Subject Description Form

Subject Code	FSN3104
Subject Title	Molecular Nutrition and Biochemistry
Credit Value	3
Level	3
Pre-requisite	**Biochemistry and Cell Biology for Food and Nutrition**, AND **Human Physiology and Anatomy for Food and Nutrition I,** AND **Human Physiology and Anatomy for Food and Nutrition II**
Co-requisite	Nil
Objectives	The subject is intended to introduce key concepts in nutritional biochemistry and metabolism at molecular, cellular and whole-body levels for human system. Students are required to learn, understand and integrate knowledge of biochemistry, cellular metabolism as well as physiology, especially digestive and endocrine system to account for different conditions of human health.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand relationships between diet (nutritional status), metabolisms, energy balance and health conditions b. Understand digestions, absorptions and assimilations of proteins, lipids and carbohydrates in diet at molecular and cellular levels c. Understand catabolism of monosaccharides, amino acids and fatty acids at molecular and cellular levels, as well as metabolic reprogramming d. Understand absorptions, metabolisms and biological functions of vitamins and minerals at molecular levels e. develop analytical, critical thinking, and written communication skills.
Subject Synopsis/ Indicative Syllabus	In total, 6 topics will be covered in the subject. Materials of these 6 topics will be delivered through 12 lectures. The topics are listed below. **Topic 1: Metabolism and Energy** • Overview of interactions among diet (energy intake & nutritional status), metabolism, energy balance and different conditions, like starvation, obesity and malnutrition **Topic 2: Carbohydrates and metabolism** • Digestion, absorption and assimilation of carbohydrates, • Enzymes for digesting carbohydrates and their enzymatic

	reaction mechanisms, • Transporters for absorbing carbohydrates in gut and cellular uptake of glucose, • Blood glucose regulation • Glycemic index of food items • Catabolism of glucose, fructose and galactose, • Glycolysis and TCA cycle, • ATP production by oxidative phosphorylation, • Creatine phosphate shuttle, • Glycogenesis & glycogenolysis **Topic 3: Protein and metabolism** • Digestion, absorption and assimilation of proteins, • Proteases in human digestive system and their enzymatic reaction mechanisms, • Protein digestibility and quality, • Digestible indispensable amino acid score, • Transporters for absorbing amino acids in gut and cellular uptake • Catabolism of essential and non-essential amino acids, • Urea cycle, • Essential amino acid and muscle growth **Topic 4: Lipid and metabolism** • Digestion, absorption and assimilation of lipids, • Lipase in human digestive system and their enzymatic reaction mechanisms; • Emulsification of lipid by bile salt; • Chylomicron; • Low density lipoprotein and high density lipoprotein • Alpha and beta oxidation of fatty acids • Ketone body metabolism; • Exercises and fat loss • Metabolic reprogramming • Thermogenesis and mitochondrial uncoupling **Topic 5: Vitamins and metabolism** • Absorption of vitamins; • Biosynthesis of vitamins by gut microbiota; • Transportations of vitamins in blood • Sodium/ multivitamin transporter and other vitamin transporters • Biological functions of vitamins; • Vitamins as cofactors of enzymes which involved in energy metabolism; • Vitamin A and vision; • Vitamin D and bone health; • Vitamin C and apoptosis

	Topic 6: Minerals and metabolism • Absorption, regulation and excretion of minerals; • Ion channels and transporters; • Biological functions of minerals Two laboratory practicals will be arranged. Students will conduct an experiment related to protein digestibility and protein quality. They will try to digest different proteins with proteases (commonly found in human digestive system). The digestibilities of different proteins will be assessed by gel electrophoresis or mass spectrometry.
Teaching/Learning Methodology	The basic contents of the subject will be presented with the aid of lecture notes, videotapes, Blackboard platform and other teaching tools. For tutorials, students will participate in small-group discussions and learn to apply adequate knowledge in daily practice. For laboratory practicals, students will be divided into small-group and conduct experiments by themselves. Instead of writing laboratory report, students will be required to work on in-class assignment during the practicals. Both lecture materials and the practicals will be examined in the examination. Students are also expected to study reference materials distributed in class, from the library or other sources (e.g. newspaper and magazine clippings, and information available on the Internet). A variety of assessment tools will be used, including quizzes and assignments to develop students' analytical skills, critical thinking and communication skills.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c	d	e
	1. Assignments	20%	√	√	√	√	√
	2. Quiz	30%	√	√	√	√	√
	3. Examination	50%	√	√	√	√	√
	Total	100 %					
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Assignments, quiz and examination are used to assess how well students learned and performed in Nutritional Biochemistry and Metabolism. The performances of the students in tutorials as well as in class assignments will be used to assess the ability of the students to apply adequate knowledge to analyze and solve everyday problems related to nutritional biochemistry and metabolisms.						
Student Study	Class contact:						

Effort Required	▪ Lecture	24 Hrs.
	▪ Tutorial	12 Hrs.
	▪ Laboratory practical	6 Hrs.
	Other student study effort:	
	▪ Self study	78 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	1. Berdanier, Carolyn D.; Berdanier, Lynne. Advanced nutrition: macronutrients, micronutrients, and metabolism, Boca Raton, FL : CRC Press, Taylor & Francis Group; 2015; Second edition 2. Webb, Geoffrey P. Nutrition : maintaining and improving health, Boca Raton, FL : CRC Press; 2020 3. Patel, Vinood B. Molecular Nutrition: Carbohydrates, Elsevier Science; 2019 4. Patel, Vinood B. Molecular Nutrition: Vitamins, Elsevier Science; 2019	