

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS – 2022

FOOD TECHNOLOGY – SECOND YEAR DEGREE

FT 214 NUTRITION I

FRIDAY 10<sup>TH</sup> JUNE, 2022 – 8:20 AM

**TIME ALLOWED: 3 HOURS**

**INFORMATION FOR CANDIDATES:**

1. You have 10 minutes to read the paper. You must not begin writing in the answer book during this time.
2. **ANSWER ALL QUESTIONS.**
3. All answers must be written in the answer books provided.
4. Write your name and number clearly on the front page. Do it now.
5. Calculators are permitted in the examination room. Notes and textbooks are not allowed.
6. Show all workings and calculations in the answer book.

**MARKING SCHEME**

|            |            |
|------------|------------|
| Question 1 | [20 marks] |
| Question 2 | [17 marks] |
| Question 3 | [16 marks] |
| Question 4 | [25 marks] |
| Question 5 | [22 marks] |

ANSWER ALL QUESTIONS

I. (a) Write True or False for each of the following statements: [½ mark each]

|   | Statements   |
|---|--|
| A | The two main factors which influence protein quality are essential amino acids and digestibility.  |
| B | Beriberi (wet & dry) are consequences of prolonged vitamin B6 deficiency.  |
| C | Coeliac disease is an example of food allergy.   |
| D | Secretin is secreted by duodenal wall cells in response to acidic chyme. It opposes action of gastrin & stimulates pancreas to release bicarbonate to neutralize acidic chyme.   |
| E | To calculate glycemic load of food; amount in grams of carbohydrate in a serving of the food is multiplied by the glycemic index of that food and then divided by 100.   |
| F | High fat and fibre in the diet will increase the glycemic load of the food.  |
| G | Cortisol and epinephrine are associated with release of glucose rather than storage of glucose.  |
| H | Type 2 diabetes is due to insulin resistance whilst Type 1 diabetes is due to lack of insulin production by the beta cells of the pancreas.  |
| I | Acceptable Macronutrient Distribution Ranges for Adults (as a percentage of Calories) are as follows: Protein: 45-65% Fat: 20-35% Carbohydrate: 10-35%.  |
| J | Generally, legumes provide more methionine and tryptophan compared to grains which have more lysine and isoleucine hence and vice versa making them a perfect match for legumes. Amino acid lacking in legumes is complemented by those in grains. |
| K | Protein efficiency ratio is the increase in nitrogen retention per unit increase in nitrogen intake whilst net protein utilization measures the amount of weight gained after eating a known amount of protein.                                    |
| L | Marasmus is caused by not enough energy and protein in the diet, also when infections and diseases affect nutrient intake and absorption. The onset is rapid (acute PEM).  |
| M | Limiting amino acid is the non-essential amino acid in the lowest concentration in relation to its requirement.  |
| N | Lysine, valine and serine are essential amino acids.   |
| O | Hepatic portal circulation is a subdivision of systemic circulation in which blood from the abdominal digestive organs and spleen circulates directly to the heart.  |
| P | The gall bladder makes, stores and concentrates bile which is important for lipid digestion and absorption.  |
| Q | Glycogenolysis is the synthesis of liver and muscle glycogen.  |
| R | Conditionally essential amino acids include glutamine, tyrosine and phenylalanine.   |
| S | Zinc, calcium, vitamin B12 and vitamin D are micronutrients of concern in a vegan diet.  |
| T | Functional foods are all safe to consume at any dosage level because they are natural and do not contain synthetic chemicals.  |

[10 marks]

(b) Match the numbered micronutrients with the appropriate alphabetically listed functions or deficiency diseases.

[½ mark each]

|    | Micronutrients |   | Functions and or deficiency diseases   |
|----|----------------|---|--|
| 1  | Vitamin K      | A | It is essential for synthesis of DNA and is also essential for the formation of both red and white blood cells in the bone marrow and for their maturation.  |
| 2  | Vitamin E      | B | It functions as a component of the coenzyme nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) which are present in all cells. NAD and NADP are most central electron carriers of cells playing essential roles in energy metabolism. Also supports health of skin, nervous system and digestive system. |
| 3  | Selenium       | C | Deficiency causes hemolytic anaemia –red blood cell membrane weaken & rupture because it protects red blood cell membranes from oxidative damage. It is said to protect DNA from cancer causing free radical damage. Interacts with other dietary components to protect the body from cancer.  |
| 4  | Potassium      | D | Fairly abundant in vegetable oils. It is essential for the activation of several proteins and mineral calcium involved in the making of blood clot.  |
| 5  | Niacin         | E | Deficiency leads to reduced resistance to infection (lowered immunity), reduced work productivity, reduced physical fitness, weakness, fatigue, reduced learning ability, impaired cognitive function in children, impaired wound healing, reduced resistance to cold, inability to regulate body temperature.                                       |
| 6  | Folate         | F | It is an integral part of the enzyme glutathione peroxidase. one of the mechanisms whereby intracellular structures are protected against oxidative damage.  |
| 7  | Vitamin B12    | G | Flow of this micronutrient and sodium into and out of the cells play important role in muscle contractions and transmission of nerves impulses. It also helps regulate blood pressure.   |
| 8  | Iron           | H | Prolonged deficiency of the vitamin leads to the disease Beri beri- the symptoms of which include mental confusion, paralysis, muscular wasting and oedema.  |
| 9  | Zinc           | I | Some of its functions include; making genetic material and proteins, also involved in normal development of foetus, wound healing, immune reactions, taste perception.   |
| 10 | Thiamine       | J | It functions in two coenzymes, which are important or essential for the normal function in the metabolism of all cells especially for those of the GI tract, bone marrow and nervous tissue. Deficiency disease is called pernicious anemia.   |

