2023-XE

EE24BTECH11020 - Ellanti Rohith

General Aptitude (GA)

1) The second smallest eigenvalue of the eigenvalue problem

$$\frac{d^2y}{dx^2} + (\lambda - 3)y = 0, \quad y(0) = y(\pi) = 0,$$

is [GATE 2023]

a) 4 b) 3 c) 7 d) 9

2) Which one of the following functions is differentiable at $z = 0$ but **NOT** differentiable at any other point in the complex plane $\mathbb{C}$? [GATE 2023]

a) $f(z) = z|z|, \quad z \in \mathbb{C}$

b) $f(z) = \begin{cases} \frac{1}{e^z}, & z \neq 0 \\ 0, & z = 0 \end{cases}, \quad z \in \mathbb{C}$

c) $f(z) = \sin(z), \quad z \in \mathbb{C}$

d) $f(z) = e^{-z^2}, \quad z \in \mathbb{C}$

3) If the polynomial

$$P(x) = a_0 + a_1x + a_2x(x-1) + a_3x(x-1)(x-2)$$

interpolates the points $(0, 2)$, $(1, 3)$, $(2, 2)$, and $(3, 5)$, then the value of $P\left(\frac{5}{2}\right)$ is _____ (round off to 2 decimal places). [GATE 2023]

4) The value of m for which the vector field

$$\mathbf{F}(x, y) = (4x^my^2 - 2xy^m)\hat{i} + (2x^4y - 3x^2y^2)\hat{j}$$

is a conservative vector field, is _____ (in integer). [GATE 2023]

5) Let

$$P = \begin{pmatrix} 4 & -2 & 2 \\ 6 & -3 & 4 \\ 3 & -2 & 3 \end{pmatrix} \quad \text{and} \quad Q = \begin{pmatrix} 3 & -2 & 2 \\ 4 & -4 & 6 \\ 2 & -3 & 5 \end{pmatrix}.$$

The eigenvalues of both P and Q are 1, 1, and 2. Which one of the following statements is TRUE? [GATE 2023]

a) Both P and Q are diagonalizable
b) P is diagonalizable but Q is NOT diagonalizable
c) P is NOT diagonalizable but Q is diagonalizable
d) Both P and Q are NOT diagonalizable

6) The surface area of the portion of the paraboloid

$$z = x^2 + y^2$$

that lies between the planes $z = 0$ and $z = \frac{1}{4}$ is [GATE 2023]

a) $\frac{\pi}{6}(2\sqrt{2}-1)$ b) $\frac{\pi}{2}(2\sqrt{2}-1)$ c) $\pi(2\sqrt{2}-1)$ d) $\frac{\pi}{3}(2\sqrt{2}-1)$

7) The probability of a person telling the truth is $\frac{4}{6}$. An unbiased die is thrown by the same person twice and the person reports that the numbers appeared in both the throws are the same. Then the probability that actually the numbers appeared in both the throws are same is _____ (round off to 2 decimal places). [GATE 2023]

8) Let $u(x,t)$ be the solution of the initial boundary value problem

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \quad x \in (0,2),\ t > 0$$

$$u(x,0) = \sin(\pi x), \quad x \in (0,2)$$

$$u(0,t) = u(2,t) = 0.$$

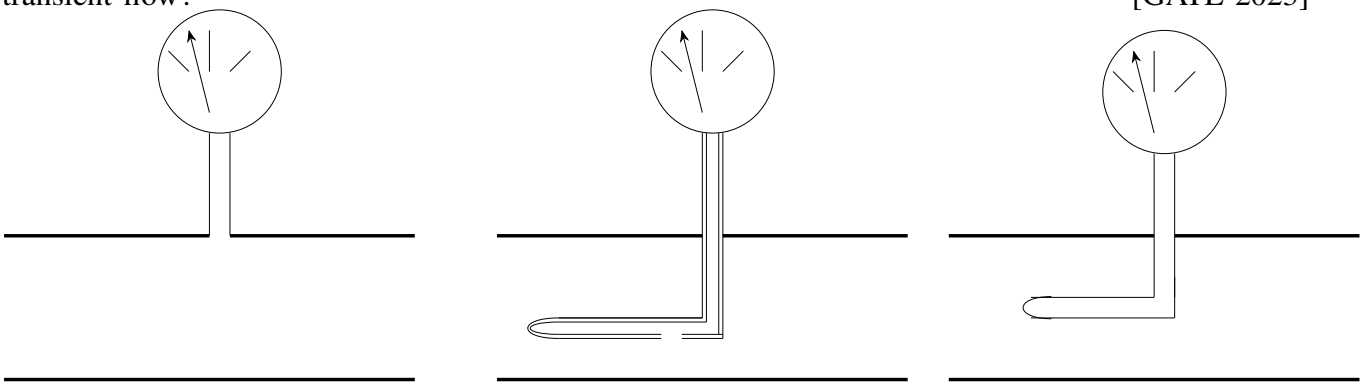
Then the value of $e^{\pi^2}\left(u\left(\frac{1}{2},1\right) - u\left(\frac{3}{2},1\right)\right)$ is _____ (in integer). [GATE 2023]

