$\qquad$

## DipIETE - ET/CS (Current Scheme)

Time: 3 Hours
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 $\mathbf{Q} .1$ 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:
a. The value of the limit $\operatorname{lt}_{x \rightarrow 0}\left(\frac{\log x}{\cot x}\right)$ is equal to
(A) $\frac{6}{5}$
(B) $\frac{4}{5}$
(C) 0
(D) -1
b. The value of definite integral $\int_{-a}^{a}|x| d x$ is equal to
(A) a
(B) $a^{2}$
(C) 0
(D) 2 a
c. The solution of $\left(e^{2 x}+y\right) d x=d y$ is
(A) $x^{2}+y^{2} e^{-y}=c y^{2}$
(B) $x-y^{2} e^{-y}=c y^{2}$
(C) $y e^{-x}=c+e^{x}$
(D) None of these
d. z is a complex number with $|z|=\sqrt{2}, \arg (z)=\pi / 4$ the value of z is
(A) $(1+i) / \sqrt{2}$
(B) $(1+i)$
(C) $(1-i)$
(D) $(-1-i) / \sqrt{2}$
e. The value of definite integral $\int_{0}^{1} \frac{\sin ^{-1} x}{x} d x$ is equal to
(A) $\frac{\pi}{2} \log 2$
(B) $\frac{\pi}{2} \log 4$
(C) 0
(D) $\frac{\pi}{2} e^{2}$
$\qquad$
f. Laplace transform of $e^{3 t} \sin ^{2} t$, 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) $\frac{1}{2}\left[\frac{1}{s+3}+\frac{(s+3)}{(s+3)^{2}+4}\right]$
g. $\quad L^{-1}\left(\frac{s^{2}-3 s+4}{s^{3}}\right)$ is
(A) $1-3 t-2 t^{2}$
(B) $1-3 t+2 t^{2}$
(C) $1+3 t+2 t^{2}$
(D) $1+3 t-2 t^{2}$
h. If $f(x)=|\cos x|,(-\pi, \pi)$ then the value of $b_{n}$ is
(A) $-\pi$
(B) 0
(C) $\pi$
(D) $2 \pi$
i. The volume of the parallelopiped whose three coterminus edges are given by $\bar{a}=-\hat{i}+\hat{j}+\hat{k}, \bar{b}=-2 \hat{i}+\hat{j}-\hat{k}, \bar{c}=3 \hat{i}-\hat{j}-\hat{k}$ is
(A) 4
(B) -4
(C) 5
(D) -5
j. If the admittance and current of a circuit are given by the complex numbers $7+5 i, 1-i$ respectively, then the voltage of the circuit is
(A) $-\frac{6}{37}-i \frac{1}{37}$
(B) $\frac{6}{37}+i \frac{1}{37}$
(C) $\frac{6}{37}-i \frac{1}{37}$
(D) $-\frac{6}{37}+i \frac{1}{37}$


## Answer any FIVE Questions out of EIGHT Questions. <br> Each question carries 16 marks.

Q. 2 a. Evaluate $\underset{x \rightarrow 0}{ } \operatorname{lt}_{x} \frac{e^{x} \sin x-x-x^{2}}{x^{2}+x \log (1-x)}$
b. Find the area enclosed by the curve $a^{2} x^{2}=y^{3}(2 a-y)$.
Q. 3 a. Separate $\sin ^{-1}(\cos \theta+i \sin \theta)$ into real and imaginary parts.
b. Find the moment about the point $\mathrm{M}(-1,-2,3)$ of the force represented in magnitude And position by $\overrightarrow{A B}$ where the point $A$ and $B$ have the coordinates $(1,2,-3)$ and $(1,-2,3)$ respectively.
Q. 4 a. A resistance of 100 ohms, an inductance of 0.5 henry are connected in a series with a battery of 20 volts. Find the current in the circuit as a function of time.
b. Find the Fourier series of the function $f(x)=\left\{\begin{array}{cc}x, & -\pi<x<0 \\ -x, & 0<x<\pi\end{array}\right.$
Q. 5 a. Find the Laplace transform of $f(t)=\left\{\begin{array}{cc}t, & 0<t<a \\ 2 a-t, & a<t<2 a\end{array}\right.$
if $f(t+2 a)=f(t)$
b. Evaluate $L^{-1}\left(\frac{s}{\left(s^{2}+1\right)\left(s^{2}+4\right)}\right)$
Q. 6 a. Expand $\log _{e} x$ in powers of $(x-1)$ and hence evaluate $\log _{e} 1.1$ correct to 4 decimal places.
b. Using Laplace transforms evaluate the integral $\int_{0}^{\infty} \frac{\sin m t}{t} d t$ if $m>0$
Q. 7 a. Solve by Laplace transform $\frac{d^{2} x}{d t^{2}}+9 x=\cos 2 t$, if $x(0)=1, x\left(\frac{\pi}{2}\right)=-1$
b. Solve $\frac{d^{2} y}{d x^{2}}+\frac{d y}{d x}+y=\left(1-e^{x}\right)^{2}$
Q. 8 a. Given that $f(x)=e^{-x}$ for $-l<x<l$ find the Fourier expansion of $\mathrm{f}(\mathrm{x})$.
b. Two circuits of impedances $1+2 \mathrm{j}$ ohms and $2+3 \mathrm{j}$ ohms are connected in parallel and a.c. voltage of 50 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 and its power factor.
Q. 9
a. IF $|\vec{A}+\vec{B}|=50,|\vec{A}-\vec{B}|=30,|\vec{B}|=10$, find $|\vec{A}|$
b. Evaluate $\int_{0}^{a} \frac{x^{n}}{\sqrt{a^{2}-x^{2}}} d x$ then find the value of $\int_{0}^{1} x^{n} \sin ^{-1} x d x$

