

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015**  
**Civil Engineering**  
**(Computer Aided Structural Engineering)**  
**01CE6101 Advanced Numerical Methods**

Max. Marks : 60

Duration: 3 Hours

*Instructions:* Answer any two questions each from Part A, Part B and Part C. Questions in Part A and Part B carries 9 marks each and questions in Part C carries 12 marks each.

**PART A**

1. Solve the system by using Dolittle's method.

$$\begin{array}{lcl} 4x_1 + 2x_2 + x_3 & = 14 \\ 2x_1 + 4x_2 + 2x_3 & = 10 \\ x_1 + 2x_2 + 3x_3 & = 1 \end{array}$$

2. Solve by equations by Gauss- Seidel iteration method

$$\left[ \begin{array}{cccc} 5 & 0 & 1 & 1 \\ -2 & 4 & 0 & 1 \\ 1 & 2 & 6 & 0 \\ 0 & 1 & 2 & 5 \end{array} \right] \left\{ \begin{array}{c} x_1 \\ x_2 \\ x_3 \\ x_4 \end{array} \right\} = \left\{ \begin{array}{c} 25 \\ -25 \\ -35 \\ 10 \end{array} \right\}$$

3. Find all the eigen values and eigen vectors of the matrix using Jacobi's method.

$$A = \begin{pmatrix} 2 & 3 & 1 \\ 3 & 2 & 2 \\ 1 & 2 & 1 \end{pmatrix}$$

### PART B

4. Obtain the cubic spline approximation of the given data and find  $y(1.5)$  and  $y'(3)$ .

X:	1	2	3	4
Y:	1	5	11	8

5. Given that

x :	4	4.2	4.4	4.6	4.8	5.0	5.2
logx :	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

Evaluate  $\int_4^{5.2} \log x \, dx$  by Simpson's 1/3-rule, Simpson's 3/8-rule and Weddle's rule.

Also find the error in each case.

6. Solve the following by Euler's modified method

$$\frac{dy}{dx} = x + \sin y, y(0) = 1, \text{ compute } y(0.2) \text{ and } y(0.4) \text{ with } h=0.2$$

### PART C

7. Determine the values of  $y$  at the pivotal points of the interval  $(0,1)$  if  $y$  satisfies the boundary value problem  $y''+81y=81x^2$ ,  $y(0)=y(1)=y''(0)=y''(1)=0$ . Take  $n=3$

8. a) Explain Schmidt method for solving partial differential equations. (3 marks)

- b) Solve the Poisson's equation  $u_{xx} + u_{yy} = -81xy$ , for  $0 < x < 1$ ,  $0 < y < 1$ . Given that  $u(0,y)=0$ ,  $u(x,0)=0$ ,  $u(1,y)=100$ ,  $u(x,1)=100$  and  $h=1/3$  (9 marks)

9. Find the values of  $u(x,t)$  satisfying the parabolic equation  $u_t = 4u_{xx}$  under the conditions  $u(0,t) = u(8,t) = 0$  and  $u(x,0) = \frac{1}{8}x^2$ ,  $t=1, \dots, 7$  and  $t=j/8$ :

$j=0, 1, 2, \dots, 5$ .

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