ENDEAVOUR College of Natural Health

SUBJECT OUTLINE

Subject Name:

Chemistry and Biochemistry

Subject Code:

BIOB111

SECTION 1 – GENERAL INFORMATION

Award/s:		**Total Course Credit Points:**	**Level:**	
	Bachelor of Health Science (Naturopathy)	128	Core	1st Year
	Bachelor of Health Science (Nutritional and Dietetic Medicine)	96	Core	1st Year
Duration:	1 Semester			
Subject is:	Core or Elective as noted	**Subject Credit Points:**	4	

Student Workload:

No. timetabled hours per week: 6	**No. personal study hours per week: 4**	**Total hours per week: 10**

Delivery Mode*:

☐ **On campus** ☒ **Online / Digital** ☐ **Blended** ☐ **Intensive**

Weekly Session^ Format/s - 2 sessions per week:

☒ eLearning modules:	Lectures: Interactive adaptive online learning modules Tutorials: can include asynchronous tutor moderated discussion forum and activities, learning journal activities or other web-based resources

*All modes are supported by the online learning management system which will include subject documents such as handouts, readings and assessment guides.

^A 'session' is made up of 3 hours of timetabled / online study time per week unless otherwise specified. Each subject has a set number of sessions as outlined above.

Study Pattern:	☒ Full Time ☒ Part Time
Pre-requisites:	Nil
Co-requisites:	Nil

SECTION 2 – ACADEMIC DETAILS

Subject Rationale

The first part of this subject introduces the student to basic and organic chemistry and explores the nature and reactivity of matter. This provides the foundation for the second part – biochemistry — which examines the relationship between the structure and function of complex biomolecules. Students will study the role of enzymes, coenzymes and cofactors in energy metabolism, and metabolic pathways involving glucose, fatty acid, and amino acid – providing knowledge of the metabolic processes that occur in the human body. This is a foundational subject for later study of nutrition, pharmacology, immunology, herbal medicine, and clinical sciences.

Learning Outcomes

1. Describe elements, atoms, ions, chemical bonding, chemical reactions, the significance of energy transfer and catalysts in biochemical systems.
2. Define the nature of matter and the different states of matter (solid, liquid, and gas) and describe how movement of atoms in the different states impacts their properties.
3. Describe solutions, mixtures and their equilibrium and explain how they impact physiological processes and metabolism.
4. Describe the structure of the organic compounds and associated chemical reactions based on the functional groups.
5. Discuss the role of enzymes in carbohydrate, lipid, and protein metabolism.
6. Discuss the major biochemical pathways involved in carbohydrate metabolism in the context of nutrition and health.
7. Discuss the major biochemical pathways involved in lipid and protein metabolism in the context of nutrition and health.

Assessment Tasks

Type	Learning Outcomes Assessed	Session Content Delivered	Due	Weighting
Online Quiz 1 multiple choice (40 minutes)	1-4	1-10	Week 7	30%
Written Assignment 1 **Carbohydrate Metabolism** (1500 words)	5, 6	11-17	Week 11	35%
Written Assignment 2 **Lipid and Protein Metabolism** (1500 words)	5, 7	17-24	Week 15	35%
All written assessments and online quizzes are due at 11:55 p.m. Sunday and submitted through the LMS.				

Pass Requirements

To achieve a passing grade in this subject students must:

- have a cumulative mark of at least 50%, and
- have submitted all assessment items with a value greater than 15%.

Prescribed Readings:

Stoker, H. S. (2016). *General, organic, and biological chemistry* (7th ed.). Cengage Learning. [ebook available]

Recommended Readings:

Berg, J. M., Tymoczko, J. L., & Stryer, L. (2015). *Biochemistry* (9th ed.). W. H. Freeman. [ebook available]

Bettelheim, F. A., Brown, W. H., Campbell, M. K., Farrell, S. O., & Torres, O. J. (2016). *Introduction to general, organic and biochemistry* (12th ed.). Cengage Learning. [ebook available]

Dominiczak, M. H. (2007). *Flesh and bones of metabolism*. Elsevier Mosby.

Timberlake, K. C. (2020). *General, organic, and biological chemistry: Structures of life* (6th ed.). Pearson.

