ROLL NO. _____

**Code: DE51/DC51 Subject: ENGINEERING MATHEMATI**

**DipIETE – ET/CS**

**Time: 3 Hours** **JUNE 2013** **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.**

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**Q.1 Choose the correct or the best alternative in the following:** **(2×10)**

a. $\lim_{x\to 0} \frac{\sin ax}{\sin bx}$ is :

**(A)** $\frac{1}{b}$ **(B)** a

**(C)** 0 **(D)** $\frac{a}{b}$

b. The ratio in which the line $3x + y - 9 = 0$ divides the segment joining the points (1, 3) and (2, 7)

**(A)** 3:4 externally **(B)** 3:4 internally
**(C)** 4:3 internally **(D)** 4:3 externally

c. $\int \frac{\sin 4x}{\sin x} dx$ is

**(A)** $2\left[\frac{\sin 3x}{3} + \sin x\right] + c$ **(B)** $\frac{\sin 3x}{3} + \sin x + c$

**(C)** $2\left[\frac{\sin 3x}{3} - \sin x\right] + c$ **(D)** $\frac{\sin 3x}{3} - \sin x + c$

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

**(A)** 3 **(B)** 1
**(C)** 0 **(D)** 4

e. If $A=\begin{bmatrix}1 & 2\\ 3 & 4\\ 5 & 6\end{bmatrix}$, $B=\begin{bmatrix}-3 & -2\\ 1 & -5\\ 4 & 3\end{bmatrix}$ and A+B-X=0, then the value of X is

**(A)** $\begin{bmatrix}2 & 3\\ -1 & 0\\ 4 & 9\end{bmatrix}$ **(B)** $\begin{bmatrix}0 & 4\\ -1 & 4\\ 9 & 8\end{bmatrix}$

**(C)** $\begin{bmatrix}2 & 0\\ -1 & 4\\ 9 & 9\end{bmatrix}$ **(D)** $\begin{bmatrix}-2 & 0\\ 4 & -1\\ 9 & 9\end{bmatrix}$

f. The order and degree of differential equation $y=\frac{dy}{dx}+\frac{c}{\frac{dy}{dx}}$ is

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

g. The middle term in the expansion of $\left(x-\frac{1}{2y}\right)^{10}$ is

**(A)** $-\frac{63x^5}{8y^5}$ **(B)** $-\frac{63y^5}{8x^5}$

**(C)** $\frac{8x^5}{63y^5}$ **(D)** $\frac{8y^5}{63x^5}$

h. If $\cot\alpha\cot\beta=2$, then the value of $\frac{\cos(\alpha+\beta)}{\cos(\alpha-\beta)}$ is

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

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

i. The distance between the pair of points A(2, 5), B(-3, 7) is

**(A)** $\sqrt{30}$ **(B)** $\sqrt{28}$
**(C)** $\sqrt{27}$ **(D)** $\sqrt{29}$

j. If $y=\log\sin x$, then $\frac{dy}{dx}$ is

**(A)** tan x **(B)** -tan x
**(C)** cot x **(D)** -cot x

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

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

b. Prove that the straight line $\frac{x}{a}+\frac{y}{b}=1$ touches the curve $y = be^{-x/a}$ at the point where the curve crosses the axis of y. **(8)**

**Q.3** a. Evaluate $\int \frac{1}{\sqrt{x(1-2x)}}dx$ **(8)**

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

**Q.4** a. Prove that $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$ **(8)**

b. Apply Cramer's rule to solve the following system of linear equations

$x + y + z = -1$

$x + 2y + 3z = -4$

$x + 3y + 4z = -6$ **(8)**

**Q.5** a. Solve $x\frac{dy}{dx} + \cot y = 0$, given that $y = \frac{\pi}{4}$ when $x = \sqrt{2}$ **(8)**

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

**Q.6** a. Prove that $\cos^2 A + \cos^2(A+120^\circ) + \cos^2(A-120^\circ) = \frac{3}{2}$ **(8)**

b. If $A+B+C=\pi$, prove that $\cot\frac{A}{2}+\cot\frac{B}{2}+\cot\frac{C}{2} = \cot\frac{A}{2}\cot\frac{B}{2}\cot\frac{C}{2}$ **(8)**

**Q.7** a. Find the term independent of 'x' in the expansion of $\left(\frac{3x^2}{2}-\frac{1}{3x}\right)^9$ **(8)**

b. If the $5^{th}$ term of a G.P. is 16 and the $10^{th}$ term is $\frac{1}{2}$, find the G.P. Also find its $15^{th}$ term. **(8)**

**Q.8** a. A line passes through (3, 4) and the sum of its intercepts on the axis is 14, find the equation of the line. **(8)**

b. Find the distance between the lines $9x + 40y - 20 = 0$ and $9x + 40y + 21 = 0$ **(8)**

**Q.9** a. Find the equation of the circle whose centre is the point $(1,-2)$ and which passes through the centre of the circle $x^2 + y^2 + 2y - 3 = 0$ **(8)**

b. Find the equation of the parabola whose focus is $(4,-3)$ and whose vertex is $(4,1)$. **(8)**