

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA  
School of Mechanical Engineering  
B. Tech. Minor Examination (Odd) 2019-20

Entry No:  /  /  /  /  /

Date: 28/09/2019

Total Number of Pages: [2]

Total Number of Questions: [4]

Course Title: Fluid Mechanics

Course Code: MEL-2231

Time Allowed: 1.5 Hours

Max Marks: [30]

Instructions / NOTE

- i. Attempt All Questions.
- ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
- iii. Assume an appropriate data / information, wherever necessary / missing.

Section - A

Q1. Answer the Following Questions:

- a) Define the concept of a continuum. [01] CO1
- c) Define buoyant force and how it is calculated. [01] CO1
- d) What is a no slip condition? What causes it? [01] CO1
- e) What is capillary effect? What is its cause? How it is effected by the contact angle? [01] CO1
- f) Define a gauge pressure and vacuum pressure. [01] CO1

Section - B

- Q2. a) Derive the coordinates of center of pressure ( $x_p, y_p$ ) for a submerged inclined plane circular plate having radius ' $r$ '. The plane surface is inclined at an angle of  $45^\circ$  to the horizontal. [05] CO2
- b) A U - tube differential manometer containing mercury is connected on one side to pipe A containing carbon tetrachloride (sp gr 2.6) under a pressure of 120 kPa, and on the other side to pipe B containing oil (sp gr 1.8 ) under a pressure of 250 kPa. The pipe A lies 2 m above pipe B and the mercury level in the limb communicating with pipe A lies 4 m below the pipe A. Determine the difference in the levels of mercury in the two limbs of the manometer. Take specific weight of water = 9.81 kN/m<sup>3</sup>. [05] CO2

- Q3. a) Discuss the stability of immersed and floating bodies. [05] CO2
- b) If  $u = ax$ ,  $v = ay$  and  $w = -2az$  are the velocity components for a fluid [05] CO2

flow, check whether they satisfy the continuity equation. If they do, is the flow rotational or irrotational? Also obtain equation of streamlines passing through the point (1, 1, 6).

- Q4. Derive the relation for the conservation of mass for a fluid flow. Find [05] CO3 out the x component of the velocity that satisfies the continuity equation in Cartesian coordinates for a two dimensional incompressible flow. If the y component of the velocity is given by  $xy$ .

### Course Outcomes

1. Understand the basic concepts of Fluid Mechanics.
2. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
3. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
4. To inculcate the importance of fluid flow measurement and its applications in industries.
5. Recognize the various types of fluid flow problems encountered in practice.

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1	5	53
CO2	2, 3	20	53
CO3	4	5	53
CO4	-	0	53
CO5	-	0	53

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA  
School of Mechanical Engineering  
B. Tech. Major Examination (Odd) 2019-20

Entry No: [ ]  
Date: 12/12/2019

Total Number of Pages: [1]  
Total Number of Questions: [5]

Course Title: Fluid Mechanics  
Course Code: MEL-2231

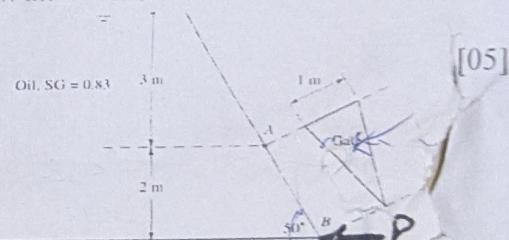
Time Allowed: 3.0 Hours Max Marks: [50]

Instructions / NOTE

- Attempt All Questions.
- Assume an appropriate data / information, wherever necessary / missing.

Q1. a) What is surface tension? What is its cause? Why the surface tension is also called as surface energy. A spherical water drop of 1 mm in diameter splits up in air in to 64 smaller drops of equal size. Find the work required in splitting up the drop. The surface tension coefficient of water in air = 0.073 N/m [05]

b) Isosceles triangle gate AB in Fig. shown below is hinged at A and weighs 1500 N. What horizontal force P is required at point B for equilibrium?



Q2. a) What is the Lagrangian description of fluid motion? Is the Lagrangian method of fluid flow analysis more similar to study of a system or a control volume? Discuss [05]

b) What is velocity potential? Give its significance. If, for a 2 D potential flow, the velocity potential is given by  $\phi = 4x(3y-4)$ , determine the velocity at point (2, 3). Determine also the value of stream function  $\Psi$  at point (2, 3). [05]

Q3. State and prove Bernoulli's equation. A venturimeter is fitted to a horizontal pipe of 0.15 m diameter with flow rate of  $240 \text{ m}^3/\text{hr}$ . The pressure head at the inlet for this flow is 18 m above atmospheric and the pressure head at the throat is 7 m below atmospheric. Between the inlet and the throat there is an estimated frictional loss of 10 % of the difference in pressure head between these points. Calculate the minimum allowable diameter for the throat [10]

Q4. a) What are orifices and mouthpieces? Prove that the discharge through an external cylindrical mouth piece is more than that of an orifice. [05]

b) What is Reynold's number? How it is used to differentiate between laminar and turbulent flows. What is the significance of hydraulic diameter? How is the friction coefficient dependent on Reynolds number? [05]

Q5. a) Discuss the effect of flow losses in pipes. Derive an expression to calculate the major losses in the flow through the pipes. [05]

b) What is the mechanism of flow separation? Discuss the head losses due to sudden contraction and sudden expansion for a pipe flow. [05]