

Roll No. _____

[Total No. of Pages : 4]

3E1646

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B.Tech .III Semester (Main/Back) Examination -2014

Electrical Engg.

3EE6A Advanced Engg. Mathematics - I

(Common to EE and EX)

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.)

Unit - I

1. a) Find the Laplace transform of the following: (3+5=8)
- i) $1-t^2 + e^{-t}$
- ii) $\sin\sqrt{t}$
- b) Find the inverse Laplace transform of $\frac{s}{s^4 + 4a^4}$ (8)

OR

1. a) Solve the following differential equation: $(D^2 + 3D + 2)y = 1, D \equiv \frac{d}{dt}$ with $y(0)=0,$
 $y'(0)=0$ (8)
- b) Solve the following differential equation: $\frac{\partial u}{\partial t} = 3 \frac{\partial^2 u}{\partial x^2}$

Boundary condition: $u\left(\frac{\pi}{2}, t\right) = 0, \left(\frac{\partial u}{\partial x}\right)_{x=0} = 0, u(x, 0) = 30 \cos 5x.$ (8)

Unit - II

2. a) Find the discrete Fourier transform of the sequence: $\{g_k\} = \{1, 0, -1\}$ (8)

b) Find the Fourier transform of the function $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$ and hence evaluate:

$$\int_0^{\infty} \frac{\sin s}{s} ds \quad (4+4=8)$$

OR

2. a) Find the Fourier sine and cosine transform of the function: $f(x) = x$ (4+4=8)

b) Solve the following partial differential equation: rtuonline.com

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

with $u_t(0, t) = 0, u(x, 0) = \begin{cases} x, & 0 \leq x \leq 1 \\ 0, & x > 1 \end{cases}$ and $u(x, t)$ is bounded and $x > 0, t > 0.$ (8)

Unit - III

3. a) Find a Fourier series for the function $f(x) = x \sin x, -\pi < x < \pi$ (8)

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

OR

3. a) Derive the following Euler-Lagrange's equation: $\frac{\partial f}{\partial y} - \frac{d}{dx} \left(\frac{\partial f}{\partial y'} \right)$

where $f = f(x, y, y')$ and $y' = \frac{dy}{dx}$ (8)

b) Find the external for the functional $\int_1^2 \frac{\sqrt{1+y'^2}}{x} dx$ with $y(1) = 0, y(2) = 1$ (8)

Unit - IV

4. a) Examine the nature of the function $f(Z) = \frac{x^3y(y-ix)}{x^6+y^2}$, $Z \neq 0$, $f(0) = 0$ in the region including the origin. (8)
- b) Find the bilinear transformation which maps the points $Z=1, i, -1$ into the points $W=i, 0, -i$. Hence find the image of $|Z| < 1$. (8)

OR

4. a) State and prove Cauchy's integral theorem. (8)
- b) Evaluate the following by using Cauchy's integral formula $\int_C \frac{e^{2z}}{(z+1)^4} dz$ where C is a circle $|Z|=3$ (8)

Unit - V

5. a) Expand the following function $\frac{1}{z(z^2-3z+2)}$ in Laurent's series for the regions
- $0 < |z| < 1$
 - $1 < |z| < 2$
 - $|z| > 2$ (2½+2½+3=8)

- b) Find the poles for the following functions

i) $\frac{1}{\sin z - \cos z}$

ii) $\frac{z^2}{(z+1)(z-2)^2}$

Also determine the order of each pole. (4+4=8)

OR

5. a) Evaluate the following integral by using residue theory: $\int_C \frac{1-2z}{z(1-z)(z-2)} dz$

$C: |z|=1.5$ rtuonline.com

(8)

b) Show that $\int_0^{2\pi} \frac{d\theta}{(5-3\sin\theta)^2} = \frac{5\pi}{32}$

(8)