2ND SEM. 2017/18

UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME : FOOD SCIENCE, NUTRITION AND TECHNOLOGY LEVEL II & YEAR III

COURSE CODE : FNS 204 / FSNT 307

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) Differentiate between the following types of populations:
   i. Continuous and compartmentalized population **(6 Marks)**
   ii. Homogeneous and heterogeneous population **(6 Marks)**

(b) Explain **three (3)** types of oven that can be used in moisture content determination of food. **(3 Marks)**

(c) The following data was obtained in the analysis of vitamin A:-

Table1. Standard calibration curve data

Concentration (mg/L)	Absorbance @ 760 nm
0	0
2	0.2
4	0.4
6	0.6
8	0.8

Table 2. Sample absorbance values

Sample	Absorbance @ 760 nm
A	0.45
B	0.48
C	0.47
D	0.44

Sample	Absorbance @ 760 nm
A	0.45
B	0.48
C	0.47
D	0.44

Answer the following questions and show all calculations
   i. Find the equation of the straight line. (5)
   ii. Calculate the correlation coefficient of the straight line (3)
   iii. Calculate the coefficient of determination and explain this value (4)
   iv. Calculate the concentration of each of the samples in Table 2 (4)
   v. Calculate the mean of the samples (3)
   vi. Calculate the standard deviation of the samples (4)
   vii. Calculate the coefficient of variation (2)

(25 Marks)

[TOTAL MARKS = 40]

QUESTION 2

(a) Explain how you would conduct the following procedures:-
   i. Random sampling **(3 Marks)**
   ii. Systematic sampling **(3 Marks)**

(b) Describe the principles behind the gas production method for moisture content determination. **(8 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) Calculate how many millilitres of 36% HCl you would add to a 500 ml volumetric flask to make a 1 M solution, given that the molecular weight of HCl is 36.5 g/mole and density (ρ) is 1.1789 g/ml. **(10 Marks)**

(b) Describe the equipment for high performance liquid chromatography (HPLC) system and its function. **(8 Marks)**

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

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

[TOTAL MARKS = 30]

QUESTION 4

(a) Explain the principle behind the Dumas method for protein determination. **(10 marks)**

(b) Explain the following fat characteristics:-
   i. Iodine number **(3 Marks)**
   ii. Acid value **(3 Marks)**

(c) Explain the principles in crude fibre determination method. What are the main components in crude fibre? **(8 Marks)**

(d) Describe the equipment for gas chromatography (GC). **(6 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)

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

Equation of a straight line

$y = mx + c$

Slope

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

y-Intercept

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

Correlation coefficient

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

Coefficient of determination

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

Outlier

$$Qexp = \frac{X_2 - X_1}{X_N - X_J}$$

X_1 = Questionable value
X_2 = Closest value to X_1
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