ROLL NO. _____

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

DipIETE – ET/CS *{NEW SCHEME}*

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. Evaluation of $\lim_{x\to\frac{\pi}{2}}(\sec x - \tan x)$ is equal to

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

(C) $\frac{1}{2}$ **(D)** does not exist

b. If $y = 1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots\ldots\ldots$, then $\frac{dy}{dx}$ is equal to

(A) x **(B)** y

(C) x+y **(D)** xy

c. The value of integral $\int \frac{dx}{x^2+2x+5}$ is equal to

(A) $\frac{1}{2}\sin^{-1}\frac{x+1}{2}$ **(B)** $\frac{1}{2}\cos^{-1}\frac{x+1}{2}$

(C) $\frac{1}{2}\tan^{-1}\frac{x+1}{2}$ **(D)** $\frac{1}{2}\cot^{-1}\frac{x+1}{2}$

d. Rank of matrix $\begin{bmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{bmatrix}$ is

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

e. The differential equation $(2xy + 3y)\,dx + (x^2 + k\,x)\,dy = 0$ is exact if k is equal to

(A) 3 **(B)** 4
(C) 2 **(D)** 6

f. The middle term in the expansion of $\left(\frac{x}{y}+\frac{y}{x}\right)^6$ is

(A) 10 **(B)** 15
(C) 20 **(D)** 25

g. The value of $\sin 105^\circ + \cos 105^\circ$ is equal to

(A) $\frac{1}{2}$ **(B)** $\frac{1}{\sqrt{2}}$
(C) $\frac{\sqrt{3}}{2}$ **(D)** $\frac{1}{\sqrt{3}}$

h. The area of the triangle with vertices (a, 0), (-a, 0) and (0, b) is

(A) a^2 **(B)** b^2
(C) ab **(D)** 0

i. The equation of the straight line which passes through the origin and makes an angle $\frac{3\pi}{4}$ with x – axis is

(A) $y - 2x = 0$ **(B)** $y + 2x = 0$
(C) $y - x = 0$ **(D)** $y + x = 0$

j. The equation of circle which is concentric with the circle $x^2 + y^2 - 8x + 12y + 43 = 0$ and which passes through (6, 2) is

(A) $x^2 + y^2 - 8x + 12y - 16 = 0$ **(B)** $x^2 + y^2 + 8x - 12y + 16 = 0$
(C) $x^2 + y^2 - 8x + 12y + 8 = 0$ **(D)** $x^2 + y^2 + 8x + 12y - 8 = 0$

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Answer any FIVE Questions out of EIGHT Questions.
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Q.2 a. State and prove Leibnitz theorem for the n^{th} derivative of the product of two functions. **(8)**

b. Find the points at which the function f(x) = (x-1) (x-2) (x-3) has a maximum and minimum values. **(8)**

Q.3 a. Evaluate $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}} dx$ **(8)**

b. Integrate $\int \frac{x^2-3x+4}{(x-2)(x+2)(x+4)} dx$ **(8)**

Q.4 a. Compute the inverse of $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ **(8)**

b. Show that the equations $2x + y + 2z = 1$
$x + 2y - z = 2$
$5x + 4y + 3z = 4$
are consistent and solve them. **(8)**

Q.5 a. Solve the differential equation: **(8)**

$$\frac{dy}{dx} = \frac{y}{x} - \sqrt{\left(\frac{y^2}{x^2} - 1\right)}$$

b. Solve the differential equation: **(8)**

$e^{-y} \sec^2 y \, dy = dx + x \, dy$

Q.6 a. If S_1, S_2, S_3 be the sums of n, 2n, 3n terms respectively of an A.P. show that $S_3 = 3(S_2 - S_1)$ **(8)**

b. The sum of first and second terms of a G.P. is $\frac{5}{4}$ and the sum of the fourth and fifth terms is 80. Find the first term and the common ratio. **(8)**

Q.7 a. If A + B + C = π, show that $\sin A + \sin B + \sin C = 4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$ **(8)**

b. In any triangle ABC, prove that $\tan\frac{B-C}{2} = \frac{b-c}{b+c}\cot\frac{A}{2}$ **(8)**

Q.8 a. Find the equation of the line through the point of intersection of 5x-3y = 1 & 2x + 3y = 23 and perpendicular to the line whose equation is 5x-3y = 1. **(8)**

b. If p and p' be the perpendiculars from the origin upon the straight lines whose equations are **(8)**

$x \sec\theta + y \operatorname{cosec}\theta = a$

and $x\cos\theta - y\sin\theta = a\cos 2\theta$

Prove that $4p^2 + (p')^2 = a^2$

Q.9 a. Find the vertex, focus, axis and the directrix of the parabola **(8)**

$y^2 = x + 2y - 2$

b. Show that the sum of the focal distances of any point on an ellipse is constant and equal to the major axis. **(8)**