ROLL NO. _____

Code: DE55/DC55 Subject: ENGINEERING MATHEMATICS - II

DipIETE – ET/CS (Current Scheme)

Time: 3 Hours **JUNE 2017** **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. If $\left(\frac{1+i}{1-i}\right)^n = 1$, then n is equal to

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

b. The Laplace transform of $e^{2t}\sin t$ is

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

c. The solution of $\left(e^{2x}+y\right)dx = dy$ is

(A) $x^2 + y^2e^{-y} = cy^2$ **(B)** $x - y^2e^{-y} = cy^2$
(C) $ye^{-x} = c + e^x$ **(D)** None of these

d. Laplace transform of $e^{3t}\sin^2 t$, is

(A) $\frac{1}{2}\left[\frac{1}{s-3} - \frac{(s-3)}{(s-3)^2+4}\right]$ **(B)** $\frac{1}{2}\left[\frac{1}{s+3} - \frac{(s+3)}{(s+3)^2+4}\right]$
(C) $\frac{1}{2}\left[\frac{1}{s-3} + \frac{(s-3)}{(s-3)^2+4}\right]$ **(D)** $\frac{1}{2}\left[\frac{1}{s+3} + \frac{(s+3)}{(s+3)^2+4}\right]$

e. The value of $\frac{(1+\mathrm{i})(2+\mathrm{i})}{3+\mathrm{i}}$ in the form of (a + ib) is equal to

(A) $\frac{2}{3}+\frac{1}{2}\mathrm{i}$ **(B)** $\frac{2}{3}-\frac{1}{2}\mathrm{i}$
(C) $\frac{3}{4}-\frac{4}{5}\mathrm{i}$ **(D)** $\frac{3}{5}+\frac{4}{5}\mathrm{i}$

f. The value of λ for which the vectors $\bar{a} = 3i + 2j + 9k$ and $\bar{b} = i + \lambda j + 3k$ are parallel to each other is equal to

(A) - 2/3 **(B)** 1/2
(C) -1/2 **(D)** 2/3

g. The expression $6e^{5\pi i/6}$ in 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)** $3\sqrt{3}-3i$

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

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

in

i. The value of the limit $\underset{x\to 0}{Lt}\ \frac{\sin x^\circ}{x}$ is equal to

(A) π **(B)** 1
(C) $\frac{\pi}{180}$ **(D)** 0

j. $L\{4\cos 5t\}$ is equal to

(A) $\frac{5S}{S^2+16}$ **(B)** $\frac{2S}{S^2+16}$
(C) $\frac{4S}{S^2+16}$ **(D)** $\frac{4S}{S^2+25}$

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

Q.2 a. Evaluate $\underset{x\to 0}{Lim}\left(\frac{\cos Ax-\cos Bx}{x^2}\right)$ **(8)**

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

Q.3 a. Find the area enclosed by the curve $a^2x^2 = y^3(2a-y)$. **(8)**

b. Find the length of the curve $y^2 = x^3$ from origin to the point (1, 1). **(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. Two circuits of impedances 2 + j4 ohms and 3 + j4 ohms are connected in parallel and a.c. voltage of 100 volts is applied across the parallel combination. Calculate the magnitude of the current as well as power factor for each circuit and the magnitude of the total current for the parallel combination. **(8)**

Q.5 a. Forces of magnitudes 5 and 3 units acting in the directions $6i + 2j + 3k$ and $3i - 2j + 6k$ respectively act on a particle which is displaced from the point (2, 2, -1) to (4, 3, 1). Find the work done by the forces. **(8)**

b. If $\bar{a} = i + 2j - 3k$ and $\bar{b} = 3i - j + 2k$, show that $\bar{a} + \bar{b}$ and $\bar{a} - \bar{b}$ are perpendicular to each other. Also find the angle between $2\bar{a} + \bar{b}$ and $\bar{a} + 2\bar{b}$. **(8)**

Q.6 a. Solve $\frac{d^2y}{dx^2} + 9y = \sec 3x$ **(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. Develop f(x) in 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)**

b. Given that $f(x) = e^{-x}$ *for* $-l < x < l$ find the Fourier expansion of f(x) **(8)**

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

b. Using Laplace transforms evaluate the integral $\int_0^\infty \frac{\sin mt}{t} dt$ if $m > 0$ **(8)**

Q.9 a. 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)**

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