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18CV752

Seventh Semester B.E. Degree Examination, Feb./Mar.2022

Numerical Methods and Applications

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Missing data may be suitably assumed.***

Module-1

1 a. Find the real root of the equation, $\cos x = 3x - 1$ correct to three decimal places using iteration method. **(10 Marks)**

b. Solve the system of linear equations by using Gauss elimination method,

$$4x_1 + 2x_2 + 3x_3 = 4$$
$$2x_1 + 2x_2 + x_3 = 6$$
$$x_1 - x_2 + x_3 = 0$$

(10 Marks)

OR

2 a. Using Newton-Raphson method, find the real root of $x\log_{10} x = 1.2$ correct to five decimal places. **(10 Marks)**

b. Solve the following set of linear equations by Gauss-Seidel method.

$$10x_1 + x_2 + x_3 = 12$$
$$2x_1 + 10x_2 + x_3 = 13$$
$$2x_1 + 2x_2 + 10x_3 = 14$$

Carryout five iterations. **(10 Marks)**

Module-2

3 a. Using Lagrange's interpolation formula, find a polynomial which passes through the points (0, -12), (1, 0), (3, 6), (4, 12). **(05 Marks)**

b. Using Lagrange's interpolation formula, find the value of 'y' corresponding to x = 10 from the following table: **(05 Marks)**

x	5	6	9	11
y = f(x)	12	13	14	16

c. The values of sinx are given below for different values of x. Find the value of $\sin 32^\circ$ using Newton's forward interpolation formula. **(10 Marks)**

x =	30°	35°	40°	45°	50°
y = sin x	0.5	0.5736	0.6428	0.7071	0.7660

OR

4 a. Use Newton's divided difference formula and evaluate f(6) given,

x	5	7	11	13	21
f(x)	150	392	1452	2366	9702

(10 Marks)

b. The following data gives the melting point of an alloy of lead and zinc, where t is the temperature in degrees C and P is the percentage of lead in the alloy. Find the melting point of the alloy containing 84% lead. Use Newton's backward difference formula.

P	40	50	60	70	80	90
t	184	204	226	250	276	304

(10 Marks)

Module-3

5 a. Find the value of $\int_0^1 \frac{dx}{1+x^2}$, taking 5 sub intervals by trapezoidal rule. Correct to five significant figures. Also compare it with its exact value. **(10 Marks)**

b. Evaluate $\int_2^3 \frac{\cos 2x}{1+\sin x}$ by using Gauss quadrature three point formula. **(10 Marks)**

OR

6 a. The velocity of a train which starts from rest is given by the following table Table Q6 (a). Estimate approximately the total distance run in 20 minutes using Simpson's $\frac{1}{3}^{rd}$ rule. **(10 Marks)**

t(min)	2	4	6	8	10	12	14	16	18	20
v(km/hr)	16	28.8	40	46.4	51.2	32	17.6	8	3.2	0

Table Q6 (a)

b. Evaluate the integral $I = \int_0^{0.2}\int_0^{0.2} e^y \sin x \, dx \, dy$ by,

(i) Trapezoidal rule with $h = k = 0.2$ and

(ii) Simpson's $\frac{1}{3}^{rd}$ rule with $h = k = 0.1$ **(10 Marks)**

Module-4

7 a. Find by Taylor's series method, the values of y at x = 0.1 and x = 0.2 to five places of decimals from $\frac{dy}{dx} = x^2 y - 1$, $y(0) = 1$. **(10 Marks)**

b. Given $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$ and $y(0) = 1$, $y(0.1) = 1.06$, $y(0.2) = 1.12$, $y(0.3) = 1.21$. Evaluate y(0.4) by Milne's predictor corrector method. **(10 Marks)**

OR

8 a. Solve by Euler's method the following differential equation at $x = 0.1$, correct to four decimal places, with the initial condition y(0) = 1, h = 0.02, $\frac{dy}{dx} = \frac{y-x}{y+x}$. **(10 Marks)**

b. Using Runge-Kutta method of order 4, find 'y' for x = 0.1, 0.2 given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$. **(10 Marks)**

Module-5

9 The deflection of a beam is governed by the equation $\frac{d^4y}{dx^4}+81y=\phi(x)$, where f(x) is given by the table,

x	$\frac{1}{3}$	$\frac{2}{3}$	1
$\phi(x)$	81	162	243

and boundary condition $y(0)=y'(0)=y''(1)=y'''(1)=0$. Evaluate the deflection at the pivoted points of the beam using three sub-intervals. **(20 Marks)**

OR

10 a. Solve the equation $\frac{\partial u}{\partial y}=\frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x,0)=\sin \pi x$, $0 \le x \le 1$; $u(0,t)=0$, $u(1,t)=0$, using Crank-Nicolson method. Carryout computations for two levels, taking $h=\frac{1}{3}$, $K=\frac{1}{36}$. **(10 Marks)**

b. Find the solution of the initial boundary value problem, $\frac{\partial^2 u}{\partial t^2}=\frac{\partial^2 u}{\partial x^2}$, $0 \le x \le 1$; subject to the initial conditions $u(x,0)=\sin \pi x$, $0 \le x \le 1$, $\left(\frac{\partial u}{\partial x}\right)(x,0)=0$, $0 \le x \le 1$ and the boundary conditions $u(0,t)=0$, u(1, t) = 0, t > 0, by using in the explicit scheme. Take h = K = 0.2. **(10 Marks)**

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