Tortora, G. J., Derrickson, B., Burkett, B., Cooke, J., DiPietro, F., Diversi, T., Dye, D., Engel, A., Green, H., Macartney, M., McKean, M., Peoples, G., & Summers, S. (2022). *Principles of anatomy and physiology* (3rd Asia-Pacific ed.). Wiley. [ebook available]

Subject Content

Week	Lectures	Tutorials
1.	Session 1 Introduction (Subject Outline / Subject Aims / Assessment / Teaching Resources) **Introduction to Chemistry** • Matter and the structure of the atom • Periodic table of elements • Use of the periodic table to predict physical and chemical properties of elements • Electronic configuration and the octet rule • Formation of ions • Significance of isotopes	• Review of atom/subatomic particles, periodic table, and electronic configuration • Animations on electron configuration
	Session 2 **Chemical Bonding** • Ionic and covalent bonding • Polyatomic ions • Electro negativity and polarity of bonds • Naming ionic and molecular compounds	• Review of writing and naming compounds
2.	Session 3 **Chemical Reactions** • Chemical change • Chemical equations • Mole	• Review of balancing equations

	• Formula weight • Balancing equations • Classification of chemical reactions • Heat of reaction	
	Session 4 **Reaction Rates** • Le Châtelier's principle and equilibrium	• Review of factors affecting chemical equilibrium
3.	Session 5 **Physical States of Matter** • Solids, liquids and gases • Boyle's law • Dalton's law • Transition between states of matter and intermolecular forces • Solubility • Kinetic molecular theory	• Review of different states of matter, gas laws, types of solutions, solubility, osmosis and dialysis • Animations on different states of matter
	Session 6 **Acids and Bases** • Reactions of acids and bases, pH and buffers	• Review of acids and bases, pH and buffer • Simple chemistry experiments on acids and bases
4.	Session 7 **Introduction to Organic Chemistry** • Organic compounds • Hydrocarbons • Functional groups • Stereo isomers	• Review of hydrocarbon compounds
	Session 8 **Properties of the Functional Groups** • Alkanes • Alkenes • Alkynes • Aromatics • Alcohols	• Review of alkanes, alkenes, alkynes, aromatics and alcohols
5.	Session 9 **Properties of the Functional Groups (Continued)** • Phenols • Ketones • Aldehydes	• Review of phenols, ketones, aldehydes, carboxylic acids and esters

	• Carboxylic acids • Esters	
	Session 10 **Properties of the Functional Groups (Continued)** • Ethers • Thiols • Amines and amides	• Review of ethers, thiols, amines and amides
6.	Session 11 **Enzymes and Co-enzymes** • The different classes of enzymes and the types of reactions they catalyse	• Review of enzymes and co-enzymes
	Session 12 **Carbohydrates** • An introduction to classification, structure and function of carbohydrates	• Concept maps on carbohydrate types
7.	Session 13 **Bioenergy Production** • Integration of the common catabolic pathways	• Review of cell structure, role of ATP and co-enzymes, significance of ATP
	Session 14 **Metabolism** • Digestion of carbohydrates • Glycolysis, pyruvate pathways • Glycogen metabolism	• Review of carbohydrate metabolism
	NON-TEACHING WEEK (note that make-up classes may be scheduled in this week) **Semester 1** – This aligns with the week after Easter so it may fall between Weeks 6 to 8 **Semester 2 & Online students** – The non-teaching week falls between Weeks 7 and 8	
8.	Session 15 **Metabolism (Continued)** • The citric acid cycle • The Cori cycle	• Concept map on carbohydrate metabolism
	Session 16 **Metabolism (Continued)** • Electron transport chain • Oxidative phosphorylation	• Review of electron transport chain/oxidative phosphorylation • Animations of ATP synthesis
9.	Session 17 **Metabolism (Continued)**	• Review of carbohydrate metabolism

	• Gluconeogenesis • Hormonal control of carbohydrate metabolism	
	Session 18 **Lipids** • An introduction to classification, structure and function of lipids	• Concept maps on lipid types
10.	Session 19 **Lipid Metabolism** • β-oxidation, ketogenesis	• Review of lipid metabolism
	Session 20 **Lipid Metabolism (Continued)** • Fatty acid synthesis	• Review of metabolism of lipids
11.	Session 21 **Amino Acids and Proteins** • Introduction to classification, structure and function of amino acids • Introduction to protein classification, structure and function	• Review of amino acids and proteins • Animations on the structure and formation of different levels of protein organisation
	Session 22 **Protein Metabolism** • Transamination / Oxidative Deamination • Fate of Carbon Skeleton	• Review of amino acid metabolism
12.	Session 23 **Protein Metabolism** • Urea cycle and synthesis of amino acids	• Review of metabolism • Concept map on protein metabolism
	Session 24 **Metabolism (Continued)** • Integrating the metabolic pathways	• Concept map on integration of carbohydrates, protein and fat metabolism
13.	Session 25 **Molecular Biology: Nucleic Acids, Nucleotides** • Classification, structure, nucleosides and nucleotides	• Review of types of nucleic acids, DNA replication, review • Online web resources on DNA structure
	Session 26 • Revision	

14-15.	**Non-Teaching Week / Practical Examination Weeks 1 & 2** Note that make-up classes may be scheduled in these weeks.
16-17.	**Final Examination Weeks 1 & 2** There is no final exam for this subject.