

3E1486

Roll No. : _____

Total Printed Pages : **4****3E1486**

B. Tech. (Sem. III) (Main/Back) Examination, January - 2012
Electrical Engg. (Common with Electrical & Electronics)
3EE6 Mathematics (Common with 3EE6.1 & 3EX1)

Time : **3 Hours**]

[Maximum Marks : **80**
 [Min. Passing Marks : **24**

Instructions to Candidates :

Attempt any five questions selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
 (Mentioned in form No. 205)

1. NIL2. NIL**UNIT - I**

1 (a) Find the Laplace transform of the following functions :

(i) $3 + 2t - 4t^3 + \cos 4t - 3e^{-2t}$

(ii) $\frac{1}{t}(1 - \cos t)$

8+8=16

(b) Find the inverse Laplace transform of the following functions :

(i) $\frac{1}{s^2} - \frac{2}{s+3} - \frac{1}{s^2+4}$

(ii) $\frac{s}{s^4+4a^4}$

8+8=16**OR**

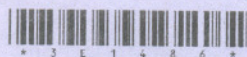
1 (a) Using Laplace transform technique to solve the following differential equation :

$$(D^2 + 9)y = \cos 2t, D \equiv \frac{d}{dt}$$

with $y(0) = 1, y\left(\frac{\pi}{2}\right) = -1$

8

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[Contd...

- (b) Solve the following partial differential equation by using Laplace transform technique

$$\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}, u = u(x, t)$$

with $u(0, t) = 0 = u(5, t)$ and $u(x, 0) = 10 \sin 4\pi x$.

8+8

UNIT - II

- 2 (a) Find the inverse Fourier sin transform of $\left\{ \frac{e^{-as}}{s} \right\}$ and hence

deduce $F_s^{-1} \left\{ \frac{1}{s} \right\}$.

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- (b) Solve the integral equation :

$$\int_0^{\infty} f(x) \cos sx dx = \begin{cases} 1-s, & \text{when } 0 \leq s \leq 1 \\ 0, & \text{when } s > 1 \end{cases}$$

8

OR

- 2 (a) Find the discrete Fourier transform of the sequence $\{1, 2, 3, 4\}$.
 (b) Solve the following partial differential equation by using Fourier transform technique :

$$\frac{\partial V}{\partial t} = \frac{\partial^2 V}{\partial x^2}$$

if

(i) $V_x(0, t) = 0$

(ii) $V(x, 0) = \begin{cases} x, & 0 \leq x \leq 1 \\ 0, & x > 1 \end{cases}$ and

(iii) $V(x, t)$ is bounded $x > 0, t > 0$

UNIT - III

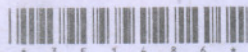
- 3 (a) Find the Fourier series of the function

$$f(x) = x + x^2$$

in the interval $(-\pi, \pi)$ and show that

$$\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \dots$$

6+2=8



- (b) Obtain the cosine series of $\sin x$ in the interval $0 < x < \pi$ 8

OR

- 3 (a) Find the external for the functional

$$\int_1^2 \frac{\sqrt{1+y'^2}}{x} dx \quad y(1)=0, y(2)=1$$

8

- (b) Find a function $y(x)$ for which $\int_0^1 (x^2 - y'^2) dx$ is stationary,

given that $\int_0^1 y^2 dx = 2, y(0) = 0, y(1) = 0$

8

UNIT - IV

- 4 (a) State and prove Cauchy-Riemann equations. 8

- (b) Find the bilinear transformation which maps the points $z = 1, i, -1$ respectively into the points $w = i, 0, -i$. For this transformation, find the image of $|z| \leq 1$.

5+3=8

OR

- 4 (a) Evaluate the integral

$$\int_0^{1+i} z^2 dz$$

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- (b) Evaluate : $\int_C \frac{(1-2z)}{z(z-1)(z-2)} dz$ where C is the circle $|z| = 2.5$.

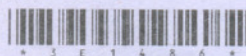
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UNIT - V

- 5 (a) Expand $\frac{z^2 - 4}{(z+1)(z+4)}$ in Laurent's series for the regions

(i) $|z| < 1$ (ii) $1 < |z| < 4$ (iii) $|z| > 4$

8



- (b) Find the poles of the following functions, find also the order of each poles :

(i) $\frac{1}{1+z^4}$ (ii) $\frac{1}{\sin z - \cos z}$

4+4=8

OR

- 5 (a) Find the residue of $\frac{z^2 - 2z}{(z+1)^2(z^2+4)}$ at all its poles in the finite plane.

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- (b) Prove that :

$$\int_{-\infty}^{\infty} \frac{x^2 - x + 2}{x^4 + 10x^2 + 9} dx = \frac{5\pi}{12}$$

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