ROLL NO. _____

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

DipIETE – ET/CS (Current Scheme)

Time: 3 Hours **June 2019** **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. $f(x) = |x|$ is _____ at $x = 0$.

(A) differentiable but not continuous
(B) continuous but not differentiable
(C) differentiable and continuous
(D) neither differentiable nor continuous

b. $\lim_{x\to 0} \frac{\sin x}{x}$

(A) 0 **(B)** 1
(C) ∞ **(D)** does not exist

c. $\int_0^{\frac{\pi}{2}} \sin^3 x \cos^4 x \, dx =$

(A) $\frac{2}{35}$ **(B)** $\frac{1}{35}$
(C) $\frac{8}{35}$ **(D)** $\frac{4}{35}$

d. The modulus of the complex number $\frac{1+2i}{1-3i}$ is

(A) $\frac{1}{2}$ **(B)** $-\frac{1}{2}$
(C) $\frac{1}{4}$ **(D)** $\frac{1}{\sqrt{2}}$

e. Which of the following is a vector?

(A) distance **(B)** speed
(C) weight **(D)** area

f. The P.I. of $(D^2+4)y = \cos 2x$ is

(A) $A\cos 2x + B\sin 2x$ **(B)** $\frac{x}{4}\cos 2x$

(C) $\frac{\cos 2x}{8}$ **(D)** $\frac{x}{4}\sin 2x$

g. Which of the following function is an odd function?

(A) $x\sin x$ **(B)** $x\cos x$

(C) $x\tan x$ **(D)** $x + x^2$

h. $L\{\sinh 2t\} =$

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

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

i. $L^{-1}\left[\frac{2}{s}\right] =$

(A) 2 **(B)** $2t$

(C) t **(D)** 0

j. If the position vectors of A and B are $2i - 9j - 4k$ and $6i - 3j + 8k$ respectively, then $\overrightarrow{AB} =$

(A) $4i + 6j + 12k$ **(B)** $-4i - 6j - 12k$

(C) $8i - 12j + 4k$ **(D)** $8i + 12j + 12k$

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

Q.2 a. Verify Rolle's theorem for $(x-a)^m(x-b)^n$ where m, n are positive integers in $[a,b]$. **(6)**

b. Using Maclaurin's series expand $\tan x$ upto the term containing x^3. **(5)**

c. Evaluate $\lim_{x\to 1}\frac{x^x - x}{x - 1 - \log x}$. **(5)**

Q.3 a. Find the reduction formula for $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x\, dx$. **(8)**

b. Find the area common to the parabola $y^2 = ax$ and the circle $x^2 + y^2 = 4ax$. **(8)**

Q.4 a. Use DeMovire's theorem to solve $x^4 - x^3 + x^2 - x + 1 = 0$. **(8)**

b. Find the complex number z if $arg(z+1) = \frac{\pi}{6}$ and $\arg(z-1) = \frac{2\pi}{3}$. **(8)**

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

b. A horizontal tie rod is freely pinned at each end. It carries a uniform load $w\ lb$ per unit length and has a horizontal pull P. Find the central deflection and the maximum pending moment, taking the origin at one of its ends. **(8)**

Q.6 a. Expand $f(x) = |\cos x|$ as a Fourier series in the interval $-\pi < x < \pi$. **(8)**

b. Obtain the first three coefficients in the Fourier cosine series for *y*, where *y* is given in the following table: **(8)**

x	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
y	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Q.7 a. Find the Laplace transform of $te^{-4t}\sin 3t$. **(8)**

b. Evaluate $\int_0^\infty \frac{e^{-t}\sin^2 t}{t}dt$ using transform method. **(8)**

Q.8 a. Apply Convolution theorem to evaluate $L^{-1}\left(\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right)$. **(8)**

b. Use transform method to solve $y'' - 3y' + 2y = 4t + e^{3t}$ when $y(0) = 1$ and $y'(0) = -1$. **(8)**

Q.9 a. Prove that four points $4i + 5j + k, -(j + k), 3i + 9j + 4k, 4(-i + j + k)$ are coplanar. **(8)**

b. 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)**