Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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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

(23/11/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	State: (i) Pascal's Law of fluid pressure; (ii) Newton's Law of Viscosity.	**02**
1B.	Derive the expression for Total Pressure and Center of Pressure on a vertical plane lamina immersed in a static liquid.	**04**
1C.	A piston, 12 cm in diameter, 15 cm long, is moving concentrically inside a 12.05 cm diameter cylinder placed horizontally. The space between the cylinder and the piston is filled with oil of specific weigh 7.85 kN/m^3, viscosity 1 stoke. Find maximum velocity attained by the piston when it is subjected to an axial force of 250N.	**04**
2A.	The velocity potential for a 2D potential flow is given by $\varphi = x(2y - 1)$, determine the velocity at the point P (4,5). Find also the value of stream function ψ at point P	**03**
2B.	In a vertical pipe conveying oil (0.8), two pressure gauges have been installed at A and B where the diameters are 16 cm and 18 cm respectively. A is 2 meters above B. The pressure gauge readings have shown that the pressure at B is greater than at A by 0.981 N/cm^2. Neglecting all losses, calculate the flow rate. If the gauges A and B are replaced by a U-tube mercury manometer, calculate its reading.	**03**
2C.	A 300 mm x 150 mm venturimeter inclined at 30 to the horizontal is installed in a 300mm diameter pipe conveying oil (0.8) upwards. The throat section of the meter being 1 metre from its entrance. Pressure gauges at entrance and throat show readings 150 kPa and 75 kPa respectively. If the coefficient of meter is 0.975, find the rate of flow of oil. If instead of the pressure gauges, the entrance and the throat sections of the meter are connected to a differential mercury, find the reading of the manometer.	**04**
3A.	Derive the expressions for velocity distribution in a laminar flow across the section of a circular pipe. Sketch the distribution and mark the points of maximum and average velocity. Also give the expression for the same.	**03**
3B.	Three pipes of diameters 400mm, 200mm, 300mm and lengths of 400m, 200m, 300m respectively are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16m. If co-efficient of friction for these pipes is same and equal to 0.02, determine the error in discharge computation if minor losses are neglected.	**03**

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3C.	Water is flowing at a rate of 300 lps in a pipe of length 2500 m and 500 mm Φ. At the end of the pipe, a valve is provided. Find the rise in pressure if the valve is closed in 2 seconds, Take C = 1400 m/sec; K for water = 1962 MN/m^2; thickness of the pipe = 10 mm; E= 196.2 GN/m^2 for pipe material. Also, calculate: (i) the circumferential and longitudinal stress developed in the pipe wall; (ii) the Strain energy stored in the pipe and in water.	**04**
4A.	Derive the conditions for a trapezoidal channel to be most economical with a sketch.	**03**
4B.	A rectangular channel of width 1.8m carries a discharge of 1.8 m3/sec at a depth of 0.20m. Calculate (i) specific energy (ii) specific force (iii) depth alternate to 0.20m and (iv)Froude's number at the two alternate depths.	**04**
4C.	The depth ratio of a hydraulic jump in a rectangular channel is 4. What is the Froude's number at the beginning of the jump? If the flow velocity at the beginning of the jump is 4m/sec, determine the energy dissipated due to the jump.	**03**
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 $0.27m^2$ is measured using a 40cm long s**uppressed** 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° 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 x 4m tank has a 15 cm diameter opening (C_d = 0.6) provided at its bottom, 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**

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