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

## Subject: ENGINEERING MATHEMATICS - II

**Time: 3 Hours** **JUNE 2009** **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.**

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**Q.1 Choose the correct or the best alternative in the following:** **(2×10)**

a. If $y = 3x^2 + 5x + 8$, then $\frac{dy}{dx}$ is equal to

**(A)** $(6x+5)$ **(B)** $(3x+2)$
**(C)** $(x+3)$ **(D)** $(x+1)$

b. $\int x^n e^{ax} dx$ is equal to

**(A)** $\frac{1}{a}x^n e^{ax} + \frac{n}{a}I_{n-1}$ **(B)** $\frac{1}{a}x^n e^{ax} - \frac{n}{a}I_{n-1}$
**(C)** $\frac{1}{a}x^n + \frac{1}{n}I_{n-1}$ **(D)** $\frac{1}{a}x^n - \frac{1}{n}I_{n-1}$

c. $(1+i)(2+i)(3+i)$ is equal to:

**(A)** $(1+i)$ **(B)** $(2+i)$
**(C)** $(3+i)$ **(D)** $(0+10i)$

d. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}|=2$, $|\vec{b}|=3$ and $\vec{a}.\vec{b} = 3$, then the angle between the vectors is equal to

**(A)** $30^\circ$ **(B)** $45^\circ$
**(C)** $60^\circ$ **(D)** $90^\circ$

e. If roots are in complex number then C.F. complementary function is equal to:

**(A)** $(C_1\beta x + C_2 \sin x)$ **(B)** $(C_1 \cos \beta x - C_2 \sin \beta x)$
**(C)** $e^{\alpha x}(C_1 \cos \beta x + C_2 \sin \beta x)$ **(D)** $(C_1\beta x + C_2\beta x)$

f. In Fourier series $|\sin x|$ is equal to

**(A)** $2\pi$ **(B)** $\pi$
**(C)** $3\pi$ **(D)** $\pi/2$

g. $\mathcal{L}\left(\frac{e^{-at} - e^{-bt}}{t}\right)$ is equal to:

**(A)** $\log\left(\frac{s+b}{s+a}\right)$ **(B)** $\log\left(\frac{s+a}{s+b}\right)$

**(C)** $\log\left(\frac{s+1}{s+2}\right)$ **(D)** $\log\left(\frac{s-1}{s-2}\right)$

h. $L^{-1}\left\{\frac{2s}{(s^2+1)^2}\right\}$ is equal to:

**(A)** $t \cdot \cos t$ **(B)** $t \cdot \sin t$

**(C)** $\cos t$ **(D)** $\sin t$

i. If P be the point represented by the complex number z such that z = x+iy, then the locus of P is equal to :_____ when $\left|\frac{z+2}{z+3}\right| = 5$

**(A)** $24x^2 + 24y^2 + 146x + 221$ **(B)** $24x^2 - 24y^2 - 146x - 146$

**(C)** $x^2 + y^2 + x + 24$ **(D)** $x^2 - y^2 - x + 24$

j. $L\left(\frac{e^t}{\sqrt{t}}\right)$ is equal to

**(A)** $\sqrt{\frac{\pi}{s-1}}$ **(B)** $\sqrt{\frac{\pi}{s+1}}$

**(C)** $\sqrt{\frac{2\pi}{s-1}}$ **(D)** $\sqrt{\frac{2\pi}{s+1}}$

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

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**Q.2** a. Expand $\log[1-\log(1-x)]$ in the power of x by Maclaur's theorem upto the term of $x^4$ and deduce the expansion of $\log[1+\log(1+x)]$. **(8)**

b. Apply Taylor's Theorem to calculate the value of $f\left(\frac{11}{10}\right)$, where $f(x) = x^3 + 3x^2 + 15x - 10$. **(8)**

**Q.3** a. Find the volume of the right circular cone formed by the revolution of a right angled triangle about a side which contained the right angle. **(8)**

b. Find the length of curve $y^2 = x^3$ from origin to the point (1, 1). **(8)**

**Q.4** a. Use De-Movire's Theorem to solve the equation $x^7 + x^4 + x^3 + 1 = 0$. **(8)**

b. A resistance of 20 ohms and inductance of 0.2 Henry and capacitance of 100 $\mu F$ are connected in series across 220 volt 50 cycle / sec main. Determine,

(i) Impedance (ii) Current

(iii) Voltage across L, R and C (iv) Power in watt

(v) Power factor. **(8)**

**Q.5** a. A rigid body is spinning with an angular velocity of 27 radian/sec about an axis parallel to $2i + j - 2k$ passing through the point $i + 3j - k$. Find the velocity of the point whose position vector is $4i + 8j + k$. **(8)**

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

**Q.6** a. An L-C-R circuit has R = 180 ohms, $C = \frac{1}{280}F$, L = 20H and applied voltage E(t) = 10 sin t. Assuming that no charge is present but an initial current of 0 (zero) amp is flowing at t = 0 when the voltage is first applied, find Q and $I = \frac{dQ}{dt}$ at any time t. Q is given by the differential equation $L\frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{Q}{C} = E(t)$. **(8)**

b. Solve the differential equation $(D^2 - 2D + 1)y = x \sin x$ where $D = \frac{d}{dx}$. **(8)**

**Q.7** a. An alternating current after passing through a rectifier has the form

$$I(Q) = \begin{cases} I_o \sin\theta, & \text{for } 0 < \theta < \pi \\ 0, & \text{for } \pi < \theta < 2\pi \end{cases}$$

Where $I_o$ is the maximum current and period $2\pi$. Express I in a Fourier series. **(8)**

b. Find half range cosine series for the function $f(x) = x^2$ in the range $0 \le x \le \pi$. **(8)**

**Q.8** a. Find the Laplace Transform of $\sin 2t \cdot \cos 3t + \cos(at + 5)$. **(8)**

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

**Q.9** a. Show that, $L^{-1}\left\{\frac{s^2}{s^4 + 4a^4}\right\} = \frac{1}{2a}(\cosh at \cdot \sin at + \sinh at \cdot \cos at)$. **(8)**

b. Solve $(D^3 - 2D^2 + 5D)y = 0$, if y=0, Dy=1 at t = 0 and y = 1 at $t = \pi/8$. **(8)**