Reg No.										

B. E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, April 2014

CIVIL Engineering

(Common to Geo-inf. Engg., Agri & Irr. Engg., E&I Engg., Rubber and Plastic Tech., Chemical Engg., Textile Tech., and Leather Tech.)

FOURTH SEMESTER

MA 8353 NUMERICAL METHODS.

(REGULATION 2012)

Time: 3 Hours. **Answer All questions** Max. Mark:100

PART-A **(10 X 2 = 20)**

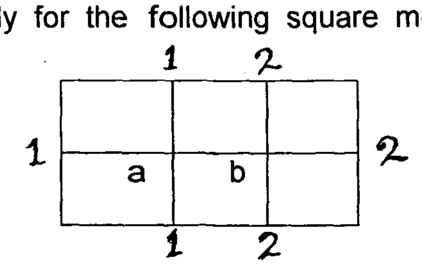
1. Solve the system of equations $3x+2y=9$, $5x-y=2$ by Gaussian elimination method.
2. Find all eigenvectors of the matrix $\begin{bmatrix} 2 & -3 \\ -3 & 2 \end{bmatrix}$, by Jacobi's method.
3. Form the Newton's divided difference table for the following data:

$$\begin{array}{cccccc} x: & 0 & 1 & 2 & 4 & 5 \\ y: & 1 & 14 & 15 & 5 & 6 \end{array}$$

4. Fit a polynomial from the following data using Newton's backward difference interpolation formula:

$$\begin{array}{ccccc} x: & 1 & 3 & 5 & 7 \\ y: & 5 & 9 & 21 & 41 \end{array}$$

5. Write down the formula to get $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ using Newton's forward difference at $x=x_0$.
6. State the order of error in the trapezoidal rule and Simpson's one third rule.
7. Given $y'=x^2+y$, $y(0)=1$, by using Euler's method find $y(0.1)$ and $y(0.2)$.
8. State Adam-Bashforth predictor-corrector formulae.
9. State implicit Crank-Nicolson's finite difference scheme for $\frac{\partial u}{\partial t}=a^2\frac{\partial^2 u}{\partial x^2}$.
10. Solve $\nabla^2 U=0$ numerically for the following square mesh with boundary values as shown in figure.



PART – B **(5 X 16 = 80)**

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(i) Solve, by finite difference method, the boundary value problem $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{3x}$, where $y(0) = 0$ and $y(1) = -2$, taking $h = 0.25$. (Correct to 4 decimal places). **(8)**

(ii) Solve $16u_{xx} - u_{tt} = 0$ for u at the pivotal points, given $u(0, t) = u(4, t) = 0$, $u_t(x,0) = 0$ and $u(x,0) = x(4 - x)$ for half of the period of vibration. (taking $h = 0.5$ and $k = 0.125$). **(8)**

12.a)(i) Find a real root of the equation $\cos x = 3x - 1$ correct to 3 decimal places by fixed point iteration method. **(8)**

(ii) Solve the given system of equations by Gauss-Seidel method **(8)**

$$x + 6y - 2z = -1$$
$$5x - 2y + z = -4.$$
$$3x + y + 5z = 13$$

OR

b)(i) Find, by Newton-Raphson method, the real root of $e^x - 2x - 1 = 0$ correct to 4 decimal places. **(8)**

(ii) Using Gauss-Jordan method, find the inverse of the matrix **(8)**

$$\begin{bmatrix} 2 & 4 & 3 \\ 0 & 1 & 1 \\ 2 & 2 & -1 \end{bmatrix}.$$

13.a)(i) Find the interpolating polynomial for the following data, using Lagrange's formula:

x	1	3	4	6
$f(x)$	0	22	57	205

Hence find $f(5)$. **(8)**

(ii) Fit a curve $y = ax^b$ to the following data, by the method of least squares, and estimate the value of y when $x = 3.5$ **(8)**

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

OR

b) Obtain the cubic spline approximation for the function $y = f(x)$ from the following data, given that $y_0'' = y_3'' = 0$,

$x: \ -1 \quad 0 \quad 1 \quad 2$

$y: \ -1 \quad 1 \quad 3 \quad 35$

Hence find $f(0.5)$ and $f(1.5)$. **(16)**

14.a)(i) Find the values of $f'(8)$ and $f''(9)$ from the following table, using divided difference interpolation formula:

x	4	5	7	10	11
$f(x)$	48	100	294	900	1210

(8)

(ii) Find the approximate value, correct to 4 decimal places, of $I = \int_0^1 \frac{dx}{1+x}$ using Trapezoidal rule with $h = \frac{1}{2}, \frac{1}{4}, \frac{1}{8}$ and then Romberg's method. **(8)**

OR

b)(i) Using three point Gaussian quadrature formula, evaluate $I = \int_1^2 \frac{dx}{1+x^2}$. **(6)**

(ii) Numerically evaluate $\int_0^1 \int_0^1 \frac{dx\,dy}{3-x^2-y^2}$ by taking $\Delta x = \Delta y = 0.25$, using Simpson's 1/3 rule, give the value correct to 4 decimal places. **(10)**

15.a)(i) Using Taylor's series method, compute $y(0.2)$ correct to 4 decimal places given $\frac{dy}{dx} = 1 - xy$ and $y(0) = 0$, taking $h = 0.1$. **(8)**

(ii) Using fourth order Runge-Kutta method, solve $\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y^2 = 0$ for $x = 0.2$ correct to 4 decimal places with initial conditions $y(0) = 1, \quad y'(0) = 0$, taking $h = 0.2$. **(8)**

OR

b) Find $y(0.2)$ by Euler's modified method and $y(0.3)$ by fourth order Runge-kutta method, given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$, $y(0.1) = 1.1169$ and then find the value of $y(0.4)$ by using Milne predictor-corrector method, correct to 4 decimal places. **(16)**

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