ROLL NO. _____

Code: DE101/DC101 **Subject: ENGINEERING MATHEMATICS-I**

DiPIETE – ET/CS *{NEW SCHEME}*

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. $\text{Lt}_{x\to 0}^{\text{Lt}} \dfrac{e^{2x}-1}{x}$ is equal to

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

b. If y = (x + 1) (x + 2), then $\dfrac{dy}{dx}$ is

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

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

(A) $\dfrac{1}{8}\left(x+\dfrac{\cos 4x}{4}\right)+C$ **(B)** $\dfrac{1}{8}\left(x-\dfrac{\cos 4x}{4}\right)+C$

(C) $\dfrac{1}{8}\left(x+\dfrac{\sin 4x}{4}\right)+C$ **(D)** $\dfrac{1}{8}\left(x-\dfrac{\sin 4x}{4}\right)+C$

d. If $3\begin{bmatrix} x & y \\ z & w \end{bmatrix}=\begin{bmatrix} x & 6 \\ -1 & zw \end{bmatrix}+\begin{bmatrix} 4 & x+y \\ z+w & 3 \end{bmatrix}$ then x, y, z and w is equal to

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

e. If $\Delta=\begin{bmatrix} x-2 & -3 \\ 3x & 2x \end{bmatrix}=3$, then the value of x is

(A) $\frac{1}{2}$, 3 **(B)** $\frac{1}{2}$, -3

(C) $-\frac{1}{2}$, 3 **(D)** $-\frac{1}{2}$, -3

f. $A = \cos\theta \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ and $B = \sin\theta \begin{bmatrix} \sin\theta & -\cos\theta \\ \cos\theta & \sin\theta \end{bmatrix}$ then A+B is equal to

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

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

g. The value of $2\cos\left(\frac{\pi}{13}\right).\cos\left(\frac{9\pi}{13}\right)+\cos\left(\frac{3\pi}{13}\right)+\cos\left(\frac{5\pi}{13}\right)$ is equal to

(A) ∞ **(B)** 1
(C) 0 **(D)** 2

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

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

i. If $\tan\alpha = \frac{a}{a+1}, \tan\beta = \frac{1}{2a+1}$, then (A+B) is equal to

(A) $\tan^{-1}\left(\frac{\pi}{4}\right)$ **(B)** $\tan^{-1}\left(\frac{\pi}{2}\right)$

(C) $\tan^{-1}\left(\frac{\pi}{3}\right)$ **(D)** $\tan^{-1}\pi$

j. The slop of the line joining between the pts. (1,2) and (4,5) is equal to

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

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

Q.2 a. Prove that $\cos A.\cos(60^o-A).\cos(60^o+A) = \frac{1}{4}\cos 3A$ and deduce that $\cos 20^o.\cos 40^o.\cos 80^o = \frac{1}{8}$ **(8)**

b. If A, B, C are the angle of a triangle, then prove that cosA + cosB + cosC = 1+ 4sinA/2. sinB/2 .sinC/2 **(8)**

Q.3 a. Find the co-efficient of x^{32} in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$. Also find co-efficient of x^{-17}. **(8)**

b. The sum of first three terms of a G.P. is 16 and the sum of the next three term is 128. Find the sum of the n^{th} term of GP. **(8)**

Q.4 a. Show that, $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} = \begin{bmatrix} 1 & -\tan\theta/2 \\ \tan\theta/2 & 1 \end{bmatrix}\begin{bmatrix} 1 & \tan\theta/2 \\ -\tan\theta/2 & 1 \end{bmatrix}^{-1}$ **(8)**

b. Find the matrix A satisfying the equation $\begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix} A \begin{bmatrix} 5 & 3 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ **(8)**

Q.5 a. For what values of K are the three lines 4x + 7y-9 = 0, 5x + ky + 15 = 0 and 9x - y + 6 = 0 are concurrent. **(8)**

b. Find the equation of the two lines passing through the point (1, -1) and inclined at an angle of 45^o with the line 2x -5y +7 = 0 **(8)**

Q.6 a. Find the equation of the circle which passes through the intersection of two circles, $x^2 + y^2$-8x – 24y +7 = 0, and $x^2 + y^2$ -4x + 10y + 8 = 0 and has it centre on the x-axis. **(8)**

b. Find the centre, length of the axes, eccentricity, directrices, foci and the length of the latus rectum of the hyperbola $9x^2 - 16y^2 = 144$ **(8)**

Q.7 a. If $y = x\log\frac{x-1}{x+1}$, show that $y_n = (-1)^{n-2}(n-2)!\left[\frac{x-n}{(x-1)^n} - \frac{x+n}{(x+1)^n}\right]$ **(8)**

b. Find the value of x for which the function $(x-2)^3 \cdot (x-3)^2$ is a maximum or minimum. **(8)**

Q.8 a. Evaluate $\int \frac{2x}{(x^2+1)(x^2+2)}dx$ **(8)**

b. Evaluate $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$ **(8)**

Q.9 a. Solve the initial value problem $(1 + x^2) \frac{dy}{dx} + 2xy - 4x^2 = 0,$ when $y(0) = 0.$ **(8)**

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