ROLL NO. _____

Code: DE55 / DC55 Subject: ENGINEERING MATHEMA

DipIETE – ET/CS (NEW SCHEME)

Time: 3 Hours **JUNE 2012** **Max. Marks: 10**

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 $\lim_{x\to 1}(x)^{\frac{1}{x-1}}$ is

(A) e **(B)** 2e
(C) e^2 **(D)** e^3

b. The value of $\int_0^{\pi/2} \sin^7 x\, dx$ is

(A) 4/5 **(B)** 35/16
(C) 16/35 **(D)** 5/4

c. Amplitude of $\frac{(3-\sqrt{2}\,i)^2}{1+2i}$ is

(A) $\tan^{-1}\left(\frac{6\sqrt{2}-4}{12\sqrt{2}-7}\right)$ **(B)** $\tan^{-1}\left(\frac{6\sqrt{2}+14}{12\sqrt{2}-7}\right)$

(C) $\tan^{-1}\left(\frac{6\sqrt{2}+4}{12\sqrt{2}+7}\right)$ **(D)** $\tan^{-1}\left(\frac{4\sqrt{2}+7}{5\sqrt{2}-4}\right)$

d. If the co-ordinates of P be (3, 4, 12) then the magnitude of $\overrightarrow{OP}$ (O is origin) is

(A) 15 **(B)** 17
(C) 11 **(D)** 13

e. The projection of the vector $\hat{i}-2\hat{j}+\hat{k}$ on $4\hat{i}-4\hat{j}+7\hat{k}$ is

(A) $\frac{9}{19}$ **(B)** $\frac{19}{9}$
(C) $\frac{11}{9}$ **(D)** $\frac{9}{11}$

f. What is the order and degree of the equation $\frac{d^2y}{dx^2} + a^2x = 0$?

(A) Order 2, Degree 2 **(B)** Order 2, Degree 1
(C) Order 2, Degree 0 **(D)** Order 1, Degree 2

g. If f(x)= xsinx, $(-\pi, \pi)$ then the value of b_n is

(A) $-\pi$ **(B)** 0
(C) π **(D)** 2π

h. value of $L\{\cos^2 2t\}$ is

(A) $\frac{1}{2}\left(\frac{1}{s} + \frac{s}{s^2+16}\right)$ **(B)** $\left(\frac{1}{s} + \frac{s}{s^2+16}\right)$
(C) $\left(\frac{1}{s} - \frac{s}{s^2+16}\right)$ **(D)** $\frac{1}{2}\left(\frac{1}{s} - \frac{s}{s^2+16}\right)$

i. value of $L\{e^{2t}\cos^2 t\}$ is

(A) $\frac{1}{2}\left\{\frac{1}{s+2} - \frac{s-2}{(s-2)^2+4}\right\}$ **(B)** $\frac{1}{2}\left\{\frac{1}{s-2} + \frac{s-2}{(s-2)^2+4}\right\}$
(C) $\frac{1}{2}\left\{\frac{1}{s-2} - \frac{s-2}{(s-2)^2+4}\right\}$ **(D)** 0

j. Inverse Laplace transform of $\left\{\frac{s^2-3s+4}{s^3}\right\}$ is

(A) $1+3t+2t^2$ **(B)** $1-3t-2t^2$
(C) $1+3t-2t^2$ **(D)** $1-3t+2t^2$

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

Q.2 a. Evaluate $\lim_{x\to 0}\left(\frac{1}{x}\right)^{2\sin x}$ **(8)**

b. Expand log $(1+e^x)$ in ascending powers of x as far as the term containing x^4, using Maclaurin's theorem. **(8)**

Q.3 a. If $I_n = \int_0^{\pi/2} x^n \sin x\, dx$, $n > 1$, show that $I_n + n(n-1)I_{n-2} = n(\pi/2)^{n-1}$ **(8)**

b. The area enclosed by the hypocycloid $x^{2/3}+y^{2/3}=a^{2/3}$ is revolved about x-axis. Find the volume of the solid generated. **(8)**

Q.4 a. If Z_1, Z_2 be two complex numbers, show that
$|Z_1 + Z_2|^2 + |Z_1 - Z_2|^2 = 2\left(|Z_1|^2 + |Z_2|^2\right)$ **(8)**

b. If $2\cos\theta = x + \frac{1}{x}$, prove that $2\cos r\theta = x^r + \frac{1}{x^r}$ **(8)**

Q.5 a. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of the vertices A,B,C of a triangle. Show that the vector area of the triangle is $\frac{1}{2}(\vec{b}\times\vec{c} + \vec{c}\times\vec{a} + \vec{a}\times\vec{b})$ **(8)**

b. Find the volume of parallelopiped if $\vec{a} = -3\hat{i} + 7\hat{j} + 5\hat{k}$, $\vec{b} = -3\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{c} = 7\hat{i} - 5\hat{j} - 3\hat{k}$ are the three co-terminous edges of the parallelopiped. **(8)**

Q.6 a. Solve $(D^2-5D+6)y=e^x\cos 2x$ **(8)**

b. Solve $\frac{d^2y}{dx^2} + 9y = \sec 3x$ **(8)**

Q.7 a. Find a Fourier series to represent x^2 in the interval $(-l, l)$. **(8)**

b. Expand $f(x)= \frac{1}{4} - x$, if $0<x< \frac{1}{2}$
$= x - \frac{3}{4}$, if $\frac{1}{2}<x<1$ as the Fourier series of sine terms. **(8)**

Q.8 a. Find the Laplace transform of $\sin 2t \cos 3t$ **(8)**

b. Find Laplace transform of $\frac{\cos at - \cos bt}{t}$ **(8)**

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

b. Apply convolution theorem to solve $L^{-1}\left\{\frac{1}{(s^2+1)(s^2+9)}\right\}$ **(8)**