B.E. Mechanical Engineering (CBCS Pattern) Third Semester

ME 301 - Applied Mathematics - III

P. Pages : 2 **GUG/W/18/11516**

Time : Three Hours Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Use of non programmable calculator is permitted.

1. a) Find $L\left\{\frac{\cos at - \cos bt}{t}\right\}$ hence evaluate $\int_0^\infty \frac{\cos at - \cos bt}{t} dt$ **6**

b) Find $L\left\{\frac{d}{dt}\frac{\sin t}{t}\right\}$ **4**

c) Find $L\left\{\int_0^t t\,e^{-t}\sin 2t\,dt\right\}$ **6**

OR

2. a) Use convolution theorem to find $L^{-1}\left\{\frac{1}{(s-2)\,(s^2+1)}\right\}$ **8**

b) Solve by Laplace transform method **8**

$$\frac{d^2x}{dt^2} + \frac{dy}{dt} - 2y = 2(1+t-t^2) \text{ given that } x(0) = 1,\ x(\pi/2) = -1.$$

3. a) Find a real root of the equation $2x - 3\sin x - 5 = 0$ correct to four decimal places by false-position method. **8**

b) Solve by Gauss Seidal method. **8**

$2x - 3y + 20z = 25$

$20x + y - 2z = 17$

$3x + 20y - z = -18$

OR

4. a) Find a real root of the equation $\log_e x - \cos x = 0$ correct to four decimal places by Newton Raphson method. **8**

b) Solve the Crout's method **8**

$4x + y - z = 13$

$3x + 5y + 2z = 21$

$2x + y + 6z = 14$

5. a) Use Taylor's series method to solve $\frac{dy}{dx} = 2y + 3e^x,\ y(0) = 0$ find y for x = 0.1 and x = 0.2. **8**

b) Given $\frac{dy}{dx}=\sqrt{xy+1}$, $y(1)=1$ find y(1.2) taking h = 0.1 by using Euler's modified method. **8**

OR

6. a) Use Runge-Kutta method to find an approximate value of y when x = 0.4 given that $\frac{dy}{dx}=-2xy^2,\ y(0)=1$ taken h = 0.2. **8**

b) Given $\frac{dy}{dx}=x-\frac{1}{10}y^2,\ y(0)=1$ **8**

x	-0.1	0.1	0.2
y	1.0151	0.9951	1.0001

Use Milne's Prediction corrector method to find y(0.3) and y(0.4).

7. a) Solve $y^2p-xyq=x(z-2y)$ **4**

b) Solve $(3z-4y)p+(4x-2z)q=2y-3x$ **4**

c) Solve $(4D^2-4DD'+D'^2)z=16\log(x+2y)$ **8**

OR

8. a) Solve $(D^3-3DD'^2+2D'^3)z=\cos(x+2y)+e^y(2x+3)$ **8**

b) Solve by method of separation of variables $\frac{\partial u}{\partial x}=4\frac{\partial u}{\partial y}$ given that $\mu(0,y)=8e^{-3y}+4e^{-y}$. **8**

9. a) Obtain Fourier series for the function f(x) is given by **8**

$$f(x)=\begin{cases}1+\frac{2x}{\pi} & -\pi<x<0\\ 1-\frac{2x}{\pi} & 0<x<\pi\end{cases}$$

Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots\ldots$

b) Find a Fourier series for $f(x)=2x-x^2$, $0<x<2$. **8**

OR

10. a) Find a Fourier series for $f(x)=\begin{cases}0 & -\pi<x<0\\ x & 0<x<\pi\end{cases}$ **8**

Hence show that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots\ldots$

b) Obtain half range cosine series for f(x) where $f(x)=x-x^2$ for 0 < x < 1. **8**

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