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

Subject: ENGINEERING MATHEMATICS - II

Time: 3 Hours **JUNE 2010** **Max. Marks: 100**

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.**
- **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 $\underset{x \to 2}{\text{Lt}} \dfrac{x^2 - 3x + 2}{x - 2}$ is

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

b. If $y = \sin^{10} x$, then $\dfrac{dy}{dx}$ is equal to

(A) $10\sin^9 x$ **(B)** $\cos^{10} x$
(C) $10\sin^9 x \cos x$ **(D)** None of these

c. If $Z_1 = 2 + 3i$, $Z_2 = 4 - 5i$, then $Z_1 Z_2$ is equal to

(A) 23+2i **(B)** $23 - 2i$
(C) 20+2i **(D)** $2i - 23$

d. The Modulus of 3-4i is equal to

(A) -5 **(B)** 5
(C) $-5i$ **(D)** 5i

e. The cosine of angle between the vectors $i - j$ and j+k is

(A) $\dfrac{2\pi}{3}$ **(B)** $\dfrac{\pi}{3}$
(C) $\dfrac{3\pi}{2}$ **(D)** $\dfrac{\pi}{2}$

f. The value of $\int_0^{\frac{\pi}{2}} \sin^8 x dx$ is

(A) $\frac{256\pi}{35}$ **(B)** $\frac{35}{256}$

(C) $\frac{256}{35}$ **(D)** $\frac{35\pi}{256}$

g. If roots are real & different, then C.F. (complementary function) is equal to

(A) $y = c_1 e^{m_1 x}$ **(B)** $y = c_1 e^{m_2 x}$

(C) $y = c_1 e^{m_1 x} + c_2 e^{m_2 x}$ **(D)** None of these

h. The Fourier series of a function f(x) of period 2π is given by

(A) $f(x) = \frac{1}{2}a_o + \sum_{n=1}^{\infty}(a_n \cos nx + b_n \sin nx)$

(B) $f(x) = \sum_{n=1}^{\infty} a_n \cos nx$

(C) $f(x) = \sum_{n=1}^{\infty} b_n \cos nx$

(D) $f(x) = \frac{1}{2}a_o + a_n \cos nx$

i. $L(e^{at})$ is equal to

(A) $\frac{-1}{s-a}$ **(B)** $\frac{1}{s-a}$

(C) $\frac{1}{s+a}$ **(D)** $s-a$

j. $L^{-1}\left[\frac{1}{s^2-5s+6}\right]$ is equal to

(A) e^{2t} **(B)** e^{3t}

(C) $e^{3t} - e^{2t}$ **(D)** $e^{3t} + e^{2t}$

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

Q.2 a. Verify Rolle's Theorem for $\left(\frac{\sin x}{e^x}\right)$ in $(0,\pi)$. **(8)**

b. Using Maclaurin's series, expand tan x upto the term containing x^5. **(8)**

Q.3 a. Evaluate $\int_0^{\frac{\pi}{6}} \cos^4 3\theta \sin^3 6\theta d\theta$. **(8)**

b. Find the volume of sphere of radius ‘a’. **(8)**

Q.4 a. If n is a positive integer, prove that $\left(\sqrt{3}+i\right)^n + \left(\sqrt{3}-i\right)^n = 2^{n+1}$ where $i = \sqrt{-1}$. **(8)**

b. Express $\frac{2+3i}{2-3i}$ in the form of a+ib and find Modulus of the number. **(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. Find the area of the parallelogram determined by the vectors i+2j+3k and $-3i-2j+k$. **(8)**

Q.6 a. Solve the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = e^{2x}\cos 3x$. **(8)**

b. In an L-C-R circuit, the charge q on a plate of a condenser is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = E\sin pt$. The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. If initially the current i and the charge q be zero, so that value of $\frac{R}{L}$, the current in the circuit at a time t is given by $(Et/2L)\sin pt$. **(8)**

Q.7 a. Obtain the Fourier series for $f(x) = e^{-x}$ in the interval $0 < x < 2\pi$. **(8)**

b. Expand f(x) = 1 in a sine series in $0 < x < \pi$. **(8)**

Q.8 a. Find Laplace transform of sin2t. **(8)**

b. Find Laplace transform of $te^{2t}\cos 5t$. **(8)**

Q.9 a. Find $L^{-1}\left[\frac{3s-8}{s^2-4s+20}\right]$. **(8)**

b. Solve the differential equation using Laplace transform $\frac{d^3y}{dt^3} - \frac{dy}{dt} = 2\cos t$, subject to condition y(0)=3, $\left(\frac{dy}{dt}\right)_{t=0} = 2$ and $\left(\frac{d^2y}{dt^2}\right)_{t=0} = 1$ **(8)**