UNIVERSITY OF ESWATINI

FINAL EXAMINATION PAPER

PROGRAMME	:	**FOOD SCIENCE, NUTRITION AND TECHNOLOGY LEVEL II**
COURSE CODE	:	**FNS204**
TITLE OF PAPER	:	**FOOD NUTRIENT ANALYSIS**
TIME ALLOWED	:	**TWO (2) HOURS**
INSTRUCTIONS	:	**ANSWER QUESTION ONE (1) AND ANY OTHER TWO (2) QUESTIONS. STATISTICAL TABLES AND FORMULA ARE PROVIDED AT THE END OF THE QUESTION PAPER**

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QUESTION 1 (COMPULSORY)

(a) Give **two (2)** reasons for conducting nutrient analysis and list the steps involved? **(5 Marks)**

(b) Distinguish between accuracy and precision. **(4 Marks)**

(c) Explain the principles of the Geber method for fat content determination in milk. **(6 Marks)**

(d) The following moisture content data for roasted cashew nuts was obtained using the dry oven moisture content determination method.

Table1. Moisture content of roasted cashew nuts

Group	1		2		3		4	
Marking	D1	D2	D1	D2	D1	D2	D1	D2
Dish Wt (g) (w1)	18.54	19.01	18.11	17.95	18.2	17.86	18.07	18.49
Sample Weight (g)	5.012	5.019	5.13	5.041	5.026	5.191	5.046	5.113
Dish + Wet Sample Wt (g) (w2)	23.55	24.03	23.24	22.99	23.23	23	23.12	23.6
Dish + Dry Sample Wt (g) (w3)	23.47	23.94	23.15	22.53	23.12	22.9	23.03	23.51
Moisture Wt(g)	0.082	0.089	0.091	0.458	0.112	0.106	0.089	0.09
%Moisture	1.646	1.769	1.764	9.083	2.221	2.034	1.762	1.764

Answer the following questions and show all calculations maintaining 4 decimal places in your calculations and rounding to 3 decimal places for the final value:-

i. Should the value 9.083%, sample D2 by group 2, be accepted or rejected at 95% confidence level? Demonstrate by calculation and explain. **(8 Marks)**

ii. Calculate the mean of the sample excluding the value 9.083% in your calculation **(2 Marks)**

iii. Calculate the standard deviation of the samples **(6 Marks)**

iv. Calculate the coefficient of variation (CoV) **(5 Marks)**

v. Calculate 95% Confidence interval ($CI_{95\%}$) **(4 Marks)**

[TOTAL MARKS = 40]

QUESTION 2

(a) Explain how you would conduct the following procedures:-

i. Composite sampling **(2 Marks)**
ii. Stratified sampling **(2 Marks)**
iii. Random sampling **(2 Marks)**
iv. Systematic sampling **(2 Marks)**

(b) Explain **three (3)** constituents of food that may affect moisture content determination stating how they will affect the results:- **(6 Marks)**

(c) Discuss the following steps in the Kjeldahl protein determination method:-

i. Digestion **(8 Marks)**
ii. Distillation **(8 Marks)**

[TOTAL MARKS = 30]

QUESTION 3

(a) Explain the type of errors you would encounter if the following happens during nutrient analysis and how these errors will affect the results:- **(4 Marks)**

i. A pH meter was used without first calibrating it with buffer solutions.
ii. Your fellow student group member weighed 25 g of reagent instead of 0.25 g

(b) Describe the different parts of a high performance liquid chromatography (HPLC) system and their function. **(8 Marks)**

(c) Explain the principle of the direct method for ash determination. **(2 Marks)**

(d) Describe the Soxhlet extraction method for crude fat determination. **(8 Marks)**

(e) Give **four (4)** other substances that are extracted together with true fats in the Soxhlet extraction method. **(8 Marks)**

[TOTAL MARKS = 30]

QUESTION 4

(a) The following fat content data for full fat and low fat milk was obtained using the Babcock and Gerber Method for fat determination in dairy products:

Table 2. Percentage Fat content of UHT milk

Full fat UHT milk	Low fat UHT milk
3.3	*1.4*
3.2	1.2
3.3	1.2
3.4	1.4

Answer the following questions showing all your calculations:-

i. Calculate the mean for each milk sample **(2 Marks)**

ii. Calculate the standard deviation for each milk sample **(6 Marks)**

iii. Using the unpaired t-test determine if the two sample means are significantly different or not at 95% confidence level. **(3 Marks)**

iv. Given that the declared fat content for full fat UHT milk is 3.4% and low fat UHT milk is 1.4%, is there any significant difference between the declared values and the determined means of the samples **(6 Marks)**

v. Calculate the error, absolute error and relative error for both milk samples **(6 Marks)**

(b) Describe the different parts of a gas chromatography (GC) system and their function.

