Sub Code: R2321014 **R23** **Set No. 1**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY- GURAJADA VIZIANAGARAM**
**II B. Tech I Semester Regular Examinations, November – 2024**
**FLUID MECHANICS**
**(CIVIL ENGINEERING)**

**Time: 3 hours** **Max. Marks: 70**

***Question paper consists of Part A, Part B.***
***Part A is compulsory, Answer all questions.***
***In Part B, Answer any one question from each unit.***
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**PART-A** **(20 Marks)**

| | | | |
|---|---|---|---|
| 1 | a) | State the Newton's law of viscosity and give examples of its applications. | [2] |
| | b) | What is vapour pressure? State its importance in pipe flow. | [2] |
| | c) | State the relation between atmospheric pressure, gauge pressure and absolute pressure. | [2] |
| | d) | Find the depth of a point below water surface where pressure intensity is 1.2 Mpa. | [2] |
| | e) | Define the Stream function. | [2] |
| | f) | Define the Uniform and Non uniform flow | [2] |
| | g) | What is Pitot tube? Write its two applications? | [2] |
| | h) | What is momentum principle? State applications. | [2] |
| | i) | Define equivalent pipe. | [2] |
| | j) | Define hydraulic gradient line. | [2] |

**PART-B** **(50 Marks)**

**Unit-1**

| | | | |
|---|---|---|---|
| 2 | a) | Name all the properties of fluids and explain any three of them. | [5] |
| | b) | A volume of 3.2 $m^3$ of certain oil weighs 27.5kN. Calculate its mass density, weight density, specific volume and specific gravity. If kinematic viscosity of the oil is $7x10^{-3}$ stokes, what would be its dynamic viscosity in centipoises? | [5] |
| | | (OR) | |
| 3 | a) | Explain the phenomenon of capillarity. Obtain the expression for capillary rise of liquid. | [5] |
| | b) | An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100mm. The thickness of oil film is 1.0 mm. | [5] |

**Unit-2**

| | | | |
|---|---|---|---|
| 4 | a) | Explain various types of manometers with neat sketches | [5] |
| | b) | A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of Specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15 cm below. | [5] |
| | | (OR) | |
| 5 | a) | Explain briefly the following types of equilibrium of floating bodies: (i) Stable equilibrium, (ii) Unstable equilibrium, and (iii) Neutral equilibrium | [5] |
| | b) | A triangular plate of 1 metre base and 1.5 metre altitude is immersed in water. The plane of the plate is inclined at 30° with free water surface and the base is parallel to and at a depth of 2 metres from water surface. Find the total pressure on the plate and the position of centre of pressure. | [5] |

**Unit-3**

6 a) Explain the terms streak line, Path line, stream line, stream tube, [5]

b) In three-dimensional incompressible third flow, the velocity components in x and y-directions are: $u=x^2+y^2z^3$; $v = -(xy + yz + zx)$ [5]
Use continuity equation to evaluate an expression for the velocity component w in the z-direction.

(OR)

7 a) Define the following types of flow: (i) Steady and unsteady flow [5]
(ii) Laminar and turbulent flow (iii) Compressible and Incompressible flow

b) The velocity potential function for a two-dimensional flow is $\Phi = x( 2y - 1)$. At a point P (4, 5) determine: [5]
(i) The velocity, and
(ii) The value of stream function

**Unit-4**

8 a) Derive Euler's equation of motion along a stream line. Obtain Bernoulli's equation from Euler's equation. [5]

b) A pipe of 30 cm diameter inclined $30^0$ to the horizontal is carrying gasoline (specific gravity = 0.82). A venturimeter is fitted in the pipe to find out the flow rate whose throat diameter is 15 cm. The throat is 1.2 m from the entrance along its length. The pressure gauges fitted to the venturimeter read 140 $kN/m^2$ and 80 $kN/m^2$ respectively. Find out the coefficient of discharge of venturimeter if the flow is 0.20 $m^3/s$. [5]

(OR)

9 a) Define the following terms i) Reynolds number ii) Froude's number iii) Euler's number iv) Mach number v) Weber Number. [5]

b) The water is flowing through a tapering pipe having diameters 300 mm and 150 mm at a sections1 and 2 respectively. The discharge through the pipe is 40 litres/sec. The section 1 is 10 m above datum and section 2 is 6 m above datum. Find the intensity of pressure at section 2 if that at section 1 is 400 $kN/m^2$ [5]

**Unit-5**

10 a) Explain the Pipes in series and pipes in parallel. [5]

b) Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of a pipe 500 m apart is 4 m of water. Take the value of co-efficient of friction, f=0.009. [5]

(OR)

11 a) What are the various minor Losses in flow through pipes? Give the equation For each case. [5]

b) A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m, 750 m and 600 m and diameters 750 mm, 600 mm and 450 mm respectively. [5]
(i) Transform the system to an equivalent 450 mm diameter pipe, and
(ii) Determine an equivalent diameter for the pipe, 2550 m long.

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