ROLL NO. _____

**Code: DE55 / DC55 Subject: ENGINEERING MATHEMATICS - II**

**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. The value of $\lim_{x\to 0}\left(\frac{1}{x}\right)^{\tan x}$ is:

**(A)** -1 **(B)** 0
**(C)** 1 **(D)** 2

b. The value of $\int_0^{\pi/2} \sin^6 x \cos^4 x \, dx$ is:

**(A)** $\frac{3\pi}{512}$ **(B)** $\frac{\pi}{128}$
**(C)** $\frac{-\pi}{128}$ **(D)** $\frac{-3\pi}{512}$

c. The multiplicative inverse of 3-4i is:

**(A)** $\frac{4}{25}+\frac{3}{25}i$ **(B)** $\frac{3}{25}-\frac{4}{25}i$
**(C)** $\frac{3}{25}+\frac{4}{25}i$ **(D)** $\frac{4}{25}-\frac{3}{25}i$

d. The area of the parallelogram formed by the vectors $\vec{a}=3\hat{i}+2\hat{j}$, $\vec{b}=2\hat{j}-4\hat{k}$ is:

**(A)** $4\sqrt{61}$ sq units **(B)** $2\sqrt{61}$ sq units
**(C)** $3\sqrt{61}$ sq units **(D)** $\sqrt{61}$ sq units

e. The value of $\lambda$ such that the vectors $\vec{a} = \lambda\hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = 5\hat{i} - 9\hat{j} + 2\hat{k}$ are perpendicular to each other is:

**(A)** $\frac{5}{16}$ **(B)** $\frac{5}{24}$

**(C)** $\frac{-5}{16}$ **(D)** $\frac{16}{5}$

f. If $\frac{d^2y}{dx^2} - y = 2 + 3x$, then C.F. is:

**(A)** $C_1e^x + C_2e^{-x}$ **(B)** $C_1\cos x + C_2\sin 3x$

**(C)** $e^x(C_1\cos x + C_2\sin x)$ **(D)** $C_1e^x + C_2e^{2x}$

g. If $f(x) = x$, as a Fourier series in the interval $[-\pi, \pi]$ then the value of $a_0$ is:

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

**(C)** 0 **(D)** 3

h. Value of L[5sin2t - 3cos2t] is:

**(A)** $\frac{3s-10}{s^2+4}, s > 0$ **(B)** $\frac{10-3s}{s^2+4}, s > 0$

**(C)** $\frac{5s+6}{s^2+4}, s > 0$ **(D)** $\frac{6-5s}{s^2+4}, s > 0$

i. Value of L[$e^{3t}$ sin4t]is:

**(A)** $\frac{4}{s^2-6s+25}$ **(B)** $\frac{4}{s^2+6s+25}$

**(C)** $\frac{4}{s^2-6s+9}$ **(D)** $\frac{4}{s^2+6s+9}$

j. The value of $L^{-1}\left[\frac{4s+15}{16s^2-25}\right]$ is:

**(A)** $\frac{1}{4}\cosh\left(\frac{5}{4}t\right) + \sinh\left(\frac{4}{5}t\right)$ **(B)** $\cosh\left(\frac{4}{5}t\right) + \sinh\left(\frac{4}{5}t\right)$

**(C)** $\frac{1}{4}\cosh\left(\frac{5}{4}t\right) + \frac{3}{4}\sinh\left(\frac{5}{4}t\right)$ **(D)** $\cosh\left(\frac{5}{4}t\right) - \frac{3}{4}\sinh\left(\frac{5}{4}t\right)$

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

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**Q.2** a. Evaluate $\lim_{x\to 0} \frac{\log\sin 2x}{\log\sin x}$ **(8)**

b. Expand $\cos x$ in powers of $\left(x - \pi/4\right)$ upto 4 terms (using Taylor's Expansion). **(8)**

**Q.3** a. Evaluate $\int_0^{2a} x^2\sqrt{2ax - x^2}\,dx$. **(8)**

b. Find the volume generated by revolving the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ about the x-axis. **(8)**

**Q.4** a. If $x + iy = \sqrt{\frac{a+ib}{c+id}}$, prove that $\left(x^2 + y^2\right)^2 = \frac{a^2 + b^2}{c^2 + d^2}$. **(8)**

b. Prove that

$$(1+i)^n + (1-i)^n = 2^{(n/2)+1}\cos\left(\frac{n\pi}{4}\right)$$ **(8)**

**Q.5** a. What is the unit vector perpendicular to each of the vectors $2\hat{i} - \hat{j} + \hat{k}$ & $3\hat{i} + 4\hat{j} - \hat{k}$? Calculate the sine of the angle between these two vectors. **(8)**

b. A force is represented in magnitude and direction by the line joining the point A(1,-2,4) to the point B(5,2,3). Find its moment about the point (-2,3,5). **(8)**

**Q.6** a. Solve $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = e^{3x}$ **(8)**

b. Solve $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 2x^2$, given that $y(0) = 0$ and $y'(0) = 0$. **(8)**

**Q.7** a. Obtain a Fourier series representation for f(x) where

$$f(x) = \left(\frac{\pi - x}{2}\right)^2, 0 < x < 2\pi.$$ **(8)**

b. Find the Fourier sine series which represents $f(x) = \pi - x$ in the interval $(0, \pi)$ **(8)**

**Q.8** a. Find the Laplace transform of $t^2\cos at$ **(8)**

b. Find Laplace transform of $\frac{1 - e^{2t}}{t}$ **(8)**

**Q.9** a. Find $L^{-1}\left\{\frac{3s+9}{(s^2 + 2s + 10)}\right\}$ **(8)**

b. Use convolution theorem to find $L^{-1}\left\{\frac{1}{(s^2 - s - 2}\right\}$ **(8)**