ROLL NO._____

Code: DE55 / DC55 Subject: ENGINEERING MATHEMATICS - II

DipIETE – ET/CS

Time: 3 Hours **JUNE 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. The value of $\lim_{x\to 0}\frac{\cos ax-\cos bx}{x^2}$ is

(A) $\frac{a^2-b^2}{2}$ **(B)** $\frac{b^2-a^2}{2}$

(C) $\frac{a^2+b^2}{2}$ **(D)** a^2+b^2

b. If $e^x(\sin x-\cos x)$ then $\frac{dy}{dx}$ is equal to

(A) $e^x \sin x.\cos x$ **(B)** $2e^x \sin x.\cos x$

(C) $2e^x \cos x$ **(D)** $2e^x \sin x$

c. If $z = 1 + i\sqrt{3}$, then the value of z^2+4 is equal to

(A) 2 z **(B)** 3z

(C) 4z **(D)** z

d. The expression $6e^{5\pi i/6}$ is the form of (a + i b) is equal to

(A) $3\sqrt{3}+i$ **(B)** $3\sqrt{3}+3i$

(C) $-3\sqrt{3}+3i$ **(D)** $3\sqrt{3}-3i$

e. If the position vector $\vec{a}$ of the point (5, n) is such that $\left|\vec{a}\right| = 13$, then the value of n is equal to

(A) ± 13 **(B)** ± 11

(C) ± 14 **(D)** ± 12

f. $\int_0^{\pi/2} \sin^2 x\,dx = \int_0^{\pi/2} \cos^2 x\,dx$ then I is equal to

(A) $\pi/2$ **(B)** $\pi/4$
(C) $-\pi/2$ **(D)** $-\pi/4$

g. The solution of $\frac{d^2y}{dx^2}+8\frac{dy}{dx}+16y=0$ is,

(A) $y = (C_1+C_2)e^{-4x}$ **(B)** $y=(C_1+C_2x)e^{4x}$
(C) $y=(C_1+C_2x)e^{-4x}$ **(D)** $y=(C_1+C_2)e^{4x}$

h. The period of the function of $\tan \pi x$ is equal to

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

i. L {5 sin2t - 3cos 2t} is equal to

(A) $\frac{10-3s}{s^2+4}$ **(B)** $\frac{10+3s}{s^2+2}$
(C) $\frac{10+5s}{s^2+4}$ **(D)** $\frac{10-5s}{s^2-4}$

j. $L^{-1}\left\{\frac{4s-3}{s^2+9}\right\}$ is equal to

(A) 4cos3t – sin3t **(B)** cos3t + sin3t
(C) 2cos3t – sin3t **(D)** 2cos3t + sin3t

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

Q.2 a. Evaluate $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{1/x^2}$ in the form of indeterminant. **(8)**

b. Use Taylor's theorem, expand $\sqrt{1+\sin x}$ upto sixth power of x. **(8)**

Q.3 a. Compute the are length of the curve $ay^2 = x^3$ from x = 0 to a point having x = 0 to a point having x = 5a **(8)**

b. Find the length of an arch of the cycloid whose equations are $x = a(\theta+\sin\theta)$ and $y = a(1+\cos\theta)$ **(8)**

Q.4 a. If $|z_1 + z_2| = |z_1 - z_2|$, prove that the difference of amplitudes of z_1 and z_2 is $\pi/2$. **(8)**

b. A resistance of 20 ohms an inductance of 0.2 Henry and a capacitance of 100 micro-farad are connected in series across 220 volts, 50 cycle/sec main. Calculate, (i) Impedance, (ii) Current, (iii) Voltage across, L, R and C. **(8)**

Q.5 a. A rigid body is rotating with angular velocity 2 radian / sec about an axis OR, where R is 2i – j + k and O is the origin. Find the velocity of the point 3i + 2j – k on the body. **(8)**

b. A force of 15 units acts parallel to the line i – 2j + 2k and passes through the points 2i – 2j – k. Using vector method, find the magnitude of the moment of the force about the point i + j – k. **(8)**

Q.6 a. Solve the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = x + \sin x$ **(8)**

b. A body weighing 10 kg is hung from a spring. A pull of 20 kg. Wt. will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position at time t sec., the maximum velocity and the period of oscillation. **(8)**

Q.7 a. Find a Fourier series for the function f(x) = x is the interval $[-\pi, \pi]$ **(8)**

b. Develop f(x) is Fourier series in the interval (0, 2), if

$$f(x) = \begin{cases} \pi x, 0 \le x \le 1 \\ \pi(2 - x), 1 \le x \le 2 \end{cases}$$ **(8)**

Q.8 a. Find the Laplace transform of cost . cos2t . cos3t. **(8)**

b. Find Laplace transform of $\cos^4 t$ **(8)**

Q.9 a. Find $L^{-1}\left\{\frac{3s - 2}{s^2 - 4s + 20}\right\}$ **(8)**

b. Solve the equation

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t}\sin t, x(0) = 0, x^1(0) = 1$$

Using Laplace transform. **(8)**