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UNIVERSITY EXAMINATIONS 2023/2024

THIRD YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING, BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING AND BACHELOR OF TECHNOLOGY IN ELECTRICAL AND ELECTRONIC ENGINEERING AND
THIRD YEAR, FIRST TRIMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING
AND
THIRD YEAR, THIRD TRIMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING

SME 3350: NUMERICAL METHODS

DATE: APRIL 2024 **TIME: 2 HOURS**

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

a) Find by the iterative method, the root near 3.8 of the equation $2x - logx = 7$correct to 4 decimal places. (6 Marks)

b) If $\pi = \frac{22}{7}$ is proximal as 3.14. Determine

i. Absolute Error (1 Mark)

ii. Relative Error (2 Marks)

iii. Relative percentage Error (2 Marks)

c) Given the equation $x^5 - 5 = 0$, deduce the New tonian Iterative formula.

$X_{n+1} = \frac{1}{5}\left(4x_n + \frac{N}{X_n^4}\right)$. (5 Marks)

d) Evaluate $\Delta^2 e^x$ (4 Marks)

e) The table below shows values of a polynomial of degree 5. It is given that $f(3)$ is in error. Correct the error.

x	0	1	2	3	4	5	6
y	1	2	33	254	1054	3126	7777

(5 Marks)

f) A rod is rotating in a plane about one of its, the table below gives the ang θ radians through which the rod has turned for different values of time t seconds. Find the angular velocity at $t = 0.7$ seconds.

t seconds	0.0	0.2	0.4	0.6	0.8	1.0
θ Radians	0.0	0.12	0.48	1.10	2.0	3.2

(5 Marks)

QUESTION TWO (20 MARKS)

a) Evaluate the values of the integral

$I = \int_0^{\pi/2} \sqrt{1 - 0.162 \sin^2 \phi} d\phi$ with n=12, by a use of an appropriate Numerical method.

(10 Marks)

b) Given that $log_{10}(654) = 2.8156, log_{10}(658) = 2.8182, log_{10}659 = 2.8189, log_{10}(661) = 2.8202$, find the value of $log_{10}(656)$by use of Lagrange method. (10 Marks)

QUESTION THREE (20 MARKS)

a) i. Apply Newton's forward difference formula and find the value of sin 52^0 following data.

x	45^0	50^0	55^0	60^0
$Y = Sinx$	0.7071	0.7660	0.8192	0.8666

(7 Marks)

ii. Estimate the absolute Error (3 Marks)

b) Interpolate the missing entries in the table below.

x	1	2	3	4	5
$Y = f(x)$	-	8	15	-	35

(10 Marks)

QUESTION FOUR (20 MARKS)

a) Solve $xtanx = -1$ by regular falsi method starting with 2.5 and 3.0 as the initial approximation to the root . give answer to 3 decimal places. (10 Marks)

b) Find the maximum and minimum values of $y = f(x)$ from the following data

x	6	1	2	3	4	5
$Y = f(x)$	0	0.25	0	2.25	16.00	56.25

(10 Marks)

QUESTION FIVE (20 MARKS)

a) Using Lagrange's interpolation formula, find a polynomial which fits the data;
(0, -12), (1,0), (3,6), (4,12) (6 Marks)

b) Develop an efficient numerical method based on Newton-Raphson approach to complete the reciprocal of an integer $\frac{1}{9}$. Apply you method to compute $\frac{1}{2.08}$ correct to a 6 decimal places.

(6 Marks)

c) The value of the integral $\int_0^1 \frac{1}{1+x^2} dx$ is evaluated using Trapezoidal rule with $n = 5$

i. Obtain the value of integrand correct to 5 sf. (4 Marks)

ii. Use an analytic method to obtain the exact value of the integral. (2 Marks)

iii. Compute the absolute Error (1 Mark)