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ITY EXAMINATION



UNIVERSITY

RESIT/SPECIAL EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF BACHELOR OF SCIENCE IN  
ECONOMICS AND STATISTICS GENERAL SCIENCE, BACHELOR OF EDUCATION IN ARTS  
/SCIENCE, BACHELOR OF ARTS MATHEMATICS AND ECONOMICS

MATH 323: NUMERICAL ANALYSIS 1

STREAMS: BED(ARTS, SCI), BA (MATH, ECON, BSC (ECON, STAT)

TIME: 2 HOURS

DAY/DATE: MONDAY 03/05/2021

11.30 A.M – 1.30 P.M

INSTRUCTIONS:

Answer Question **ONE** and any other **TWO** Questions

QUESTION ONE (COMPULSORY)(30MARKS)

- a. Evaluate  $\int_0^2 (x^2 + 4x - 1) dx$  with  $h = 0.25$  using the Trapezoidal rule (7Marks)
- b. If exact value of  $x$  is  $x_{exact} = 0.45606$  and the approximate value is  $x_{approx} = 0.455$ , find the absolute error, relative error and the percentage error (6Marks)
- c. Use the data to find Lagranges 2<sup>nd</sup> degree formula and use to find the value of  $y$  at  $x = 1.5$  (5Marks)

x	0	2	3
f(x)	-4	2	14

- d. Using the Secant method to find a root of  $f(x) = x - \cos x$  to 6 decimal places given that  $x_0 = 0$  and  $x_1 = 1$  (6Marks)
- e. Use the values in the table to estimate  $y$  at  $x = 3.5$  use Newton's Backward difference interpolating formula (6Marks)
- f.

x	0	1	2	3	4
y	7	10	13	22	43

**QUESTION TWO (20MARKS)**

- a. Use Romberg's method to evaluate  $\int_1^2 \frac{1}{x} dx$  correct to 4 decimal places by taking  $h_0=0.5$   $h_1=0.25$  and  $h_2=0.125$  (12Marks)
- b. Find the cubic interpolation polynomial for the given data using Lagrange's interpolation formula hence evaluate  $f(2.6)$  (8Marks)

x	1	2	3	4
f(x)	1.54	0.58	0.01	0.35

**QUESTION THREE (20MARKS)**

- a. The table below shows the voltage drop ( $v$ ) across a resistor for a number of different values of current ( $i$ )

i	0.25	0.75	1.25	1.75
v	-0.45	-0.60	0.70	1.88

- i. Use the Newton's forward difference interpolating formula to find a cubic polynomial that best describes this data (8Marks)
- ii. Use the polynomial obtained in 5a(i) above to estimate the voltage drop for  $i=0.4$  (2Marks)
- b. Find the root of the equation  $\sin x = 1+x^3$  between  $-2$  and  $-1$  correct to 3 decimal places using Newton Raphson method with 5 iterations (10Marks)

**QUESTION FOUR (20MARKS)**

- a. Consider the data in the table below

x	-3		-1	0	1	2	3
f(x)	-17	-25	-13	-5	-1	23	115

- i. Construct the divided difference table for the data (5Marks)

- ii. Using Newton's divided difference interpolation formula, obtain the polynomial for the given data based at  $x_0 = -3$  (5Marks)
- iii. Compute  $f(-2.3)$  (2Marks)
- b. Use the Bisection method to find the root of the equation  $x^2 + 4x - 10 = 0$  to 6 decimal places between 1 and 2 with 5 iterations (8Marks)

**QUESTION FIVE (20MARKS)**

- a. Compute  $I_s = \int_{1.2}^{2.0} \frac{1}{2x^3 + 7} dx$  to 4 decimal places using Simpson's rule with 9 ordinates (10Marks)
- b. Use the Regula Falsi method to compute the real root of the equation  $\cos x = \sqrt{x}$  correct to 5 decimal places (10Marks)
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