirs are connected by a pipe line consisting of two pipes in series. The first pipe is 15 cm in diameter and 6 m long and the second pipe is 22.5 cm in diameter and 15 m long. Assuming f=0.02 for both the pipes, determine the % error in discharge calculation that can occur if minor losses are neglected.	**03**
3C.	Two reservoirs whose surface levels differ by 30 metres are connected by a pipe of 600 mm diameter and 3000 m long. The pipe line crosses a ridge whose summit is 9 m above the water level and 300 m distant from the U/S reservoir. Find the maximum depth below the ridge at which the pipe must be laid if the absolute pressure head in the pipe is not to fall below 2.5 m of water. Calculate, also, the discharge. Take atmospheric pressure as 10.3 m of water and f as 0.03. Neglect minor losses.	**03**
4A.	(i) Define specific energy and specific force. (ii) Show that the most economical trapezoidal channel section is a half hexagon.	**03**
4B.	A 4m wide rectangular channel conveys $10m^3$/sec of water with a velocity of 5m/sec. Is there a condition for hydraulic jump to occur? If so calculate: (i) the depth after the jump; (ii) height of the jump, length of the jump; (iii) loss of energy and power due to the jump.	**03**
4C.	A 3m wide rectangular channel carries 12 cumec of water at a depth of 1.5m. Determine: (i) Specific energy and the alternate depth; (ii) Critical depth, critical velocity and minimum specific energy; (iii) Is the flow sub-critical or supercritical at depth of 1.5m; (iv) If Chezy's C is 65 determine the critical slope.	**04**
5A.	(i) Define the terms: Orifice, Mouthpiece; State with reason advantage of Mouthpiece. (ii) Define the term Cippoletti Notch; State its advantage giving reason.	**1+1**
5B.	The flow in a rectangular channel of flow area 0.27 m^2 is measured using a 40 cm long **suppressed** rectangular notch. If the depth of water on its U/S is 22.5 cm above the sill, find the discharge. If the same discharge is to be measured with a 90^0 V-notch, find its required depth and top width. Take C_d = 0.62 and consider velocity of approach for both the notches.	**04**
5C.	A 3m × 4m tank has a 15 cm diameter opening (C_d = 0.6) provided at its bottom, A constant discharge of 90 lps is supplied into the tank with its orifice open. Find: (i) the time required to reduce the depth of water in the tank from 5 m to 2 m; (ii) Volume of water flowing out of the tank in that time.	**04**

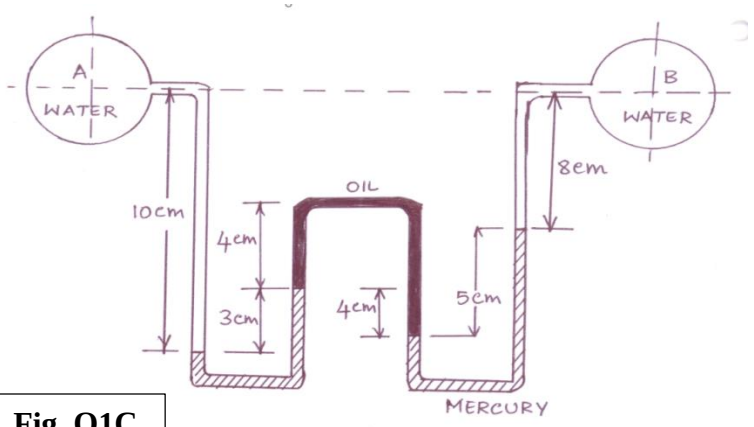

Fig. Q1C

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