ROLL NO. _____

Code: DE55/DC55 Subject: ENGINEERING MATHEMATICS - II

DipIETE – ET/CS

Time: 3 Hours **DECEMBER 2014** **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 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 $\underset{x\to 0}{Lim}\frac{\tan ax}{\tan bx}$ is

(A) $\frac{b}{x}$ **(B)** $\frac{a}{x}$

(C) $\frac{a}{b}$ **(D)** a.b

b. The value of $\int_0^{\pi/2} \sin^5 x.\sin^7 x dx$ is

(A) $\frac{230\pi}{2045}$ **(B)** $\frac{231\pi}{2048}$

(C) $\frac{232\pi}{2048}$ **(D)** $\frac{233\pi}{2040}$

c. The value of $\frac{(1+i)(2+i)}{3+i}$ in the form of (a + ib) is equal to

(A) $\frac{2}{3}+\frac{1}{2}i$ **(B)** $\frac{2}{3}-\frac{1}{2}i$

(C) $\frac{3}{4}-\frac{4}{5}i$ **(D)** $\frac{3}{5}+\frac{4}{5}i$

d. If $\vec{a}$ = i + 3j - 2k and b = i +3k, then $\left|\vec{a}\times\vec{b}\right|$ is

(A) $\sqrt{91}$ **(B)** $\sqrt{90}$

(C) $\sqrt{75}$ **(D)** $\sqrt{76}$

e. The value of λ for which the vectors $\vec{a} = 3i + 2j + 9k$ and $\vec{b} = i + \lambda j + 3k$ are parallel to each other is equal to

(A) - 2/3 **(B)** 1/2
(C) -1/2 **(D)** 2/3

f. If $\frac{d^2y}{dx^2} - 4y = x^2$, then C.F. is

(A) $e^{2x}(c_2 + c_1)$ **(B)** $e^{-2x}(c_1 + c_2)$
(C) $c_1 e^{2x} + c_2 e^{-2x}$ **(D)** $c_1 e^{x} + c_2 e^{-x}$

g. The fourier coefficient of $\int_{-\pi}^{\pi} \sin mx . \cos nx \, dx$ is equal to

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

h. The value of L [t sin 2t] is equal to

(A) $\frac{4s}{s^2 + 4}$ **(B)** $\frac{4s}{(s^2 - 4)^2}$

(C) $\frac{4s}{(s^2 + 4)^2}$ **(D)** $\frac{4s}{s^2 - 4}$

i. The value of L $\{t^3 e^{-2t}\}$ is equal to

(A) $\frac{6}{(s + 2)^2}$ **(B)** $\frac{6}{(s - 2)^2}$

(C) $\frac{6}{(s - 2)^4}$ **(D)** $\frac{6}{(s + 2)^4}$

j. The value of $L^{-1}\left\{\frac{s}{(s^2 + 1)^2}\right\}$ is equal to

(A) $\frac{1}{2}$ sin ht **(B)** $\frac{t}{2}$ sin ht

(C) $\frac{t}{2}\cos ht$ **(D)** $-\frac{1}{2}\sin ht$

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

Q.2 a. Evaluate $\lim_{x\to 0}\left(\frac{\cos Ax - \cos Bx}{x^2}\right)$ **(8)**

b. Expand e^x in powers of (x + 3). **(8)**

Q.3 a. Evaluate $\int_0^2 \sqrt{\frac{2+x}{2-x}}dx$ **(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. Separate into real and imaginary part of sec (x + iy) **(8)**

b. If two impedance $Z_1 = 50 \angle -40^0$ and $Z_2 = 70\angle 30^0$ are connected in series, find the total impedance in polar form. **(8)**

Q.5 a. If $\vec{a} = i + 2j - 3k$ and $\vec{b} = 3i - j + 2k$, show that $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are perpendicular to each other. Also find the angle between $2\vec{a}+\vec{b}$ and $\vec{a}+2\vec{b}$. **(8)**

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

Q.6 a. Solve the equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x.\sin x$ **(8)**

b. The deflection of a strut of length ℓ with one end (x = 0) build-in and the other supported and subjected to end thrust P, satisfies the equation

$$\frac{d^2y}{dx^2} + a^2y = \frac{a^2R}{P}(\ell - x)$$

Prove that the deflection curve is $y = \frac{R}{P}\left(\frac{\sin ax}{a} - \ell\cos ax + \ell - x\right)$, where $a\ell = \tan a\ell$ **(8)**

Q.7 a. Obtain the Fourier series to represent the function f(x) = $|x|$ for $-\pi < x < \pi$ and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \ldots$ **(8)**

b. Find the Fourier series for the function f(x) = x in the interval $[-\pi, \pi]$ **(8)**

Q.8 a. Find the Laplace transform of $e^{-t}(3 \sin t - \cos^2 t)$ **(8)**

b. Find the Laplace transform of $t \sin^2 t$ **(8)**

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

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