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B.Tech. III Semester (Main/Back) Examination, Dec. - 2016

Civil Engineering

3CE6A Advanced Engg. Mathematics

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

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 for the function $f(x)=\frac{x(\pi^2-x^2)}{12}$ $in(-\pi,\pi)$

b) Find the inverse z - transform of $\frac{1}{(z-5)^3}$ $|z|>5$

OR

1. a) Find the Fourier series as for the second harmonic to represent the function given by table below :

x :	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0
$f(x)$:	2.34	3.01	3.69	4.15	3.69	2.20	0.83	0.51	0.88	1.09	1.19	1.64

b) Find the z- transform of $\{^{m+n}C_m\}$.

Unit - II

2. a) Using second shifting property find $L<f(t)>$ where

$$f(t)=\begin{bmatrix}\sin\left(t-\pi/3\right) & t>\pi/3 \\ 0 & t<\pi/3\end{bmatrix}$$

b) i) Define unit step function (Heaviside's function) and find the Laplace transform of unit step function.

ii) Find $L^{-1}\left\{\frac{1}{s^2+8s+16}\right\}$

OR

2. a) Prove $L\left\{\frac{\sin t}{t}\right\} = \tan^{-1}\frac{1}{s}$ and hence find $L\left\{\frac{\sin t}{t}\right\}$.

b) Solve $(D^2+9)y=\cos 2t$ where y(0) = 1, $y\left(\frac{\pi}{2}\right)=-1$.

Unit - III

3. a) Obtain the Fourier transform of

$$f(x)=\begin{cases} x^2 & |x|\le 9 \\ 0 & |x|>9 \end{cases}$$

b) Heat flow in an infinite bar with given initial temperature u(x ,t) is governed by

$\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$, $t>0, -\infty<x<\infty$ satisfy u(x,0) = f(x)

OR

3. a) Find the Fourier sine and cosine transform of $f(x)=e^{-x}$ $x\ge 0$ Also show that

$\int_0^\infty \frac{x\sin mx}{x^2+1}dx=\frac{\pi}{2}e^{-m}; m>0$ **rtuonline.com**

b) Use the method of Fourier transform to determine the displacement u(x ,t) of an infinite string, given that the string is initially at rest and the initial displacement is f(x), $-\infty<x<\infty$. show that the solution can be put in the form

$u(x,t)=\frac{1}{2}\left[f(x+(t))+f(x-(t))\right]$

Unit - IV

4. a) Evaluate

1) $\Delta \log x$

2) $\Delta-\nabla=\Delta\nabla$

b) The population of a country is the decimal censes were as under estimate the population for the year 1925

year (x) :	1891	1901	1911	1921	1931
Population (in thousands) f(x):	46	66	81	93	101

OR

4. a) Evaluate $\int_0^1 \frac{dx}{1+x}$ by using

   i) Simpson's 1/3

   ii) Simpson's 3/8

   Trapezoidal method

   b) Find the value of f(5) with the help of lagrange's interpolation formula. Given that

x	0	2	3	4	7
f(x)	2	4	8	16	128

Unit - V

5. a) Use Euler's modified method with cone step to obtain the value of y at x =0.1 when $\frac{dy}{dx} = x^2 + y$ with x = 0, y = 0.94

   b) Use Runge - Kutta fourth order method to solve

   $dy/dx = -2xy^2$, y(0) = 1 with h = 0.2 for x = 0.2 and 0.4

OR

5. a) Use Milne's predictor - corrector method to obtain y (0.4) for the following differential Equation. $dy/dx = 2e^x - y$ given that

x	0	0.1	0.2	0.3
y	2	2.01	2.04	2.09

   b) Apply Picard's method to find the solution of the differential equation

   $dy/dx = y - x$ with x = 0, y = 2 up to third order of approximation.

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