No. of Pages: 2

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017

Branch: Civil Engineering

Stream: Structural Engineering

01CE6101 Advanced Numerical Methods

Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours

PART A

1. a. Find the relative error if the number X= 0.0006987 is

   (i) Truncated to four decimal digits
   (ii) Rounded off to four decimal digits — 2

   b. Solve the equations using Gauss Elimination method — 7

   $p+2q+3r-s=5$

   $2p+3q-3r-s=1$

   $2p-q+2r+3s=6$

   $3p+2q-4r+3s=4$

2. a. Write a note on Ill conditioned systems — 2

   b. Solve the equations by Gauss-Seidel iteration method — 7

   $20x+y-2z=17$

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

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

3. a. Write a note on Jacobi's method to find eigen values. — 2

   b. Find the largest eigen value and eigen vector of the matrix — 7

$$\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$$

PART B

4. The voltage v across a capacitor at time t seconds is given by the following table: 9

t :	0	2	4	6	8
v :	150	63	28	12	5.6

Use the method of least squares to fit a curve of the form $v = ae^{kt}$ to this data.

5. A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Simpson's 1/3 rd rule, find the velocity of the rocket at t = 80 seconds. 9

t (sec)	0	10	20	30	40	50	60	70	80
f(cm/sec²)	30	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

6. Using Runge-Kutta method of order 4, find y for x = 0.1, 0.2, 0.3, given that $dy/dx = xy+y^2$, y(0) = 1. Continue the solution at x = 0.4 using Milne's method. 9

PART C

7. a. Explain i) Collocation method and ii) Galerkin's method 3

   b. Solve the boundary value problem $y''-64y + 10 = 0$ with y(0)=y(1)=0 by the finite difference method. Take n=4 and find y(0.5). 9

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

   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

9. a. Solve the boundary value problem $u_t = u_{xx}$ under the conditions u(0,t) = u(1,t) and $u(x,0) = \sin \pi x$, $0 \le x \le 1$ using Schmidt method (Take h=0.2 and α=0.5) 12