

ASSIGNMENT-3

GATE XE-2014

EE24BTECH11019 - DWARAK A

A : ENGINEERING MATHEMATICS

Q.1 to Q.7 carry one mark each.

- 1) Ten chocolates are distributed randomly among three children standing in a row. The probability that the first child receives exactly three chocolates is

- a) $\frac{5 \times 2^{11}}{3^9}$
- b) $\frac{5 \times 2^{10}}{3^9}$
- c) $\frac{1}{3^9}$
- d) $\frac{1}{3}$

- 2) Let the function $f : [5, 0] \rightarrow \mathbb{R}$ be defined by

$$f(x) = \begin{cases} 2x + 5, & 0 \leq x < 1 \\ 2x^2 + 5, & 1 \leq x < 2 \\ \frac{2}{3}x^3 + \frac{23}{3}, & 2 \leq x \leq 5 \end{cases}$$

The number of points where f is not differentiable in $(0, 5)$, is _____.

- 3) An integrating factor of the differential equation $(3x^2y^3e^y + y^3 + y^2)dx + (x^3y^3e^y - xy)dy = 0$ is

- a) $\frac{1}{y}$
- b) $\frac{1}{y^2}$
- c) $\frac{1}{y^3}$
- d) $\ln y$

- 4) If a cubic polynomial passes through the points $(0, 1)$, $(1, 0)$, $(2, 1)$ and $(3, 10)$, then it also passes through the point

- a) $(-2, -11)$
- b) $(-1, -2)$
- c) $(-1, -4)$
- d) $(-2, -23)$

Q.8 to Q.11 carry two marks each.

- 5) Let the function $f : [0, \infty) \rightarrow \mathbb{R}$ be such that $f'(x) = \frac{8}{x^2 + 3x + 4}$ for $x > 0$ and $f(0) = 1$. Then $f(1)$ lies in the interval

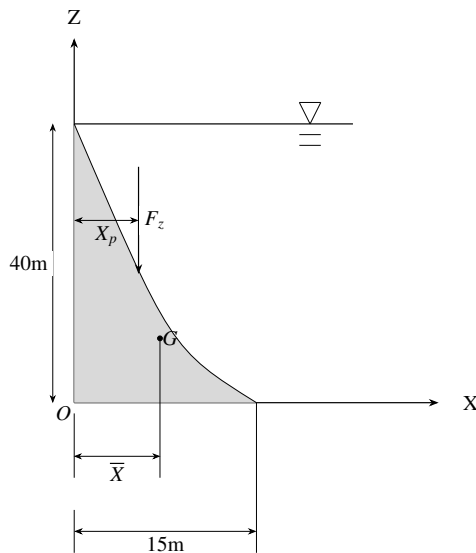
- a) $[0, 1]$
- b) $[2, 3]$
- c) $[4, 5]$
- d) $[6, 7]$

- 6) The perimeter of a rectangle having the largest area that can be inscribed in the ellipse $\frac{x^2}{8} + \frac{y^2}{32} = 1$, is _____.
- 7) If the work done in moving a particle once around a circle $x^2 + y^2 = 4$ under the force field $\mathbf{F}(x, y) = (2x - ay)\hat{i} + (2y + ax)\hat{j}$ is 16π , then $|a|$ is equal to _____.
- 8) Let r and s be real numbers. If $A = \begin{pmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ r & s & 0 \end{pmatrix}$ and $b = \begin{pmatrix} 1 \\ 1 \\ s - 1 \end{pmatrix}$, then the system of linear equations $AX = b$ has
- a) no solutions for $s \neq 2r$.
 - b) infinitely many solutions for $s = 2r \neq 2$.
 - c) a unique solution for $s = 2r = 2$.
 - d) infinitely many solutions for $s = 2r = 2$.

B : FLUID MECHANICS

Q.1 to Q.9 carry one mark each.

- 9) A dam with a curved shape is shown in the figure. The cross sectional area of the dam (shaded portion) is 100m^2 and its centroid is at $\bar{x} = 10\text{m}$. The vertical component of the hydrostatic force, F_z , is acting at a distance x_p . The value of x_p is _____m.



- 10) For an unsteady incompressible fluid flow, the velocity field is $\mathbf{V} = (3x^2 + 3)t\hat{i} - 6xyt\hat{j}$, where x, y are in meters and t is in seconds. Acceleration in m/s^2 at the point $x = 10\text{m}$ and $y = 0$, as measured by a stationary observer is

- a) 303
- b) 162
- c) 43
- d) 13

11) For an incompressible flow, the existence of components of acceleration for different types of flow is described in the table below.

Type of Flow	Components of Acceleration
P: Steady and uniform	1: Local exists, convective does not exist
Q: Steady and non-uniform	2: Both exist
R: Unsteady and uniform	3: Both do not exist
S: Unsteady and non-uniform	4: Local does not exist, convective exists

Which one of the following options connecting the left column with the right column is correct?

- a) P-1; Q-4; R-3; S-2
- b) P-4; Q-1; R-2; S-3
- c) P-3; Q-2; R-1; S-4
- d) P-3; Q-4; R-1; S-2

12) Velocity in a two-dimensional flow field is specified as $u = x^2y$; $v = -y^2x$. The magnitude of the rate of angular deformation at a location ($x = 2m$ and $y = 1m$) is _____ s^{-1} .

13) For a plane irrotational flow, equi-potential lines and streamlines are

- a) parallel to each other.
- b) at an angle of 90° to each other.
- c) at an angle of 45° to each other.
- d) at an angle of 60° to each other.