Subject: ENGINEERING MATHEMATICS - II

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

JUNE 2011

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 the $\lim_{x \to 0} \frac{8^x - 2^x}{x}$ is

(**A**) log 4 (**B**) log 2
(**C**) log 6 (**D**) log 8

b. If $y = \cos(\sin x)$, then $\frac{dy}{dx}$ is equal to

(**A**) $\cos x . \sin x$ (**B**) $-\sin(\sin x).\cos x$
(**C**) $\sin^2 x . \cos x$ (**D**) $\cos^2 x . \sin x$

c. If $z = 1 + i\sqrt{3}$, then $z^2 + 4$ is equal to

(**A**) $z\sqrt{3}$ (**B**) 3z
(**C**) 2z (**D**) 4z

d. The principal argument of $-2i$ is equal to

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

e. If $|\vec{a} + \vec{b}| = 60$, $|\vec{a} - \vec{b}| = 40$ and $|\vec{b}| = 46$, then $|\vec{a}|$ is equal to

(**A**) 24 (**B**) 42
(**C**) 22 (**D**) 26

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

(A) $\pi/4$ **(B)** $\pi/2$
(C) $\pi/3$ **(D)** $\pi/6$

g. If the roots are 2, 3 then complementary function is equal to

(A) $c_1 e + c_2 e^{5x}$ **(B)** $c_1 e^{x} + c_2 e^{5x}$
(C) $c_1 e^{2x} + c_2 e^{3x}$ **(D)** $c_1 e^{x_1} + c_2 e^{x_2}$

h. The period of the function of $|\cos x|$ is equal to

(A) π **(B)** 2π
(C) 3π **(D)** 4π

i. $L\{4\cos 5t\}$ is equal to

(A) $\frac{5s}{s^2+16}$ **(B)** $\frac{2s}{s^2+16}$
(C) $\frac{4s}{s^2+16}$ **(D)** $\frac{4s}{s^2+25}$

j. $L^{-1}\left\{\frac{5}{s+3}\right\}$ is equal to

(A) $3e^{-5t}$ **(B)** $5e^{3t}$
(C) $5e^{-3t}$ **(D)** $3e^{5t}$

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

Q.2 a. Verify Rolle's theorem for $f(x) = (x-1)(x-2)(x-3)$ **(8)**

b. Using Maclaurin's series, expand in the power series of sinx. **(8)**

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

b. Find the length of the curve $x = a\cos^3\theta, y = a\sin^3\theta$, in the first quadrant. **(8)**

Q.4 a. If n is positive integer, prove that

$$\left(\sqrt{3}+i\right)^{n}+\left(\sqrt{3}-i\right)^{n}=2^{n+1}\cos\frac{n\pi}{6},\left(i=\sqrt{-1}\right)$$ **(8)**

b. The impedances $z_1 = 10 - j60$ and $z_2 = 10 + j20$ are connected in parallel across a 200 volts a.c. supply. Calculate
(i) current in each branch and the total current and
(ii) power consumed in each branch. **(8)**

Q.5 a. Show that the four points $2\vec{a}+3\vec{b}-\vec{c}$, $\vec{a}-2\vec{b}+3\vec{c}$, $3\vec{a}+4\vec{b}-2\vec{c}$ and $\vec{a}-6\vec{b}+6\vec{c}$ are coplanar. **(8)**

b. A force given by $3\hat{i}+2\hat{j}-4\hat{k}$ is applied at the point $(1,-1,2)$. Find the moment of the force about the point $(2,-1,3)$. **(8)**

Q.6 a. Solve the differential equation $\dfrac{d^2y}{dx^2}+\dfrac{dy}{dx}+y=\cos 2x$. **(8)**

b. The differential equation for a circuit in which self inductance neutralize each other is $L\dfrac{d^2I}{dt^2}+\dfrac{I}{C}=0$. Find the current I as a function of t, given that I_m is the maximum current and I = 0 when t = 0. **(8)**

Q.7 a. Find the Fourier series representing $f(x)=x,\quad 0<x<2\pi$ and sketch its graph from $x=-\pi$ to $x=4\pi$. **(8)**

b. Expand $f(x)=e^{x}$ in a cosine series over $(0,1)$. **(8)**

Q.8 a. Find Laplace transform of sin 3t cos 5t **(8)**

b. Find Laplace transform of $\dfrac{1-e^{2t}}{t}$ **(8)**

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

b. Solve the differential equation using Laplace transform method,

$$\frac{d^2y}{dt^2}+4y=\sin t,\ y(0)=1,\ y'(0)=0$$ **(8)**