Code: DE51/DC51   Subject: **ENGINEERING MATHEMATICS - I**

DipIETE – ET/CS

Time: 3 Hours   **DECEMBER 2014**   **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **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. The value of $\lim_{x \to 0} \dfrac{x^2 \sin 1/x}{\sin x}$ is :

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

b. In what ratio is the line joining the points A(4, 4) and B(7, 7) divided by P (-1, 1).

    (A) (7 : 1)   **(B)** (2 : 3)
    (C) (5 : 3)   **(D)** (5 : 8)

c. $\int \left(\dfrac{1}{\cos^2 x} + \dfrac{\cot x}{\sin x} \right) dx$ is :

    (A) cot x + sec x
    (B) tan x – cosec x
    (C) tan x + cosec x
    (D) cot x – sec x

d. If $\Delta = \begin{vmatrix} 2x-1 & x+7 & x+4 \\ x & 6 & 2 \\ x-1 & x+1 & 3 \end{vmatrix}$, then the value of Δ in the respect of x is equal to,

    (A) 2, 3, 5
    (B) 1, 3, 4
    (C) 1, 2, 3
    (D) 1, 2, 4

e. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & -1 & 5 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 & -6 \\ 0 & -1 & 3 \end{bmatrix}$, and 2A- 3B - X = 0 then the value of X

   is equal to

   (A) $\begin{bmatrix} 1 & 0 & 20 \\ 0 & 1 & 1 \end{bmatrix}$ **(B)** $\begin{bmatrix} 1 & 0 & -6 \\ 4 & 5 & 3 \end{bmatrix}$

   (C) $\begin{bmatrix} 20 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ **(D)** $\begin{bmatrix} 0 & 1 & 3 \\ 5 & 4 & -6 \end{bmatrix}$

f. The order and degree of differential equation of $y\dfrac{d^2x}{d^2y} = y^2 + 1$ is

   (A) O = 2, D = 1   **(B)** O = 0, D = 1
   (C) O = 1, D = 1   **(D)** O = 1, D = 2

g. The middle term in the expansion of $\left(x - \dfrac{1}{x} \right)^{10}$ is

   (A) 225   **(B)** 252
   (C) -252   **(D)** -225

h. If $\tan A = \dfrac{1}{2}$, $\tan B = \dfrac{1}{3}$, then the value of tan (2A +B) is equal to

   (A) 2   **(B)** 3
   (C) -3   **(D)** -2

i. Change of the polar equation of $\theta = \dfrac{\pi}{4}$ into Cartesian equation is

   (A) y = 2x   **(B)** x = 4y
   (C) x = 2y   **(D)** y = x

j. If $y = \sin x^{10}$, then $\dfrac{dy}{dx}$ is

   (A) $10 \sin x \cdot x^9$ **(B)** $10 \cos x \sin x$
   (C) $10 \cos x^{10} \cdot x^9$ **(D)** $10 \sin x^{10} \cdot \cos x$

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

Q.2   a.   If $x^y = e^{x-y}$, show that $\dfrac{dy}{dx} = \dfrac{\log x}{(1 + \log x)^2}$ **(8)**

         b.   Find the point on the curve y = 7x – 3x^2 where the inclination of the tangent
              with x – axis is of $45°$, Also find the equation of the normal to the given curve
              at that point.   **(8)**

Q.3 a. Evaluate $\int \dfrac{1+\sin x}{\sin x(1+\cos x)} dx$ **(8)**

   b. Evaluate $\displaystyle\int_0^{\pi/2} \log \tan x\, dx$ **(8)**

Q.4 a. Prove that, $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$.   **(8)**

   b. Apply Cramer's rule to solve the following system of linear equations:
      3x – 2y + 4z = 5
      x + y + 3z = 2
      -x + 2y – z = 1   **(8)**

Q.5 a. Solve $\cos(x+y)dy = dx$ **(8)**

   b. Solve $\dfrac{d^2 y}{dx^2} + \dfrac{dy}{dx} + y = \cos 2x$ **(8)**

Q.6 a. Prove that, $\cos 2A \cdot \cos 2B + \sin^2(A-B) - \sin^2(A+B) = \cos(2A+2B)$ **(8)**

   b. If $A + B + C = \pi/2$, then prove that
      $\sin 2A + \sin 2B + \sin 2C = 4\cos A \cdot \cos B \cdot \cos C$ **(8)**

Q.7 a. Find the term independent of x in the expansion of $\left(x^2 + \dfrac{1}{x}\right)^9$.   **(8)**

   b. In a G. P. the first term is 7, the last term is 448 and the sum is 889. Find the common ratio and the series.   **(8)**

Q.8 a. Show that the lines x – y = 6, 4x – 3y = 20 and 6x + 5y = -8 are concurrent. Also find their point of intersection.   **(8)**

   b. Find the equation of the straight lines through the point (2, -1) and making an angle of 45° with the line 6x + 5y – 1 = 0   **(8)**

Q.9 a. Find the equation of the circle which passes through the points (3, -2), (-2, 0) and having its centre on the line 2x – y = 3.   **(8)**

   b. Find the equation of the parabola with focus (3, -4) be the directrix 6x – 7y + 5 = 0   **(8)**