DipIETE – ET/CS (NEW SCHEME)   –   Code: DE51 / DC51

Subject: ENGINEERING MATHEMATICS - I

Time: 3 Hours   DECEMBER 2009   **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1   Choose the correct or the best alternative in the following: (2×10)

a. $\lim\limits_{x \to 0} \dfrac{\sqrt{1 - \cos x}}{x}$ is

    (A) 1   **(B)** -1
    (C) ± 1 **(D)** does not exist

b. $\dfrac{d}{dx}\left(\sqrt{2x + 3}\right)$ is equal to

    (A) $\dfrac{1}{2\sqrt{2x + 3}}$ **(B)** $\left(\sqrt{2x + 3}\right)$

    (C) $\dfrac{1}{\sqrt{2x + 3}}$ **(D)** None of these

c. $\int e^{mx} \, dx$ is equal to

    (A) $m e^{x}$ **(B)** e^{mx}

    (C) $\dfrac{e^{mx}}{m}$ **(D)** $\dfrac{e^{mx}}{-m}$

d. If $A = \begin{bmatrix} 1 & 2 \\ 0 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 5 & 4 \\ -7 & 2 \end{bmatrix}$, then 2A+3B is equal to

    (A) $\begin{bmatrix} 17 & 16 \\ -21 & 0 \end{bmatrix}$ **(B)** $\begin{bmatrix} 17 & 0 \\ 0 & -21 \end{bmatrix}$

    (C) $\begin{bmatrix} 16 & 17 \\ 0 & -21 \end{bmatrix}$ **(D)** $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$

e. The value of $\begin{vmatrix} \sin x & -\cos x \\ \cos x & \sin x \end{vmatrix}$ is

    (A) 0   **(B)** 1
    (C) -1   **(D)** 2

f. The order of differential equation $\left(\dfrac{dy}{dx}\right)^2 - 4x = \dfrac{d^2y}{dx^2}$ is

(A) 2   (B) 1
(C) 0   (D) none of these

g. The value of $^{10}C_5$ is

(A) 522   (B) 225
(C) 252   (D) None of these

h. The value of tan $105°$ is equal to

(A) $1 - \sqrt{3}$ (B) $1 + \sqrt{3}$

(C) $\dfrac{1 - \sqrt{3}}{1 + \sqrt{3}}$ (D) $\dfrac{1 + \sqrt{3}}{1 - \sqrt{3}}$

i. The point (-3, 4) lie in the quadrant

(A) Ist   (B) IInd
                                                     (C) IIIrd   (D) IVth

j. The eccentricity of the ellipse $3x^2 + 4y^2 = 1$ is

(A) $-\dfrac{1}{2}$ (B) 2

(C) $\dfrac{1}{2}$ (D) None of these

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Find $\dfrac{dy}{dx}$, when $x = \dfrac{3at}{1+t^2}, y = \dfrac{3at^2}{1+t^2}$.   **(8)**

b. For what value of x does sin x (1 + cos x) become maximum? Find the maximum values.   **(8)**

Q.3 a. Evaluate $\displaystyle\int \dfrac{e^{m\sin^{-1}x}}{\sqrt{1-x^2}}dx$ **(8)**

b. Evaluate $\displaystyle\int x\tan^{-1}x \, dx$ **(8)**

Q.4 a. Solve the following equation by Cramer's Rule
$x + y + 2z = 4$
$2x - y + 3z = 9$
$3x - y - z = 2$ **(8)**

b. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, show that $A^2 - 4A - 5I = 0$ where I is a unit matrix of order 3.   **(8)**

Q.5   a.   Solve the differential equation

$$(y + xy)dx + (x - xy^2)dy = 0$$ **(8)**

b.   Solve the differential equation

$$\frac{dy}{dx} + \frac{1}{x}y = x^2$$ **(8)**

Q.6   a.   Find the 5th term in the expansion of $\left(\dfrac{4x}{5} - \dfrac{5}{2x}\right)^8$ **(8)**

b.   Find three numbers in A.P. whose sum is -3 and product is 8.   **(8)**

Q.7   a.   Show that $\dfrac{\tan(90° + \theta)\sin(180° + \theta)\sec(270° + \theta)}{\cos(270° - \theta)\cosec(180° - \theta)\cot(360° - \theta)} = 1$ **(8)**

b.   Prove that $\sin 10° \sin 50° \sin 60° \sin 70° = \dfrac{\sqrt{3}}{16}$ **(8)**

Q.8   a.   Find the area of a triangle whose vertices are (4,4), (3,-2) and (-3, 16)   **(8)**

b.   Find the angle between two straight lines

$y = \sqrt{3}x + 1$ and $x - \sqrt{3}y + 2 = 0$ **(8)**

Q.9   a.   Find the equation of parabola with focus(3, -4) and equation of directrix is   6x-7y+5=0   **(8)**

b.   Find the co-ordinate of the centre and radius of the circle

$$4(x^2 + y^2) + 12ax - 6ay - a^2 = 0$$.   **(8)**