Q. Code: 922886

Reg. No.

M.E. / M.TECH. DEGREE EXAMINATIONS, DEC 2019

First Semester

MA16183 – ADVANCED NUMERICAL METHODS

(Internal Combustion Engineering)

(Regulation 2016)

Time: Three Hours **Maximum : 100 Marks**

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	State the condition for convergence of Newton-Raphson method.	1	R
2.	Solve the system of equation by Gauss elimination method $3x + y = 2,\ x + 3y = -2$	1	AP
3.	Write Adams-Bash forth predictor-corrector method for solving the initial value problem.	2	R
4.	Using R.K.method of second order, compute y(0.1) from $y' = \frac{1}{2}(1+x)y^2, y(0) = 1$	2	AP
5.	State Neumann conditions.	3	R
6.	What are the explicit and implicit schemes to solve parabolic PDE.	3	U
7.	Classify the PDE $f_x - f_{yy} = 0$	4	U
8.	Write the standard five point formula for solving the Laplace equation.	4	R
9.	Explain orthogonal collocation method.	5	U
10.	Define Conforming elements.	5	R

PART B - (5 X16 = 80 Marks)

					CO	RBT
11.	(a)	(i)	Solve the system of linear equation using Gauss Seidel method $10x - 5y - 2z = 3; 4x - 10y + 3z = -3; x - 6y + 10z = -3$	(8)	1	AP
		(ii)	Solve the following equation by Gauss Elimination method $2x - 6y + 8z = 24; 5x + 4y - 3z = 2; 3x + y + 2z = 16$	(8)	1	AP
	(OR)					
	(b)		Use Faddeev's method to find the eigen values of the matrix $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & 1 \\ 1 & -1 & 2 \end{pmatrix}$ and hence find its inverse.	(16)	1	AP

12.	(a)		Solve the initial value problem $y' = y + x, y(0) = 1$ at $x = 0.2, 0.4$ with h=0.2. Use Runge Kutta method of 4th order.	**(16)**	**2**	**AP**
			(OR)			
	(b)	(i)	Using shooting technique solve the boundary value problem $y'' = y, \quad y(0) = 0, y(1) = 1.17$. Compare the solution with exact solution.	**(8)**	**2**	**AP**
		(ii)	Using Orthogonal collocation method solve the BVP: $y'' + y + x = 0$, $y(0) = 0 = y(1)$	**(8)**	**2**	**AP**
13.	(a)	(i)	Solve $u_{xx} = u_t$ in $0 < x \le 5$, t > 0 given that u(x,0) = sinπx, u(0,t) = 0, u(1,t) = 0 using Bender Schmidt method by taking h=0.2.	**(8)**	**3**	**AP**
		(ii)	Solve $u_{xx} = u_t$ given that u(x,0) = 0, u(0,t) = 0, u(1,t) = t. Compute u for one time step with h = ¼ and k =1/16 by Crank Nicholson method.	**(8)**	**3**	**AP**
			(OR)			
	(b)		Approximate the solution to the wave equation $u_{xx} = u_{tt}$, u(0,t) = 0, u(5,t) = 0, t > 0, u(x,0) = $x^2(5 - x)$ and $u_t(x,0) = 0,\ 0 \le x \le 5$ with $\Delta x = 1$ and $\Delta t = 0.25$ for up to t=2.	**(16)**	**3**	**AP**
14.	(a)		Solve $\nabla^2 u = 8x^2y^2$ for the square mesh given $\boldsymbol{u} = 0$ on the 4 boundaries dividing the square into 16 sub squares of length 1 unit.	**(16)**	**4**	**AP**
			(OR)			
	(b)		Solve $u_{xx}+u_{yy}=0$ in $0 \le x \le 4, 0 \le y \le 4$ given that $u(0,y) = 0, u(4,y) = 12 + y, u(x,0) = 3x, u(x,4) = x^2$ Take $h=k=1$ and obtain the result correct to three decimal places.	**(16)**	**4**	**AP**
15.	(a)		Obtain one parameter approximate solution of BVP $\nabla^2 u = x^2 - 1$, for $\lvert x\rvert \le 1, \lvert y\rvert \le \frac{1}{2}$, $u = 0$ on the boundary by collocation method.	**(16)**	**5**	**AP**
			(OR)			
	(b)		Obtain a one parameter approximate solution of the BVP $\nabla^2 u = -1$ $\lvert x\rvert \le 1, \lvert y\rvert \le 1$, $u = 0$ on the boundary using Galerkin finite element method.	**(16)**	**5**	**AP**