ROLL NO. _____

Code: DE105/DC105 **Subject: ENGINEERING MATHEMATICS II**

DipIETE – ET/CS *{NEW SCHEME}*

Time: 3 Hours **JUNE 2016** **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 $Lim_{x\to 0}\dfrac{\log x}{\cot x} =$

(A) 0 **(B)** 1
(C) 2 **(D)** 3

b. The area of the region bounded by the curves $y^2 = x$, $x^2 = y$ is :

(A) 1 **(B)** 1/6
(C) 1/3 **(D)** 3

c. The general solution of differential equation $(3D+1)^2 y = 0$ is :

(A) $(A+Bx)e^{-x}$ **(B)** $(A+Bx)e^{-\frac{x}{3}}$
(C) $(A+Bx^2)e^{-\frac{x}{3}}$ **(D)** $Ae^{-\frac{x}{3}}$

d. Laplace transform of t^2e^{-3t} is :

(A) $\dfrac{7}{(s+4)^2}$ **(B)** $\dfrac{2}{(s+3)^3}$
(C) $\dfrac{6}{(s+3)^4}$ **(D)** $\dfrac{2}{(s+6)^2}$

e. The expression $\dfrac{5+4i}{4-5i}$ in the form of $A+iB$ is :

(A) $1+i$ **(B)** $1-3i$
(C) $3+2i$ **(D)** i

f. The complete interval of convergence of the series $\sum_{k=1}^{\infty}\frac{(x+1)^k}{k^2}$ is :

(A) $0 < x < 2$ **(B)** $0 \le x \le 2$

(C) $-2 \le x \le 0$ **(D)** $-2 \le x < 0$

g. If $L\{f(t)\} = \bar{f}(s)$ then $L\left\{\int_0^t f(u)du\right\}$ is :

(A) $\int_0^s \bar{f}(s)ds$ **(B)** $\int_0^s \frac{\bar{f}(s)}{s}ds$

(C) $\frac{\bar{f}(s)}{s}$ **(D)** $s\bar{f}(s)$

h. The inverse Laplace transform of $\frac{s}{(s^2-a^2)}$ is :

(A) $\cos at$ **(B)** $\frac{1}{a}\sin at$

(C) $\cosh at$ **(D)** $\frac{1}{a}\sinh at$

i. The Mean Value theorem guarantees the existence of a special point on the graph of $y = \sqrt{x}$ between $(0,0)$ and $(4,2)$. What are the coordinates of this point?

(A) $(2,1)$ **(B)** $(1,1)$

(C) $(2,\sqrt{2})$ **(D)** $\left(\frac{1}{2},\frac{1}{\sqrt{2}}\right)$

j. If $a = 5i - 4j + k$, $b = -4i + 3j - 2k$ and $c = i - 2j - 7k$ then $c \cdot (a \times b)$ is :

(A) 23 **(B)** -45

(C) -345 **(D)** 0

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

Q.2 a. Obtain the first four terms in the expansion of ***logsinx*** in powers of **(x-3)** by Taylor's theorem. **(8)**

b. If $Lim_{x\to 0}\frac{\sin 2x + a\sin x}{x^3}$ be finite, find the value of ***a*** and also the limit. **(8)**

Q.3 a. Evaluate $\int_0^{2a} x^3(2ax - x^2)^{\frac{3}{2}}dx$. **(8)**

b. Find the length of the arc of the curve $ay^2 = x^3$ from the vertex $(0,0)$ to the point (a,a). **(8)**

Q.4 a. If the point represented by a complex number z moves round the circle $|z|=1$, find the locus of the point $\frac{z+1}{z-1}$. **(8)**

b. Prove that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n=2^{n+1}\cos^n\frac{\theta}{2}\cos\frac{n\theta}{2}$ **(8)**

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

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

Q.6 a. Solve the differential equation $\left(D^3-D^2-6D\right)y=x^2+1$ **(8)**

b. An e.m.f. $E\sin pt$ is applied at $t=0$ to a circuit containing a capacitance C and inductance L. The current satisfied the equation $L\frac{di}{dt}+\frac{1}{C}\int idt=E\sin pt$. If $p^2=\frac{1}{LC}$ and initially the current I and the charge q are zero, show that the current at time t is $\left(\frac{Et}{2L}\right)\sin pt$. **(8)**

Q.7 a. Test the convergence of the series $\frac{1}{\sqrt{1}+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\ldots..$. **(8)**

b. Test the convergence of the series $\sum\frac{n^3+a}{2^n+a}$. **(8)**

Q.8 a. Find the Laplace transform of $te^{-2t}\sin 2t$. **(8)**

b. Solve the following differential equation using Laplace transform:
$\frac{d^2y}{dt^2}+2\frac{dy}{dt}+y=\sin t$, Given $y(0)=1, y'(0)=0$ **(8)**

Q.9 a. Compute the inverse Laplace transform of $\log\frac{s(s+1)}{(s^2+4)}$. **(8)**

b. Find inverse Laplace transform of $\frac{(2s+1)}{(s+2)^2(s-1)^2}$. **(8)**