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3E1616

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

Electronic Instrumentation & Control

3EI6 Advanced Engg. Mathematics-I

(Common to EC & EIC)

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

i) $t^2 e^t \sin t$

ii) $(t-1)^2 u(t-1)$ **(8)**

b) Solve the differential equation using Laplace transform method.

$$\frac{d^2y}{dt^2} + m^2 y = aC\cos nt$$

given $y(0) = y'(0) = 0$. **(8)**

OR

1. a) Find the inverse Laplace transform of **(8)**

i) $\frac{s}{s^4 + 4a^4}$

ii) $\log\left(\frac{s+1}{s-1}\right)$

b) Solve the partial differential equation using Laplace transform method.

$\frac{\partial^2 u}{\partial t^2} = 9\frac{\partial^2 u}{\partial x^2}$ Subject to

$u(0,t) = 0; u(2,t) = 0$. and $u(x,0) = 20\sin 2\pi x$, $u_t(x,0) = 0$ **(8)**

Unit - II

2. a) Obtain the Fourier series for the function $f(x)=x^2,\ -\pi<x<\pi$ and deduce the result

$$\frac{\pi^2}{8}=1+\frac{1}{3^2}+\frac{1}{5^2}+\ldots$$ **(8)**

b) Find the inverse Z-transform of

$$F(z)=\frac{1}{(z-5)^3},|z|>5$$ **(8)**

OR

2. a) Find half - range sine series for f(x) = x in $0 < x < 2$. **(8)**

b) Obtain the constant term and the first three cosine terms in the Fourier series for y, where the values of y are given by the following table.

x	0	1	2	3	4	5	6
y	4	8	15	7	6	2	4

(8)

Unit - III

3. a) Obtain the Fourier transform of

$$f(x)=x^2,\ for|x|\le a$$
$$=0\quad for|x|>a$$

(8)

b) Solve the boundary value problem for

$\frac{\partial u}{\partial t}=k\frac{\partial^2 u}{\partial x^2}$, using Fourier transform.

given $u(0,t)=u_0;t>0;$

$u(x,0)=0\ x>0\ and\ \frac{\partial u}{\partial x}\to 0$ and as

$x\to\infty,u\to 0$ **(8)**

OR

3. a) Find F(x), if its Fourier sine transform is $\frac{1}{s}e^{-as}$. Also show that $\overline{F}\left(\frac{1}{s}\right)=\sqrt{\frac{\pi}{2}}$ **(8)**

b) Find Fourier transform of $f(x)=\begin{cases}1 & |x|\le a\\ 0 & |x|>a\end{cases}$. and evaluate the integral

$$\int_{-\infty}^{\infty}\frac{\sin\lambda a\cos\lambda x}{\lambda}d\lambda$$

Deduce the value of $\int_0^{\infty}\frac{\sin\theta}{\theta}d\theta$ **(8)**

Unit - IV

4. a) Define the analytic function f(z) and determine it if

$f(z) = u + iv, where$

$u = e^{2x}(x\cos 2y - y\sin 2y)$ **(8)**

b) Show that the transformation $W = \frac{2z+3}{z-4}$ maps the circle $x^2+y^2-4x=0$ into straight line 4u+3=0 **(8)**

OR

4. a) Verify Cauchy's Theorem for $f(z)=z^3-iz^2-5z+2i$ if the contour C be the circle $|z-1|=2$ **(8)**

b) Evaluate $\int_c \frac{\cos \pi z}{z^2-1} dz$ around the rectangles with vertices.

i) $2 \pm i, -2 \pm i$

ii) Vertices at z = -i, z-i, z+i, i. **(8)**

Unit - V

5. a) Obtain the Laurent's series expansion of

$f(z) = \frac{e^z}{(z-1)^2}$ about z=1. **(8)**

b) Find the residue of $f(z) = \frac{z^2-2z}{(z+1)^2(z^2+4)}$ at the poles in the finite part of z-plane. **(8)**

OR

5. a) Obtain the Taylor's series expansion of

$f(z) = \frac{z^2-1}{(z+2)(z+3)}$ for the region $|z|<2$ **(8)**

b) Prove by contour integration

$\int_0^\infty \frac{\log(1+x^2)}{1+x^2} dx = \pi \log_e^2$ **(8)**
