

Enrolment No./Seat No _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-IV (NEW) EXAMINATION – WINTER 2024

Subject Code:2141906

Date:22-11-2024

Subject Name:Fluid Mechanics

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

	Marks
Q.1 (a) What is the difference between fluid statics, kinematics and dynamics?	03
(b) Define following terms: a) Surface tension b) Vapour pressure c) Compressibility d) Viscosity	04
(c) State and derive Pascal's law with usual notations. States its applications.	07
Q.2 (a) What is water hammer and what are its effects?	03
(b) A body of dimensions 2m x 2m x 1m, weights 1970 N in water. Find its weight in air. Find its mass.	04
(c) Derive equation of total pressure and center of pressure for vertical submerged body.	07
OR	
(c) The velocity vector in a fluid flow is given $V = 4x^3 i - 10x^2y j + 2t k$. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time $t = 1$.	07
Q.3 (a) Classify different fluid flows.	03
(b) Define followings: (1) Mach Number (2) Stagnation Pressure (3) Stagnation Temperature (4) Zone of action.	04
(c) A horizontal Venturimeter 20 cm x 10 cm is used to measure the flow rate of oil having specific gravity 0.9. The discharge through the venturi meter is 3600 liters / minute. Find the reading of oil – mercury differential manometer. Take $C_d = 0.98$.	07

OR

- Q.3** (a) Define path line, stream line and streak line. **03**
(b) List out minor losses for flow through pipe and explain any one in detail. **04**
(c) A crude oil of viscosity 0.1Ns/m^2 and relative density 0.9 is flowing through a horizontal circular pipe of diameter 60 mm and length 200 m. calculate the difference of pressure at the two ends of the pipe if flow rate through the pipe is 4 liters/s. **07**

- Q.4** (a) Define following non dimensional numbers: **03**
a) Reynold's Number
b) Weber's Number
c) Froude's Number
(b) Explain the following terms **04**
a) Hydraulic grade line
b) Total Energy Line
(c) Derive Darcy-Weisbach equation for head loss due to friction in pipe flow. **07**

OR

- Q.4** (a) Explain the phenomenon of water hammer. **03**
(b) An aeroplane is flying at an height of 15 km where the temperature is -50°C . Speed of the plane is corresponding to $M = 2$. Assuming $k = 1.4$ and $R = 287 \text{ J/kg K}$, find the speed of the plane. **04**
(c) For viscous flow through pipe, derive equation of velocity distribution and prove that ratio of maximum velocity to average velocity for this flow is 2. **07**

- Q.5** (a) What are repeating variables? How are they selected for dimensional analysis? **03**
(b) Explain Reynold's experiment with neat sketch. **04**
(c) The resistance force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l , velocity V , air viscosity μ , air density ρ and bulk modulus of air k . explain the functional relationship between the variables and the resisting force. **07**

OR

- Q.5** (a) Explain the construction and working of a Venturimeter. **03**
(b) Distinguish between free vortex flow and forced vortex flow. **04**
(c) Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions. Also get Bernoulli's equation from it. **07**
