ROLL NO. ____________________

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

DipIETE – ET/CS (Current Scheme)

Time: 3 Hours **DECEMBER 2018** **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 $\underset{x\to\infty}{\mathrm{Lt}} \frac{\log x}{x}$ is

(A) 2 **(B)** –1
(C) 1 **(D)** 0

b. If $f(x) = f(2a - x)$, then $\int_0^{2a} f(x)dx$ is equal to

(A) $\int_a^0 f(2a - x)dx$ **(B)** $2\int_0^a f(x)dx$

(C) $-\int_0^a f(x)dx$ **(D)** 0

c. The particular Integral of the differential equation $(D^2 + 4)y = \cos 2x$

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

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

d. The value of 'c' for which the Rolle's theorem is applicable for the function $f(x) = x^2 - 6x - 8$ in the interval [2, 4] is

(A) 3 **(B)** 2.5
(C) 2.4 **(D)** None of these

e. If $\vec{A} = 4i + 3j + k$, $\vec{B} = 2i - 2j + 2k$, then the unit vector perpendicular to both $\vec{A}$ and $\vec{B}$ is

(A) $8i + 6j - 14k/\sqrt{296}$ **(B)** $8i - 6j - 14k/\sqrt{296}$

(C) $8i + 6j + 14k/\sqrt{296}$ **(D)** $8i - 6j + 14k/\sqrt{296}$

f. The value of $|A \times B|^2 + |A \bullet B|^2$ is equal to

(A) $|A|^2|B|^2$ **(B)** $2|A||B|$

(C) $4|A||B|$ **(D)** $4|A|^2|B|^2$

g. The real part of $(\sin x + i \cos x)^5$ is

(A) $-\cos 5x$ **(B)** $-\sin 5x$

(C) sin 5x **(D)** cos 5x

h. If $f(x) = x^2$, in $-2 < x < 2$, $f(x+4) = f(x)$, then a_n is equal to

(A) $\int_0^2 x^2 \sin\frac{n\pi x}{2}dx$ (B) $\int_0^2 x^2 \cos\frac{n\pi x}{2}dx$

(C) $\int_0^4 x^2 \cos\frac{n\pi x}{2}dx$ (D) $\int_0^4 x^2 \sin\frac{n\pi x}{2}dx$

i. If value of $L\{F(t)\} = f(s)$, then $L\{(\sinh at)F(t)\}$ is equal to

(A) $\frac{1}{2}[f(s-a) - f(s+a)]$ **(B)** $\frac{1}{2}[f(s-a) + f(s+a)]$

(C) $-\frac{1}{2}[f(s-a) - f(s+a)]$ **(D)** $\frac{1}{2}[f(s+a) - f(s-a)]$

j. The maximum value of $L^{-1}\left\{\frac{1}{(s-a)^2 + b^2}\right\}$ is equal to

(A) $e^{at}\sin b\mathbf{t}$ **(B)** $e^{at}\cos b\mathbf{t}$

(C) $\frac{1}{b}e^{at}\sin b\mathbf{t}$ **(D)** $\frac{1}{b}e^{at}\cos b\mathbf{t}$

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

Q.2 a. Use Maclaurin's series, expand $\tan x$ upto the term containing x^5. **(8)**

b. Find the value of a and b such that $\lim_{x\to 0}\frac{x(1 + a\cos x) - b\sin x}{x^3} = 1.$ **(8)**

Q.3 a. Find the area of the segment cut off from the parabola $x^2=8y$ by the line $x - 2y + 8 = 0$. **(8)**

b. Evaluate $\int_0^{\pi/2}\sin^4 x\cos^6 x dx$. **(8)**

Q.4 a. Express $\left[\frac{2-\sqrt{3}i}{1+i}\right]$ in the form $a + ib$ and find its modulus and amplitude. **(8)**

b. If n is positive integer, prove that $\left(\sqrt{3}+i\right)^n + \left(\sqrt{3}-i\right)^n = 2^{n+1}\cos\left(\frac{n\pi}{6}\right)$,

(i=$\sqrt{-1}$) **(8)**

Q.5 a. Show that the points –6i+3j+2k, 3i-2j+4k, 5i+7j+3k and –13i+17j-k are coplanar. **(8)**

b. A particle acted on by, constant forces 4i+j–3k and 3i+j–k is displaced from the point i+2j+3k to the point 5i+4j+k. Find the total work done by the forces. **(8)**

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

b. Solve the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = xe^{3x} + \cos 2x.$ **(8)**

Q.7 a. Find the fourier series expansion of $f(x) = 2x - x^2$ in the interval $0 \le x \le 2$. **(8)**

b. Obtain the fourier expansion of $f(x) = x \sin x$ as a cosine series in $(0, \pi)$. **(8)**

Q.8 a. Find the Laplace transform of $[t^3 e^{-2t} \sin 4t]$. **(8)**

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

Q.9 a. Apply Convolution theorem to evaluate $L^{-1}\left[\frac{1}{s^2\left(s^2+9\right)}\right]$. **(8)**

b. Using Laplace transform, solve the differential equation $Y'' + 4Y' + 4Y = 0,$ given that $Y(0) = 0$ and $Y'(0) = 1.$ **(8)**