ROLL NO. ____________________

Code: DE51/DC51/DE101/DC101 Subject: ENGINEERING MATHEMATICS - I

DipIETE – ET/CS (Current & New Scheme)

Time: 3 Hours **DECEMBER 2015** **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 $\underset{x\to0}{Limit}\dfrac{x^2\sin\frac{1}{x}}{\sin x}$ is

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

(C) $\frac{1}{2}$ **(D)** None of these

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

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

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

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

(A) $\cot x+\sec x$ **(B)** $\tan x-\cos ecx$

(C) $\tan x-\cos ecx$ **(D)** $\cot x-\sec x$

d. Let A and B be two matrices, then the relation $(AB)^n=A^nB^n$ if

(A) AB = BA **(B)** AB $\neq$ BA

(C) A = B **(D)** $A^{-1}=B$

e. The equation of a circle which passes through the intersection of the lines $3x-2y=1$ and $4x+y=27$

And the centre is at point $(2,-3)$ is

(A) $(x+2)^2+(y-3)^2=100$ **(B)** $(x-2)^2+(y+3)^2=100$

(C) $(x-2)^2+(y+3)^2=109$ **(D)** $(x+2)^2+(y-3)^2=109$

f. The order (O) and degree (D) 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 middle term in the expansion of $\left(x - \frac{1}{x}\right)^{10}$ is

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

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

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

i. The differential coefficient of cos (sin x) is

(A) $\sin^2 x(\cos x)$ **(B)** $-\cos(\sin x)$
(C) $-\sin(\sin x).\cos x$ **(D)** $\cos^2(\sin x)$

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

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

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

Q.2 a. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, then prove that $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$ **(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 $\int x \cos^3 x dx$ **(8)**

b. Evaluate $\int_0^{\pi/2} x^2 \cos^2 x dx$ **(8)**

Q.4 a. Solve $\cos(x+y)dy = dx$ **(8)**

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

Q.5 a. Find the term independent of x in the expansion of $\left(2x^2 - \frac{1}{x}\right)^{12}$ **(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 1^{st} n terms (S_n) of G.P. **(8)**

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

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

Q.7 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 vertex, focus, directrix, axis and latus-rectum of the parabola of $y^2 = 4x + 4y$ **(8)**

Q.8 a. If p be the length of perpendicular from the origin to the line whose intercepts on the axes are a and 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 lines through the point $(2,-1)$ and making an angle of 45° with the line $6x + 5y - 1 = 0$ **(8)**

Q.9 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. If $\begin{bmatrix} a & a^2 & a^3 - 1 \\ b & b^2 & b^3 - 1 \\ c & c^2 & c^3 - 1 \end{bmatrix} = 0$. Prove that abc = 1. **(8)**