KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: MATH 314

COURSE TITLE: NUMERICAL ANALYSIS I

STREAM: SESSION V & VII

DAY: THURSDAY

TIME: 9.00 – 11.00 A.M.

DATE: 14/04/2011

INSTRUCTIONS:

1.Question **ONE** is compulsory.

2. Attempt question ONE and any other TWO

PLEASE TURN OVER

QUESTION ONE (30 MARKS) COMPULSORY

(a) (i) Given that x = 3.141592 and $\overline{x}$ = 3.14, find the relative error in the approximation. (2 marks)

(ii) Derive a relation between the operators E and δ (3 marks)

(b) Find $f(x)$ from the table below hence $f(7)$ (7 marks)

x:	0	1	2	3	4	5	6
$f(x)$:	– 1	3	19	53	111	199	323

(c) Find the value of $\int_1^5 log_{10}\, x dx$, taking 8 sub intervals correct to four decimal places by Trapezoidal Rule (6 marks)

(d) The following are the measurements **t** made on a curve recorded by the oscillograph representing a change of current **I** due to a change in the conditions of an electric current

t	1.2	2.0	2.5	3.0
I	1.36	0.58	0.34	0.20

Using Lagrange's formula find I at t = 1.6 (5 marks)

(e) When a train is moving at 30m/sec steam is shut off and brakes are applied. The speed of the train per second after t seconds is given by

Time (t)	0	5	10	15	20	25	30	35	40
Speed (v)	30	24	19.5	16	13.6	11.7	10.0	8.5	7.0

Using Simpson's $^1/_3$ rule, determine the distance moved by the train in 40 seconds. (7 marks)

QUESTION TWO (20 MARKS)

(a) Find and correct the error in the values of y shown in the table below given that $y = f(x)$ is a polynomial of degree 3. (10 marks)

x	0	1	2	3	4	5	6
y	4	10	30	75	160	294	490

(b) Determine $f^1(6)$ from the following table

x	0	2	3	4	7	9
$f(x)$	4	26	58	112	466	922

(Note: intervals are unequal) (5 marks)

(c) Given that $y = x^3 + x^2 - 2x + 1$ determine the values of y for $0 \le x \le 5$ and using a difference table determine the value of y at $x = 6$ by extending the table and verify that the same value is obtained by substitution. (5 marks)

QUESTION THREE (20 MARKS)

(a) Derive the Newton – Gregory interpolation formula for equal intervals. (10 marks)

(b) The population of a town is as follows

Year (x)	1941	1951	1961	1971	1981	1991
Population (y)	20	24	29	36	46	51

Estimate the population increase during the period 1946 to 1976 [Apply Newton's forward and backward formula respectively] (10 marks)

QUESTION FOUR (20 MARKS)

(a) Given the following table, find $y(35)$ by using stirling's formula

x	20	30	40	50
y	512	439	346	243

(5 marks)

(b) Obtain the value of $f^1(0.04)$ using Bessel's formula given the table below.

x	0.01	0.02	0.03	0.04	0.05	0.06
$f(x)$	0.1023	0.1047	0.1071	0.1096	0.1122	0.1148

Bessels formula: $y^1(x) = {}^1/_h\left[\Delta y_0 + \frac{2u-1}{4}\left(\Delta^2 y_{-1} + \Delta^2 y_0\right) + \frac{\left(3u^2 - 3u + {}^1/_2\right)}{6}\Delta^3 y_{-1}\right]$

(10 mks)

QUESTION FIVE (20 MARKS)

(a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ with subdivision of $h = 0.2$ using

(i) Trapezoidal rule

(ii) Simpson's $\frac{1}{3}$ rule

(iii)Direct integration [exact solution]. Estimate the error involved in each case. (12 marks)

(b) Find the missing value in the following table

x	0	1	2	3	4
y	1	2	4	-	16

(4 marks)

(c) From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for a policy maturing at age 46. (4 marks)

Age (x)	45	50	55	60	65
Premium (y)	114.84	96.16	83.32	74.48	68.48