Code: DE55/DC55 **Subject: ENGINEERING MATHEMATICS - II**

Diplete - ET/CS

Time: 3 Hours

DECEMBER 2013

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 O.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 $\underset{x\to 0}{\text{Lt}} \frac{\sin x^{\circ}}{x}$ is equal to

(C)
$$\frac{\pi}{180}$$

b. The value of definite integral $\int \sin^7 x dx$ is equal to

(A)
$$\frac{14}{35}$$

(B)
$$\frac{16}{35}$$

(C)
$$\frac{17}{35}$$

(D)
$$\frac{11}{35}$$

c. The complementary function for the differential equation $\frac{d^2x}{dt^2} + \frac{g}{\ell}x = \frac{g}{\ell}L$ where g, ℓ ,L are constants, is given by

(A)
$$c_1 \cos \sqrt{\frac{\ell}{g}} t + c_2 \sin \sqrt{\frac{\ell}{g}}$$

(A)
$$c_1 \cos \sqrt{\frac{\ell}{g}} t + c_2 \sin \sqrt{\frac{\ell}{g}} t$$
 (B) $c_1 \cos \sqrt{\frac{g}{\ell}} it + c_2 \sin \sqrt{\frac{g}{\ell}} it$

(C)
$$c_1 \cos \sqrt{\frac{g}{\ell}} t + c_2 \sin \sqrt{\frac{g}{\ell}} t$$
 (D) $c_1 \cos \sqrt{\frac{g}{\ell}} t + ic_2 \sin \sqrt{\frac{g}{\ell}} t$

(D)
$$c_1 \cos \sqrt{\frac{g}{\ell}} t + ic_2 \sin \sqrt{\frac{g}{\ell}} t$$

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

(A)
$$-\pi/3$$

(B)
$$-\pi/2$$

(C)
$$\pi/2$$

(D)
$$\pi/3$$

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- e. If $Z = 1 + i\sqrt{3}$, then $Z^2 + 4$ is equal to
 - (A) $Z\sqrt{3}$

(B) 3Z

(C) 2Z

- **(D)** 4Z
- f. $L{4\cos 5t}$ is equal to
 - (A) $\frac{5S}{S^2 + 16}$

(B) $\frac{2S}{S^2 + 16}$

(C) $\frac{4S}{S^2 + 16}$

- **(D)** $\frac{4S}{S^2 + 25}$
- g. $L^{-1}\left\{\frac{5}{S+3}\right\}$ is equal to
 - **(A)** $3e^{-5t}$

(B) $5e^{3t}$

(C) $5e^{-3t}$

- **(D)** $3e^{5t}$
- h. The period of the function of $|\cos x|$ is equal to
 - (A) π

(B) 2π

(C) 3π

- **(D)** 4π
- i. If $\overrightarrow{a} = 3i + 2j + 9k$ and $\overrightarrow{b} = i + \lambda j + 3k$ are perpendicular to each other then λ is equal to
 - (A) 15

(B) 27

(C) -27

- **(D)** 15
- j. The voltage and current of a circuit are given by the complex number 3+4j and 2-5j respectively then complex number of the impedance of the circuit is equal to
 - (A) $\frac{14}{29} \frac{23}{29}$ j

(B) $\frac{7}{29} - \frac{15}{29}$ j

(C) $\frac{7}{29} + \frac{15}{29}$ j

(D) $\frac{-14}{29} + \frac{23}{29}$ j

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

Q.2 a. Evaluate
$$\lim_{x \to 0} \frac{\sin 2x + \sin 6x}{\sin 5x - \sin 3x}$$

(8)

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b. If f is a real function defined by $f(x) = \frac{x-1}{x+1}$ then prove that

$$f(2x) = \frac{3f(x) + 1}{f(x) + 3} \tag{8}$$

- Q.3 a. Find the volume of the right circular cone formed by the revolution of a right angled triangle about a side which contains the right angle. (8)
 - b. Find the length of the curve $y^2 = x^3$ from origin to the point (1, 1).
- Q.4 a. If n is a positive integer then show that $(\sqrt{3} + i)^n + (\sqrt{3} i)^n = 2^{n+1} \cos \frac{n\pi}{6}$ where $i = \sqrt{-1}$
 - b. A resistance of 20 ohms and inductance of 0.2 H and a capacitance of 100 μF are connected in series a cross 220 Volt, 50cycle/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/second 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 area of the triangle formed by the point whose position vectors are 3i+j, 5i+2j+k, i-2j+3k.
- **Q.6** a. Solve $\frac{d^2y}{dx^2} 6\frac{dy}{dx} + 9y = 6e^{3x} + 7e^{-2x} \log 2$ (8)
 - b. Solve $\frac{d^2y}{dx^2} + 9y = \sec 3x$ (8)
- **Q.7** a. Expand $f(x) = e^x$ in a cosine series over (0, 1)
 - b. Find the Fourier Series of the function (8)

$$f(t) = \begin{cases} 0 & \text{when} & -2 < t < -1 \\ K & " & -1 < t < 1 \\ 0 & " & 1 < t < 2 \end{cases}$$

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Q.8 a. Evaluate
$$L \left\{ te^{-t} \cosh t \right\}$$
 (8)

b. Evaluate
$$L \left\{ \int_{0}^{t} \frac{e^{t} \sin t}{t} dt \right\}$$
 (8)

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

b. Evaluate
$$L^{-1} \left\{ \log \frac{s+1}{s-1} \right\}$$
 (8)