ROLL NO. _____

Code: DE51/DC51 Subject: ENGINEERING MATHEMATICS - I

DipIETE – ET/CS

Time: 3 Hours **JUNE 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. $\lim_{x\to 0} \frac{e^{2x}-1}{x}$ is equal to

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

b. If $f(x) = x\cos x - \sin x$, then $f'(x)$ is equal to

(A) $x \sin x$ **(B)** $-x \sin x$
(C) $x \cos x$ **(D)** $-x \cos x$

c. $\int \sin^2 x.\cos^2 x \, dx$ is equal to

(A) $\frac{1}{8}\left(x - \frac{\sin 4x}{4}\right) + c$ **(B)** $\frac{1}{8}\left(x + \frac{\sin 4x}{4}\right) + c$

(C) $\frac{1}{8}\left(x - \frac{\cos 4x}{4}\right) + c$ **(D)** $\frac{1}{8}\left(x + \frac{\cos 4x}{4}\right) + c$

d. If $\begin{bmatrix} x & 2x & -3 \\ 5 & y & 2 \\ 1 & -1 & z \end{bmatrix}\begin{bmatrix} 3 & -1 & 2 \\ 4 & 2 & 5 \\ 2 & 0 & 3 \end{bmatrix} = \begin{bmatrix} 5 & 3 & 3 \\ 19 & -5 & 16 \\ 1 & -3 & 0 \end{bmatrix}$, then x, y, z is equal to

(A) x = 1, y = 1, z = 1 **(B)** x = 1, y = 2, z = 3
(C) x = -1, y = 2, z = -3 **(D)** x = 1, y = 0, z = 1

e. If $s = \begin{vmatrix} 2 & 3 & 4 \\ -4 & x & -8 \\ 5 & 6 & 7 \end{vmatrix} = 0$, then x is equal to

(A) 2 **(B)** -6
(C) 6 **(D)** -2

f. If 17^{th} and 18^{th} terms is the expansion of $(2+a)^{50}$ are equal then the value of a is equal to

(A) 1 **(B)** 2
(C) 3 **(D)** 4

g. The solution of the differential equation $\frac{dy}{dx} = xy^2 - xy$ is equal to

(A) $\ell og\frac{y-1}{y} = \frac{x^2}{2} + c$ **(B)** $\ell og\frac{y-1}{y} = x + 2 + c$

(C) $\ell og\frac{y+1}{y} = \frac{x^2}{2} + c$ **(D)** $\ell og\frac{y+1}{y} = x - 2 + c$

h. If $\frac{\cos 12^0 + \sin 12^0}{\cos 12^0 - \sin 12^0} = x$, Then x is equal to

(A) $\tan 45^0$ **(B)** $\tan 60^0$
(C) $\tan 90^0$ **(D)** $\tan 57^0$

i. The angle between the lines 2x + y + 4 = 0 and y -3x -7 = 0 is equal to

(A) $\frac{\pi}{2}$ **(B)** $\frac{\pi}{4}$

(C) $\frac{2\pi}{3}$ **(D)** $\frac{\pi}{3}$

j. If one end of the diameter of the circle $x^2 + y^2 + 4x + 6y - 12 = 0$ is (1, 1) then other end of the diameter is equal to

(A) (-5, -7) **(B)** (-2, -3)
(C) (-3, 5) **(D)** (2, 7)

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

Q.2 a. If $y = e^{ax}.\sin bx$, then prove that $y_2 - 2ay_1 + (a^2 + b^2)y = 0$ **(8)**

b. Find the equation of the tangent to the curve $y^2 = 3 - 5x$ parallel to the lines 5x – 4y + 13 = 0 **(8)**

Q.3 a. Evaluate $\int e^{2x}.\sin 3x dx$ **(8)**

b. Evaluate $\int_1^2 \frac{5x^2}{x^2 + 4x + 3} dx$ **(8)**

Q.4 a. Let $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 5 & 2 \\ 7 & 4 \end{bmatrix}, C = \begin{bmatrix} 2 & 5 \\ 3 & 8 \end{bmatrix}$ find a matrix D such that $CD - AB = 0$ **(8)**

b. Using Cramer's rule, solve the following system of liner equations,
$(a + b)x - (a - b)y = 4ab$
$(a - b)x + (a + b)y = 2(a^2 - b^2)$ **(8)**

Q.5 a. Solve the differential equation $(x + y)dy + (x - y)dx = 0$ given that $y = 1$ when $x = 1$ **(8)**

b. Solve the equation $\cos x(1 + \cos y)dx - \sin y(1 + \sin x)dy = 0$ **(8)**

Q.6 a. Prove that the coefficient of x^n is expansion of $\left(\frac{1+x}{1-x}\right)^2$ is 4n **(8)**

b. Let S_n denote the sum of the first n terms of an A.P. If $S_{2n} = 3S_n$, then prove that $\frac{S_{3n}}{S_n} = 6$ **(8)**

Q.7 a. If A, B, C are the angles of a triangle, then prove that,
$\sin 2A + \sin 2B + \sin 2C = 4 \sin A.\sin B.\sin C$ **(8)**

b. Prove that, $\cos 20^o.\cos 60^o.\cos 40^o.\cos 80^o = \frac{1}{16}$ **(8)**

Q.8 a. Find the equation of the two straight lines through (7, 9) and making an angle of 60^o with the line $x - \sqrt{3}y - 2\sqrt{3} = 0$ **(8)**

b. Find the area of the triangle formed by the lines $y = x$, $y = 2x$ and $y = 3x + 4$ **(8)**

Q.9 a. Find the equation of the circle passing through the point (1, -2) & (4, -3) and which has its centre on the strength line $3x + 4y = 7$ **(8)**

b. Find the focus, vertex, axis, latus-rectum and directrix of the parabola $x^2 + 4x + 2y = 0$ **(8)**