3E1626

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

Civil Engg.

3CE6(O) Advance Engg. Mathematics

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 Fourier series to represent $f(x) = x - x^2$ in the interval $-l < x < l$. **(8)**

b) Obtain the first three cosine terms and the constant term in the Fourier series for y, where

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

(8)

OR

1. a) Use convolution theorem to evaluate $Z^{-1}\left[\frac{z^2}{(z-a)(z-b)}\right]$. **(8)**

b) Obtain $Z[\sin n\theta], Z[\cos n\theta]$ and hence find $Z[a^n \sin n\theta]$ and $Z[a^n \cos n\theta]$. **(8)**

Unit - II

2. a) Find Inverse Laplace transform of:

$$\frac{s}{s^4 + 4a^4}$$ **(8)**

b) Use L.T. theory to solve:

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y = t; \text{ given } y(0) = -3, y(1) = -1.$$ **(8)**

OR

2\. a) If $L[f(t)] = \bar{f}(s)$, then prove that $L[t\,f(t)] = -\frac{d}{ds}\bar{f}(s)$. Hence, find the Laplace transform of: $t^2 \cos at$. **(8)**

b) Find the bounded solution $y(x,t)$, $0 < x < 1, t > 0$ of the boundary value problem.

$$\frac{\partial y}{\partial x} - \frac{\partial y}{\partial t} = 1 - e^{-t},\; y(x,0) = x$$ **(8)**

Unit - III

3\. a) Find *f(x)* if its Fourier sine transform is $\frac{1}{s}e^{-as}$. Hence deduce $F_s^{-1}\left[\frac{1}{s}\right]$. **(8)**

b) Use Fourier transform theory to solve:

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$ given that $u_x(0,t) = 0$ and $u(x,0) = \begin{cases} x, & 0 \le x \le 1 \\ 0, & x > 1 \end{cases}$, *u(x,t)* is bounded and $x>0,\ t>0$ **(8)**

OR

3\. a) Find the Fourier transform of:

$$f(x) = 1 - x^2, \quad |x| < 1$$
$$= 0, \quad |x| > 1$$ **(8)**

b) Use Fourier transform theory to solve:

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2},\; t > 0$$ given that $u(x,0) = f(x) = \begin{cases} u_0, & |x| < a \\ 0, & |x| > a \end{cases}$ **(8)**

Unit - IV

4\. a) Use Lagrange's formula to find *f(x)* from the following data.

x:	0	1	4	5
f(x):	4	3	24	39

(8)

b) A slider in a machine moves along a fixed straight rod. Its distance *x* (cm.) along the rod is given below for various values of time t (secs.).

t:	0	0.1	0.2	0.3	0.4	0.5	0.6
x:	30.28	31.43	32.98	33.54	33.97	33.48	32.13

Evaluate:

i) $\frac{dx}{dt}$ for t=0.1 and t=0.3.

ii) $\frac{dx}{dt}$ for t=0.5 and also $\frac{d^2x}{dt^2}$ for all above points. **(8)**

OR

4. a) Compute $u_{12.2}$ from the following data:

x:	10	11	12	13	14
$10^5 u_x$:	23967	28060	31788	35209	38368

State the formula used. Why? **(8)**

b) Evaluate Numerically $\int_0^1 \frac{dx}{1+x^2}$ using:

i. Simpson's $\frac{1}{3}$ rule and

ii. Simpson's $\frac{3}{8}$ rule. Find approximate value of π. **(8)**

Unit - V

5. a) Employ Picard's method to obtain correct to four places of decimals solution to the differential equation $\frac{dy}{dx} = x^2 + y^2$ with y=0 when x=0 for x=0.4 **(8)**

b) Solve by the modified Euler's method the differential equation: $\frac{dy}{dx} = y^2 - \frac{y}{x}$, given that $y=1$ when $x=1$ and determine y for $x=1.1(0.1)1.4$. **(8)**

OR

5. a) If $\frac{dy}{dx} = x + y^2$, use Runge-Kutta method to find an approximate value of y for $x=0.2$, given that $y=1$ when $x=0$ (h=0.1). **(8)**

b) Use Milne's Predictor-Corrector method to obtain y(0.4) for the following differential equation $\frac{dy}{dx} = 2e^x - y$, given that

x:	0	0.1	0.2	0.3
y:	2	2.01	2.04	2.09

(8)