9) Match the following measuring instruments with the appropriate figures. [GATE 2023]

I. Pitot probe
II. Pitot-static probe
III. Piezometer

a) I – P; II – Q; III – R
b) I – R; II – Q; III – P
c) I – R; II – P; III – Q
d) I – Q; II – P; III – R

10) Among the following non-dimensional numbers, which one characterizes periodicity present in a transient flow? [GATE 2023]

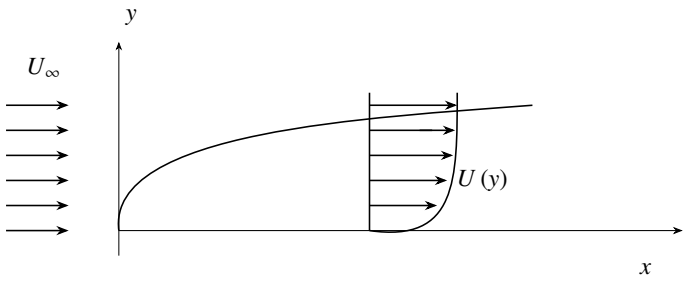


(P) (Q) (R)

a) Froude number
b) Strouhal number
c) Peclet number
d) Lewis number

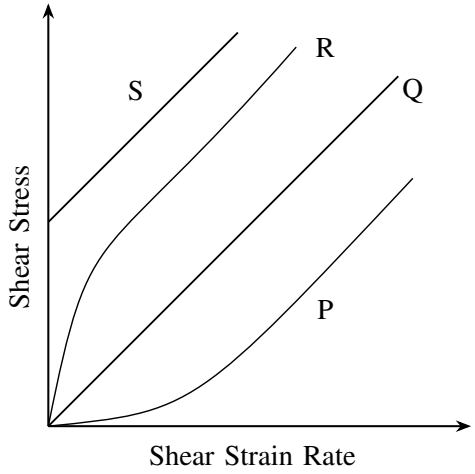
11) For an incompressible boundary layer flow over a flat plate shown in the figure, the momentum thickness is expressed as [GATE 2023]

a) $\int_0^\infty \frac{u}{U_\infty}\,dy$
b) $\int_0^\infty \left(1 - \frac{u}{U_\infty}\right)dy$
c) $\int_0^\infty \frac{u}{U_\infty}\left(1 - \frac{u}{U_\infty}\right)dy$
d) $\int_0^\infty \left(1 - \frac{u^2}{U_\infty^2}\right)dy$



(Fluid Mechanics)

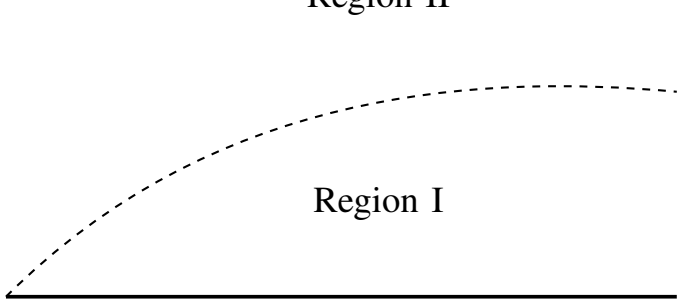
12) Among the shear stress versus shear strain rate curves shown in the figure, which one corresponds to a shear thinning fluid?



[GATE 2023]

a) *P*
b) *Q*
c) *R*
d) *S*

13) Consider steady incompressible flow over a flat plate, where the dashed line represents the edge of the boundary layer, as shown in the figure. Which one among the following statements is true?[GATE 2023]



a) Bernoulli's equation can be applied in Region I between any two arbitrary points.
b) Bernoulli's equation can be applied in Region I only along a streamline.
c) Bernoulli's equation cannot be applied in Region II.
d) Bernoulli's equation cannot be applied in Region I.