|    |                  |   |  |
|----|------------------|---|--|
| 11 | Choline          | K | Very important in the reactions in the synthesis of lipids, neurotransmitters and steroid hormones. Serves as part of coenzyme A which is used in energy metabolism.   |
| 12 | Pantothenic acid | L | It is a component of two thyroid hormones that help to regulate growth, development, and the metabolic rate, essential for normal growth and physical and mental development.  |
| 13 | Biotin           | M | A water-soluble compound used by the body to synthesize acetylcholine (neurotransmitter) and a variety of phospholipids needed for cell membrane structure; considered a conditionally essential nutrient.   |
| 14 | Vitamin A        | N | Essential for metabolism of carbohydrates, amino acids and lipids. It discharges these functions as the co-enzymes, which are important in the electron transport system; also supports normal vision and skin health.   |
| 15 | Vitamin C        | O | Apart from serving as coenzyme of numerous enzymes involved in practically all reactions in the metabolism of amino acids, it is also needed for the conversion of tryptophan (amino acid) to niacin.  |
| 16 | Vitamin D        | P | Important for mineralization of bones and teeth, involved in muscle contraction and relaxation, nerve functioning, cellular metabolism, blood clotting (form fibrin), blood pressure and immune defense.   |
| 17 | Calcium          | Q | It serves several metabolic functions as an enzyme cofactor, a protective agent (antioxidant), and as a reactant with transition metal ions.   |
| 18 | Iodine           | R | Has essential metabolic roles in the maintenance of calcium and phosphorus homeostasis and cell differentiation. Also involved in calcium uptake.  |
| 19 | Riboflavin       | S | Has essential roles in vision, growth and development, the development and maintenance of epithelial tissues, cell differentiation, immune functions, reproduction and bone growth.  |
| 20 | Vitamin B6       | T | It plays an important role in metabolism as a coenzyme that carries carbon dioxide, this role is critical in the TCA cycle. This coenzyme also serves crucial role in gluconeogenesis, fatty acid synthesis and in the breakdown of certain fatty acids and amino acids. |

[10 marks]

(Total = 20 marks)

2. (a) Blood glucose must be maintained within limits that allow cells to nourish themselves. Write notes describing how this glucose homeostasis is maintained. [4 marks]
- (b) Adequate carbohydrates spares protein and assists in lipid metabolism. Explain. [3 marks]
- (c) Explain what happens during the 'fight and flight' situation, include in your explanation, the hormones involved and what they do. [3 marks]
- (d) Fully state the areas of energy use in the body. [3 marks]
- (e) Chemical energy needed by the cells for cellular metabolism is held in the bonds of energy yielding nutrients. However, these are not usable for cells so has to be converted to the usable form which is ATP. Give an overview of how this happens. [4 marks]

(Total = 17 marks)

3. (a) Write short notes describing the specific mechanisms that exist in the body which helps facilitate the digestion and absorption of lipids. [4 marks]
- (b) Describe the changes that occur in the body when a person is on a prolonged fasting period and explain why these changes occur. Explain in terms of fuel usage and relevant adjustments made during the periods of fed and fast to sustain life. [4 marks]
- (c) Choose either triacylglycerols or phospholipids and write notes describing what they are and their important functions in the body. [4 marks]
- (d) Describe ketogenesis: what it is, where it occurs, the process and its importance. [4 marks]

(Total = 16 marks)

4. (a) Describe amino acid catabolism for energy. [4 marks]
- (b) Write notes describing the anatomy of the small intestine and the important functions it plays in the digestion and absorption of nutrients. [4 marks]
- (c) How does gastric bypass surgery affect vitamin B12 status. [2 marks]

- (d) Select any TWO named micronutrients and write notes describing their functions, deficiency diseases and common food sources. [6 marks]
- (e) Explain bioavailability and describe the factors that affect vitamin bioavailability. [3 marks]
- (f) Explain what food composition databases are and why it is important to have a national food composition database. [2 marks]
- (g) Discuss the important properties of soluble and insoluble fibre and how these properties are important in promoting good health. [4 marks]

(Total = 25 marks)

5. (a) Name ANY ONE example of toxins under the following categories and describe what it is and how it affects human health:
- (i) Environmental contaminants. [2½ marks]
  - (ii) Substances formed as a result of food processing. [2½ marks]
- (b) Eicosanoids are hormone like substances derived from essential fatty acids and play very important roles in promoting good health. Discuss. [3 marks]
- (c) Diet is one of the lifestyle related risk factors for cancer. Discuss the relationship between consumption of red and processed meats on cancer risk. [3 marks]
- (d) With your understanding of the important functions of protein and their importance in the growth and development of children, discuss kwashiorkor which is a form of protein-energy malnutrition. [4 marks]
- (e) With regards to functional foods, discuss what they are and why we as food scientists need to have a good understanding of their physical and chemical properties as well as their efficacy before use. [3 marks]
- (f) Describe what food intolerance and food allergy are and explain their importance to a consumer and a food manufacturer. [4 marks]

(Total = 22 marks)