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

Subject: ENGINEERING MATHEMATICS - I

Time: 3 Hours **JUNE 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. $\lim_{x \to 2} \frac{x^2 - 5x + 6}{x^2 - 4}$ is:

(A) $\frac{1}{4}$ **(B)** $\frac{-1}{4}$

(C) $\frac{1}{3}$ **(D)** $\frac{-1}{3}$

b. If $y = x^2 - \cos x - \frac{1}{x^2}$, then $\frac{dy}{dx}$ is:

(A) $x - \cos x + \frac{2}{x^3}$ **(B)** $2x - \sin x + \frac{2}{x^3}$

(C) $2x + \sin x - \frac{2}{x^3}$ **(D)** $2x + \sin x + \frac{2}{x^3}$

c. $\int \sin^{-1}(\cos x)\,dx$ is:

(A) $\frac{\Pi x}{2} + \frac{x^2}{2} + C$ **(B)** $x + \frac{x^2}{2} + C$

(C) $\frac{\Pi x}{2} - \frac{x^2}{2} + C$ **(D)** $\frac{\Pi x}{2} + C$

d. If $\Delta = \begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix}$, then value of Δ is:

(A) 0 **(B)** 1

(C) - 1 **(D)** 2

e. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 & 3 \\ -1 & 0 & 2 \end{bmatrix}$, then 2A – B is:

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

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

f. The order and degree of differential equation $\frac{d^2y}{dx^2} = 1 + \sqrt{\frac{dy}{dx}}$ is:

(A) O=1, D=2 **(B)** O=2, D=2
(C) O=2, D=1 **(D)** O=3, D=1

g. The sixth term from the end in the expansion of $(2x^2 - \frac{1}{x})^{12}$ is:

(A) 26344 x^3 **(B)** 25344 x^3
(C) – 25344 x^3 **(D)** – 26344 x^3

h. The value of $\sin 10^\circ \sin 50^\circ \sin 70^\circ$ is:

(A) $\frac{1}{8}$ **(B)** $\frac{-1}{8}$
(C) $\frac{3}{8}$ **(D)** $\frac{-3}{8}$

i. The area of a triangle whose vertices are (3,5), (5,3), (7,7) is

(A)12 sq units. **(B)** 18 sq units.
(C) 6 sq units. **(D)** 4 sq units.

j. The slope of a line which is perpendicular to the line 4x+9y-3=0 is:

(A) $\frac{-9}{4}$ **(B)** $\frac{4}{9}$
(C) $\frac{-4}{9}$ **(D)** $\frac{9}{4}$

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

Q.2 a. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, prove that $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$ **(8)**

b. Find all the points of maxima and minima also the corresponding maximum and minimum values of the function:
$f(x) = 2x^3 - 21x^2 + 36x - 20$ **(8)**

Q.3 a. Evaluate $\int x \cos^3 x \, dx$ **(8)**

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

Q.4 a. if $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, find A^{-1} and show that $A^{-1} = A^2$ **(8)**

b. Using Cramer's method solve the following system of linear equations for x,y,z:

$3x - y + z = 5$
$2x - 2y + 3z = 5$
$x + y - z = -1$ **(8)**

Q.5 a. Solve $2x^2 \frac{dy}{dx} = y(x+y)$ **(8)**

b. Solve $\frac{dy}{dx} + y.\sec x = \tan x$ **(8)**

Q.6 a. Find the term independent of x in the expansion of $(2x^2 - \frac{1}{x})^{12}$ **(8)**

b. The sum of three terms of a G.P is $\frac{13}{12}$ and their product is –1, find the G.P **(8)**

Q.7 a. Prove that $\frac{\sin\theta + \sin 2\theta + \sin 4\theta + \sin 5\theta}{\cos\theta + \cos 2\theta + \cos 4\theta + \cos 5\theta} = \tan 3\theta$ **(8)**

b. The sides of a triangle are x^2+x+1, $2x+1$ and x^2-1. Find the greatest angle. **(8)**

Q.8 a. If p be the length of perpendicular from the origin to the line whose intercepts on the axes are a & b respectively, then show that $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$ **(8)**

b. Find the equation of the straight line parallel to $2x+3y+11=0$ and which is such that sum of its intercepts on the axes is 15. **(8)**

Q.9 a. Find the equation of the circle passing through the points (2,-6), (6,4) and (-3,1). **(8)**

b. Show that $9x^2+4y^2-54x-56y+241=0$ represents an ellipse. Find its centre, vertices, foci, eccentricity, directrices, latus-rectum and equations of major and minor axes. **(8)**