ROLL NO. _____

DipIETE – ET/CS (NEW SCHEME) – Code: DE55 / DC55

Subject: ENGINEERING MATHEMATICS - II

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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 the limit $\lim_{x\to 0}\left(\frac{2^x-1}{(1+x)^{1/2}-1}\right)$ is equal to

(A) 2 log2 **(B)** log2
(C) 0 **(D)** 1

b. The value of definite integral $\int_0^{\pi}\theta\sin^3\theta\cos\theta d\theta$ is equal to

(A) $\frac{3\pi}{32}$ **(B)** $-\frac{3\pi}{32}$
(C) $\frac{\pi}{32}$ **(D)** $\frac{-\pi}{32}$

c. The solution of $xdy - ydx = \sqrt{x^2+y^2}\,dx$ is

(A) $y-\sqrt{x^2+y^2}=cx^2$ **(B)** $x-y^2e^{-y}=cy^2$
(C) $y+\sqrt{x^2+y^2}=cx^2$ **(D)** None of these.

d. z is a complex number with $|z|=1$, $\arg(z)=3\pi/4$ the value of z is

(A) $(1+i)/\sqrt{2}$ **(B)** $(-1+i)/\sqrt{2}$
(C) $(1-i)/\sqrt{2}$ **(D)** $(-1-i)/\sqrt{2}$

e. How many seconds a clock would lose per day if the length of its pendulum were increased in the ratio 900 : 901

(A) 48 **(B)** 45
(C) 40 **(D)** 44

f. Laplace transform of $te^{at}\sin(at), t>0$ is

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

g. $L^{-1}\left(\tan^{-1}\frac{1}{s}\right)$ is

(A) $\frac{\cos t}{t}$ **(B)** $\frac{\sin t}{t}$
(C) $1+\cos t$ **(D)** $1-\cos t$

h. If $f(x)=\cos x, (-\pi,\pi)$ then the value of b_n is

(A) $-\pi$ **(B)** 0
(C) π **(D)** 2π

i. The volume of the parallelopiped whose three coterminus edges are given by $\bar{a}=-\hat{i}+\hat{j}+3\hat{k},\ \bar{b}=-\hat{i}+2\hat{j}-3\hat{k}, \bar{c}=\hat{i}-2\hat{j}-\hat{k}$ is

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

j. If the admittance and current of a circuit are given by the complex numbers $7+i, 1-i$ respectively, then the voltage of the circuit is

(A) $\frac{4}{25}+i\frac{4}{25}$ **(B)** $-\frac{4}{25}-i\frac{4}{25}$
(C) $\frac{4}{25}-i\frac{4}{25}$ **(D)** $-\frac{4}{25}+i\frac{4}{25}$

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

Q.2 a. Evaluate $\lim_{x\to 0} \frac{e^x - e^{\sin x}}{x - \sin x}$ **(8)**

b. If f(x) is twice differentiable such that $f''(x) = -f(x)$ and $f'(x) = g(x)$, $h(x) = [f(x)]^2 + [g(x)]^2$, then find the value of h(10) if h(5) = 11. **(8)**

Q.3 a. Find the volume of the solid generated by the revolution of the area of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ about x-axis. **(8)**

b. If $U_n = \int_0^{\pi/2} x\left(\sin^n x\right)dx (n > 1)$ then prove that $U_n = \frac{n-1}{n} U_{n-2} + \frac{1}{n^2}$.

Deduce that $U_5 = \frac{149}{225}$ **(8)**

Q.4 a. Separate $\tan^{-1}(a + ib)$ into real and imaginary parts. **(8)**

b. If n is a positive integer, prove that $(\sqrt{3}+i)^n + (\sqrt{3}-i)^n = 2^{n+1}$ where $i = \sqrt{-1}$

(8)

Q.5 a. Find the moment about a line through the origin having direction of $2\hat{i} + 2\hat{j} + \hat{k}$ due to a 30kg force acting at a point $(-4,2,5)$ in the direction of $12\hat{i} - 4\hat{j} - 3\hat{k}$. **(8)**

b. If $|\vec{A} + \vec{B}| = 60, |\vec{A} - \vec{B}| = 40, |\vec{B}| = 46,$ find $|\vec{A}|$ **(8)**

Q.6 a. Solve $\frac{d^2x}{dt^2} + 9x = \cos 2t,$ if $x(0) = 1, x(\pi/2) = -1$ **(8)**

b. Solve $x \sin x \frac{dy}{dx} + (x\cos x + \sin x)\, y = \sin x$ **(8)**

Q.7 a. Find the Fourier series of the function $f(x) = \begin{cases} 0, & -2 < x < -1 \\ 1+x, & -1 < x < 0 \\ 1-x, & 0 < x < 1 \\ 0, & 1 < x < 2 \end{cases}$ **(8)**

b. Given that $f(x) = x + x^2$ $for - \pi < x < \pi$ find the Fourier expansion of f(x). Deduce that $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + ...$ **(8)**

Q.8 a. Find the Laplace transform of $\frac{1 - \cos t}{t^2}$ **(8)**

b. Find the Laplace transform of the function $f(t) = \begin{cases} \sin wt & for\ 0 < t < \frac{\pi}{w} \\ 0 & for\ \frac{\pi}{w} < t < \frac{2\pi}{w} \end{cases}$ **(8)**

Q.9 a. Evaluate $L^{-1}\left(\frac{s}{\left(s^2 + a^2\right)^2}\right)$ **(8)**

b. Find $L^{-1}\left[\frac{3s - 8}{s^2 - 4s + 20}\right]$ **(8)**