(7 Marks)

[TOTAL MARKS = 30]

Formula

Mean

$$\overline{X} = \frac{\Sigma X}{n}$$

Standard deviation

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Coefficient of variation (CoV)

$$CoV = \frac{s}{\bar{x}} \times 100$$

Standard error

$$\text{Standard error} = \frac{Standard\ deviation}{\sqrt{n}}$$

Margin of error at 95% confidence level

$$Margin\ of\ error = 2\ x\ standard\ error$$

Confidence interval

Lower limit = mean - margin of error
Upper limit = mean + margin of error

Equation of a straight line

$y = mx + c$

Slope

$$m = \frac{\Sigma xy}{\Sigma x^2}$$

One sample t-test

$$t_{calc} = \frac{(M - \bar{X})\sqrt{n}}{S}$$

Unpaired t-test

$$t_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{S_{pooled}} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where

$$S_{pooled} = \sqrt{\frac{s_1^2(n_1 - 1) + s_2^2(n_2 - 1)}{n_1 + n_2 - 2}}$$

$$\text{degree of freedom} = n_1 + n_2 - 2$$

$$t_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{(s_1^2 / n_1) + (s_2^2 / n_2)}}$$

Paired t-test

$$t_{calc} = \frac{\bar{d}}{s_d}\sqrt{n} \qquad s_d = \sqrt{\frac{\sum (d_i - \bar{d})^2}{n-1}}$$

y-Intercept

$$c = \bar{y} - m\bar{x}$$

Correlation coefficient

$$r = \frac{\sum xy}{\sqrt{(\sum x^2)(\sum y^2)}}$$

Coefficient of determination

$$r^2 = \frac{(\sum xy)^2}{(\sum x^2)(\sum y^2)}$$

Outlier

$$Q_{exp} = \left| \frac{X_2 - X_1}{X_N - X_J} \right|$$

X_2 = Questionable value
X_1 = Closest value to X_2
X_N = Highest value
X_J = Lowest value

Critical values for Dixon's Q-test

n	Q_{crit} CL at 90%	Q_{crit} CL at 95%	Q_{crit} CL at 99%
3	0.941	0.970	0.994
4	0.765	0.829	0.926
5	0.642	0.710	0.821
6	0.560	0.625	0.740
7	0.507	0.568	0.680
8	0.468	0.526	0.634
9	0.437	0.493	0.598
10	0.412	0.466	0.568

The data is discarded if the calculated Q-value is higher than the tabulated value Q-critical

Critical Values for the t-Test

df	Critical Value P=0.05	df	Critical Value P=0.05
1	12.70620	51	2.00758
2	4.30265	52	2.00665
3	3.18245	53	2.00575
4	2.77645	54	2.00488
5	2.57058	55	2.00404
6	2.44691	56	2.00324
7	2.36462	57	2.00247
8	2.30600	58	2.00172
9	2.26216	59	2.00100
10	2.22814	60	2.00030
11	2.20099	61	1.99962
12	2.17881	62	1.99897
13	2.16037	63	1.99834
14	2.14479	64	1.99773
15	2.13145	65	1.99714
16	2.11991	66	1.99656
17	2.10982	67	1.99601
18	2.10092	68	1.99547
19	2.09302	69	1.99495
20	2.08596	70	1.99444
21	2.07961	71	1.99394
22	2.07387	72	1.99346
23	2.06866	73	1.99300
24	2.06390	74	1.99254
25	2.05954	75	1.99210
26	2.05553	76	1.99167
27	2.05183	77	1.99125
28	2.04841	78	1.99085
29	2.04523	79	1.99045
30	2.04227	80	1.99006
31	2.03951	81	1.98969
32	2.03693	82	1.98932
33	2.03452	83	1.98896
34	2.03224	84	1.98861
35	2.03011	85	1.98827
36	2.02809	86	1.98793
37	2.02619	87	1.98761
38	2.02439	88	1.98729
39	2.02269	89	1.98698
40	2.02108	90	1.98667
41	2.01954	91	1.98638
42	2.01808	92	1.98609
43	2.01669	93	1.98580
44	2.01537	94	1.98552
45	2.01410	95	1.98525
46	2.01290	96	1.98498
47	2.01174	97	1.98472
48	2.01063	98	1.98447
49	2.00958	99	1.98422
50	2.00856	100	1.98397