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3E1486

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3E1486

B. Tech. (Sem. III) (Main & Back) Examination, January - 2013
Electrical Engg.
3EE6 Mathematics (Common with Electrical & Electronics (3EE6.1 & 3EX1)

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

*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. NIL 2. NIL

UNIT - I

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

(i) $\frac{1}{t}\sin at$

(ii) $t^2 \cup (t-3)$

(b) Using Laplace transform solve the equation $\left(D^2+m^2\right)y = a\cos mt,\ \ y = Dy = 0$ at $t=0$ where $D=\frac{d}{dt}$.

OR

1 (a) Find inverse Laplace transform of the function :

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

(ii) $\log\frac{s+3}{s+2}$

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(b) Solve : $\frac{\partial u}{\partial t} = 2\frac{\partial^2 u}{\partial x^2}$ $u(0\ t) = 0$

$u(5, t) = 0,\ u(x, 0) = 0 \sin 4\pi x$

UNIT - II

2 (a) Find the Fourier Cosine transform of $f(x)$ where

$$f(x) = \begin{cases} 1 & 0 \le x < a \\ 0 & x \ge a \end{cases}$$

Hence find the function whose Fourier cosine transform is $\frac{\sin as}{s}$.

(b) Solve the differential equation using Fourier cosine transform

$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}; x > 0,\ t > 0$ subject to the condition

$$u_x(0\ t) = 0,\quad u(x, 0) = \begin{cases} x & 0 \le x \le 1 \\ 0 & x > 1 \end{cases}$$

$u(x, t)$ is bounded with $x > 0,\ t > 0$.

OR

2 (a) Solve $f(x) = \begin{cases} \frac{2}{\pi} \sin x & \text{for } 0 \le x \le \pi \\ 0 & \text{for } x < 0 \end{cases}$ as a fourier sine integral

and hence evaluate $\int_0^\infty \frac{\sin \lambda x \sin \lambda\pi}{1 - \lambda^2} d\lambda$.

(b) Find the discrete Fourier transform of the sequence $\{d_n\} = \{0, 1, -1\}$.

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UNIT - III

3 (a) Find the Fourier series for $f(x) = x + x^2;\ -\pi < x < \pi$. Hence show that

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

(b) Obtain the expansion for y from the following table upto first harmonic

x:	0	1	2	3	4	5
y:	9	18	24	28	26	20

OR

3 (a) Find the half range cosine series for the function $f(x) = x(\pi - x)$.

(b) Find the path on which a particle in the absence of Friction will slide from one point to another fixed point not on the same vertical line, under gravity in the shortest time.

UNIT - IV

4 (a) If $f(z)$ be a regular function of z prove that

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2.$$

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

OR

4 (a) Evaluate $\int_C \frac{e^{tz}}{z^2+1} dz;\ t > 0$ where C is the contour $|z| = 3$.

(b) If $u = \cos x \cosh y$; find the analytic function $u + iv$.

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UNIT - V

5 (a) Expand $\frac{1}{z(z-1)(z-2)}$ as Laurent's series for

(i) $|z| > 2$

(ii) $|z-1| < 1$

(b) Determine the poles and residue at them for the functions :

(i) $f(z) = \frac{1+e^z}{\sin z + z\cos z}$

(ii) $f(z) = \frac{z\cos z}{\left(z-\frac{\pi}{2}\right)^2}$

OR

5 (a) Evaluate $\int_0^{\pi} \frac{a\,d\theta}{a^2+\sin^2\theta}$; $a > 0$.

(b) Expand $f(z) = \sin z$ in a Taylor's series about $z = \frac{\pi}{4}$.
