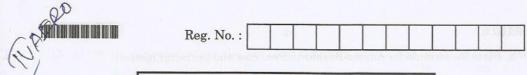
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# Question Paper Code: 41316

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018 Fourth/Fifth/Sixth/Seventh Semester Civil Engineering MA 6459 – NUMERICAL METHODS

(Common to Aeronautical Engineering/Agriculture Engineering/Electrical and Electronics Engineering/Electronics and Instrumentation Engineering/ Geoinformatics Engineering/Instrumentation and Control Engineering/ Manufacturing Engineering/Mechanical and Automation Engineering/ Petrochemical Engineering/Production Engineering/Chemical Engineering/ Chemical and Electrochemical Engineering/Handloom and Textile Technology/ Petrochemical Technology/Plastic Technology/Polymer Technology/Textile Chemistry/Textile Technology)

(Regulations 2013)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions.

PART - A

(10×2=20 Marks)

- 1. What is the condition for convergence and the order of convergence of Newton Raphson method?
- 2. Why Gauss-Seidel method is better than Gauss-Jordan method?
- 3. When to use Newton's forward interpolation and when to use Newton's backward interpolation formula?
- 4. Find the first and second divided differences with arguments a, b, c of the function  $f(x) = \frac{1}{x} \, .$
- 5. Write the formula for y'(x) and y"(x) using Newton's backward differences.
- 6. Evaluate  $\int_{1}^{1} \frac{dx}{1+x^2}$  by two point Gaussian formula.
- 7. What are multi-step methods? How are they better than single step method?

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12. a) i) Use Lagrange's interpolation formula to fit a polynomial to the given data

ii) the numerical solution of the given system.

$$f(-1) = -8$$
,  $f(0) = 3$ ,  $f(2) = 1$  and  $f(3) = 2$ . Hence find the value of  $f(1)$ . (8)

ii) Find the value of tan 45° 15' by using Newton's forward difference interpolation formula for  $\,$ 

$$x^{\circ}$$
: 45 46 47 48 49 50   
 $\tan x^{\circ}$ : 1.00000 1.03553 1.07237 1.11061 1.15037 1.19175 (8)

(16)

b) Fit the cubic spline for the data:

x : 0 1 2 3
f(x): 1 2 33 244

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#### 41316 From the following table of values of x and y, obtain y'(x) for x = 1615 4.583 4.796 3.873 4.359 ii) Using Romberg's method, evaluate $\int_{0}^{1} \frac{dx}{1+x}$ with step size 0.5, 0.25 and 0.125 (10)correct to three decimal places. (OR) b) i) Find the first derivative of f(x) at x = 2 for the data f(-1) = -21, f(1) = 15, f(2) = 12 and f(3) = 3, using Newton's divided difference formula. (8) ii) Evaluate $\int_{1}^{2.5} \left| \int_{1}^{4.5} \frac{1}{xy} dx \right|$ dy by Simpson's one-third rule with h = 0.2 and (8)14. a) i) Find the values of y at x = 0.1 given that $\frac{dy}{dx} = x^2 - y$ , y(0) = 1 by modified (8) ii) Find the value of y at x = 0.1, given that $\frac{dy}{dx} = x^2 - y$ , y(0) = 1 by Taylor's (8)series method. b) Given $\frac{dy}{dx} = xy + y^2$ , y(0) = 1, y(0.1) = 1.1169 and y(0.2) = 1.2774, find i) y(0.3)by Runge-Kutta method of fourth order and ii) y(0.4) by Milne's method. (16)15. a) i) Solve the boundary value problem y" = xy subject to the conditions y(0) + y'(0) = 1, y(1) = 1, taking $h = \frac{1}{3}$ , by finite difference method. (8) $ii) \ \ Solve \ \frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}, \ 0 < x < 1, \ t > 0 \ given \ u(x,0) = 0, \\ \frac{\partial u}{\partial t}(x,0) = 0, \ u(0,t) = 0 \ \ and \ \ u(x,0) = 0, \ u(0,t) = 0 \ \ and \ \ u(x,0) = 0, \ u(0,t) = 0 \ \ and \ \ u(x,0) = 0, \ u(0,t) = 0 \ \ and \ \ u(x,0) = 0, \ u(0,t) = 0 \ \ and \ \ u(x,0) = 0, \ u(0,t) = 0 \ \ and \ \ u(x,0) = 0, \ u(0,t) = 0 \ \ and \ \ u(x,0) = 0, \$ $u(1, t) = 100 \sin \pi t$ . Compute u(x, t) for four times steps with h = 0.25. (8) b) Solve the Laplace equation over the square mesh of side 4 units, satisfying the (16)boundary conditions: $u(0, y) = 0, u(4, y) = 12 + y, 0 \le y \le 4$ $u(x, 0) = 3x, u(x, 4) = x^2, 0 \le x \le 4.$