

# Shri Mata Vaishno Devi University

Department of Mechanical Engineering

Minor 1

Examination (Sept. - 2017)

B.Tech

Subject: - Fluid Mechanics

Course Code: - MEL 2231

Time: - 1 Hr

Marks: - 20

Q1. Answer the following questions briefly.

- Define a continuum.
- What is a no slip condition? What causes it?
- What is capillary effect? What is its cause? How it is affected by the contact angle?
- Stability of rolling is of much more concern than in that of pitching. Justify.
- Define absolute viscosity. Give its units.

(5)

Q2.

- Discuss the stability of floating bodies.
- A 1.9-mm-diameter tube is inserted into an unknown liquid whose density is  $960 \text{ kg/m}^3$ , and it is observed that the liquid rises 5 mm in the tube, making a contact angle of  $15^\circ$ . Determine the surface tension of the liquid.

(3, 2)

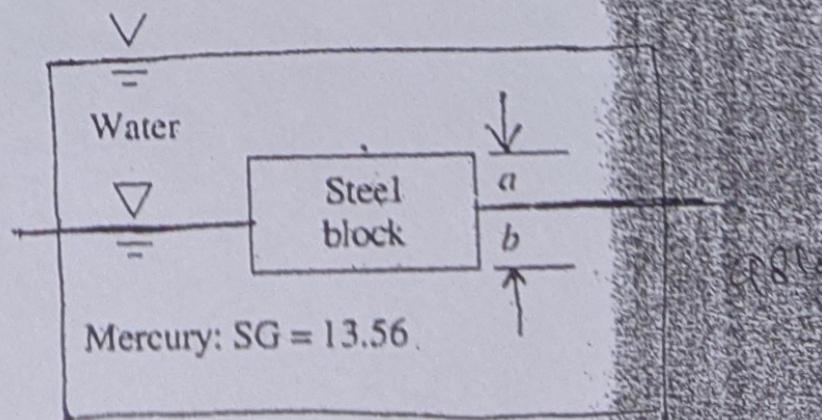
Q3. State and Prove Hydrostatic Law



(5)

Q4. A uniform block of steel (SG 7.85) will "float" at a mercury-water interface as in Fig. What is the ratio of the distances  $a$  and  $b$  for this condition?

(5)



**Shri Mata Vaishno Devi University**

Department of Mechanical Engineering

**Minor 2**

**Examination (Oct.- 2017)**

**B.Tech**

**Subject: - Fluid Mechanics**

**Course Code: - MEL 2231**

**Time: - 1 Hr**

**Marks:-20**

**Q1.** Answer the following questions briefly.

- What is Lagrangian description of fluid flow?
  - Give the significance of stream function?
  - Write the continuity equation in vector form and designate its each term?
  - Define Vorticity and give its significance.
  - What is the difference between running full and running free mouthpieces
- (5)

**Q2.** If  $u = ax$ ,  $v = ay$  and  $w = -2az$  are the velocity components for a fluid 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 (2,2,4).

(5)

**Q3.** State and prove Bernoulli's equation .

(5)

**Q4.** a) Water is flowing through a pipe of 2.5 cm diameter with a velocity of 0.5m/s. Compute the discharge in  $m^3/s$  and litres/s.  
b) Differentiate between notches and weirs .

(3,2)

**SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA**  
**Minor 1 (Odd Semester) – 2018-19**

Entry No:

17bme021

Total number of pages: [1]

Total number of questions: 4

**B.Tech. || MECHANICAL ENGG || Sem III**  
**Fluid Mechanics**  
**Subject Code: MEL-2231**

Time allowed: 1.5 Hrs

Max Marks: 20

**Important Instructions:**

- All questions are compulsory
- Assume any missing data

**PART A**

Q. 1. Short-Answer Questions:

- (a) What is a no slip condition? What causes it? [1 x 5=5]  
(b) Define surface tension and capillarity.  
(c) Stability of rolling is of much more concern than in that of pitching. Justify.  
(d) Distinguish between surface forces and body forces.  
(e) Give the implications of Archimedes principle.

**PART B**

Q. 2. State and prove Pascal's law. Discuss different types of pressures on a pressure scale. [5] ✓

Q. 3. A 50-cm x 30-cm x 20-cm block weighing 150 N is to be moved at a constant velocity of 1.8 m/s on an inclined surface with a friction coefficient of 0.3. (a) Determine the force F that needs to be applied in the horizontal direction. (b) If a 0.2-mm-thick oil film with a dynamic viscosity of 0.012 Pa - s is applied between the block and inclined surface, determine the percent reduction in the required force.  $\angle 30^\circ$

Q. 4. a) Consider a U-tube whose arms are open to the atmosphere. Now water is poured into the U-tube from one arm, and light oil ( $\rho = 790 \text{ kg/m}^3$ ) from the other. One arm contains 70-cm-high water, while the other arm contains both fluids with an oil-to-water height ratio of 6. Determine the height of each fluid in that arm. [3,2]  
b) Discuss the effect of metacentric height on the stability of floating bodies

**SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA**  
**Minor 2 (Odd Semester) – 2018-19**

Entry No:

1 7 b m e 0 2 1

Total number of pages:[1]

Total number of questions: 4

**B.Tech. || MECHANICAL ENGG || Sem III**  
**Fluid Mechanics**  
**Subject Code: MEL-2231**

Time allowed: 1.5 Hrs

Max Marks: 20

**Important Instructions:**

- All questions are compulsory
- Assume any missing data

**PART A**

Q. 1. Short-Answer Questions:

[1 x5=5]

- Differentiate between a running full and running free mouthpiece.
- What is Lagrangian description of fluid flow?
- What is positive and negative shear strain rate.
- Give the significance of stream function?
- Write the continuity equation in vector form and designate its each term?

**PART B**

Q. 2. Derive Euler's equation in Cartesian coordinates.

[5]

Q. 3. A steady, incompressible, two-dimensional velocity field is given by [5]  
 $V = (0.5 + 0.8x)i + (1.5 - 0.8y)j$

where the x and y coordinates are in meters and the magnitude of velocity is in m/s. Calculate the various kinematic properties, namely, the rate of translation, rate of rotation, linear strain rate, shear strain rate, and volumetric strain rate.

Q. 4. a) Give the statement of Bernoulli's equation. What assumptions are made in [3,2] deriving Bernoulli's equation?  
c) Differentiate between notches and weirs.

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

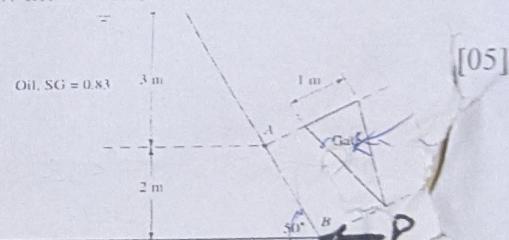
Time Allowed: 3.0 Hours Max Marks: [50]

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]