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337455(37)

BE (4th Semester)
Examination, Nov.-Dec., 2017
(New Scheme)

Numerical Analysis and Computer Programming (C & C++)

Time Allowed : 3 hours *Maximum Marks* : 80
Minimum Pass Marks : 28

Note : (*i*) Part *(a)* is compulsory from each question. Attempt any **two** parts from *(b)*, *(c)* and *(d)*.

(*ii*) The figures in the right-hand margin indicate marks.

UNIT—I

1. *(a)* Define truncation error and rounding error. [2]

(b) Obtain the root of the following equation :

$$f(x) = x^3 - 4x - 9 = 0$$

Find the root for permissible error of 0·02. [7]

(c) Find the real root of the equation $x^3 + 2x - 5 = 0$ by applying Newton-Raphson method at the end of the fifth iteration. [7]

(d) Solve the following system of equations using Gauss-Seidel method : [7]

$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$
$$27x + 6y - z = 85$$

UNIT—II

2. *(a)* Determine : $\Delta f(x)$ for $f(x) = x^3 - 2x + 5$ with $h = 1$. [2]

(b) For the following data, calculate forward differences and obtain the forward difference polynomial. Interpolate this polynomial at $x = 0{\cdot}25$: [7]

x	0·1	0·2	0·3	0·4	0·5
$y = f(x)$	1·40	1·56	1·76	2·00	2·28

(c) Predict the mean radiation dose at an altitude of 3000 feet by fitting an exponential curve to the given data : [7]

Altitude (x)	50	450	780	1200	4400	4800	5300
Dose of radiation (y)	28	30	32	36	51	58	69

(d) State and derive Newton's forward interpolation formula. [7]

UNIT—III

3. *(a)* Write the principle of trapezoidal rule. [2]

(b) A curve is drawn to pass through the points given by the following table :

x	1	1.5	2	2.5	3	3.5	4
y	2	2.4	2.7	2.8	3	2.6	2.1

Estimate the area bounded by the curve, the x-axis and ordinates $x = 1$, $x = 4$. [7]

(c) Calculate

$$\int_0^{\pi/2} e^{\sin\theta} d\theta$$

by Simpsons $\frac{1}{3}$th rule for interval $\left[0, \frac{\pi}{2}\right]$ in 4 equal parts. [7]

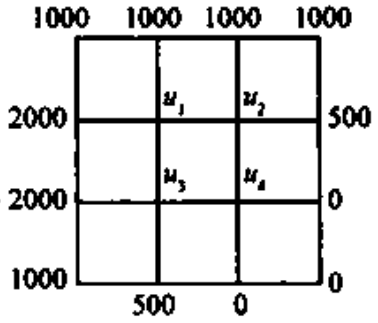
(d) Using Runge-Kutta method, solve $y'' = xy^2 - y^2$ for $x = 0{\cdot}2$ correct to 4 decimal points. Initial conditions are $x = 0$, $x = 1$, $y' = 0$. [7]

UNIT—IV

4. *(a)* Classify the equation

$$\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$$ [2]

(b) Given the values of $u(x, y)$ on the boundary of the square in the figure, evaluate the function $u(x, y)$ satisfying the Laplace equation $\nabla^2 u = 0$ at the pivotal points of this figure by Jacobi's method : [7]



(c) Solve the Poisson equation

$$u_{xx} + u_{yy} = -81xy,$$

$$0 < x < 1; \quad 0 < y < 1$$

given that

$u(0, y) = 0$; $u(x, 0) = 0$

$u(1, y) = 100$; $u(x, 1) = 100$

and $h = \frac{1}{3}$ [7]

(d) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial^2 x^3}$ in

$0 < x < 5$; $t \geq 0$

given that $u(x, 0) = 20$;

$u(0, t) = 0$;

$u(5, t) = 100$

Compute the u for the time-step with $h = 1$ by Crank-Nicholson method. [7]

UNIT—V

5. *(a)* What are keywords? [2]

(b) Explain 'switch', 'for', 'while' and 'do-while' statements. [7]

(c) Describe different data types in 'C'. [7]

(d) Write a 'C' program to get the solution by using Runge-Kutta method. [7]