UNIVERSITY of NICOSIA

Year 1

Course Title	**Principles of Cellular Function & Biochemistry II**				
Course Code	**VET-106**				
Course Type	Required				
Level	Undergraduate				
Year / Semester	Year 1/ Semester 2 (Spring)				
Teacher's Name	**Course Lead:** Dr Manos C. Vlasiou **Contributor:**				
ECTS	Lectures/week	Lectures / week	3	Laboratories / week	2
Course Purpose and Objectives	This course covers the fundamental principles governing the metabolic reactions in cells providing an in-depth understanding of the metabolism of essential biomolecules such as carbohydrates, proteins, and fats. Additionally, the course covers the critical metabolic pathways involved in nucleotide synthesis and breakdown, steroid synthesis, amino acid derivatives, and the role of vitamins in metabolism. Lastly, the course provides students with the necessary knowledge of hematology and practical laboratory medicine. The course will also include tutorials and laboratory sessions to supplement and enhance the understanding of the concepts covered in lectures.				
Learning Outcomes	The following list provides the learning objectives that will be covered in the lectures, practical lab sessions, and tutorials of each week: **Week 1** **LOBs covered during lectures:** **1.** Explain how metabolism is composed of many coupled, interconnecting reactions. **2.** Describe that ATP is the universal currency of free energy in biological systems. **3.** Explain that the oxidation of carbon fuels is an essential source of cellular energy. **4.** Explain why glycolysis is an energy conversion pathway in many organisms. **5.** Describe how the catalytic pathway is tightly controlled. **6.** Describe how glucose can be synthesized from non-carbohydrate precursors. **Week 2** **LOBs covered during lectures:** **7.** Explain how the pyruvate dehydrogenase complex links glycolysis to the citric acid cycle. **8.** Describe how the citric acid cycle oxidizes two carbon units and how the cycle is a source of biosynthetic precursors. **9.** Describe eukaryotic oxidative phosphorylation in mitochondria. **10.** Explain how oxidative phosphorylation depends on electron transfer. **11.** Describe the four complexes of the respiratory chain.				

12. Explain how the regulation of cellular respiration is governed primarily by the need for ATP.

Laboratory Session 1: *Bradford assay*

13. Carry out a Bradford assay and generate a standard curve.
14. Determine the concentration of a protein sample of unknown concentration.

Week 3

LOBs covered during lectures:

15. Explain that glycogen breakdown requires the interplay of several enzymes.
16. Describe how allosteric interactions and reversible phosphorylation regulate phosphorylase.
17. Describe how epinephrine and glucagon signal the need for glycogen breakdown.
18. Describe the glycogen's breakdown and synthesis by several pathways.
19. Describe how the metabolism of glycogen is regulated.

Laboratory Session 2: *Purification of Lactate Dehydrogenase*

Week 4

LOBs covered during lectures:

20. Describe how proteins are degraded to amino acids.
21. Mention that protein turnover is tightly regulated.
22. Describe that the first step of amino acid degradation is the removal of nitrogen.
23. Describe how ammonium ion is converted into urea in most terrestrial vertebrates.
24. Explain how carbon atoms of degraded amino acids emerge as a significant metabolic intermediate.
25. Mention that inborn errors of metabolism can disrupt amino acid degradation.
26. Explain nitrogen fixation.
27. Explain that amino acids are made from intermediates of the citric acid cycle and other significant pathways.
28. Describe how amino acids are precursors of many molecules.

Tutorial 1: *Problem-solving tutorial (LOBs for Week 1-4)*

Week 5

LOBs covered during lectures:

29. Outline triacylglycerols as highly concentrated energy stores.
30. Describe the three stages of fatty acid processing.
31. Mention that unsaturated and odd-chain fatty acids require additional steps for degradation.
32. Explain how ketone bodies are fuel sources derived from fats.
33. Describe how fatty acids are synthesized by fatty acid synthase.
34. Explain how accessory energy systems accomplish the elongation and unsaturation of fatty acids.

35. Explain how acetyl CoA carboxylase controls fatty acid metabolism.

Week 6

LOBs covered during lectures:

36. Explain that phosphatide is a common intermediate in synthesizing phospholipids and triacylglycerols.
37. Describe how cholesterol is synthesized from acetyl coenzyme A in three stages.
38. Review the complex regulation of cholesterol biosynthesis.
39. Mention that important biochemical is synthesized from cholesterol and isoprene.

Week 7

LOBs covered during lectures:

40. Describe the water-soluble vitamins (ascorbic acid, thiamine, riboflavin, niacin, pantothenic acid, biotin, pyridoxine, and cobalamin).
41. Describe the lipid-soluble vitamins (vitamins A, D, E, K).
42. Outline the trace elements (iron, zinc, copper, manganese, selenium, iodine, and cobalt).
43. Explain the deficiencies in vitamins and trace elements and their pathological outcomes.

Laboratory Session 3: *Protein electrophoresis*

Week 8

LOBs covered during lectures:

44. Explain how caloric homeostasis regulates body weight.
45. Outline how the brain plays a crucial role in caloric homeostasis.
46. Discuss that diabetes is a common metabolic disease often resulting from obesity.
47. Explain how exercise alters the biochemistry of cells.
48. Discuss how food intake and starvation induce metabolic changes.

Week 9

LOBs covered during lectures:

49. Outline the red blood cells and their function.
50. Outline the platelets and their function.
51. Describe the function of the white blood cells.
52. Explain how to perform diagnostic profiling and sample collection.

Week 10

LOBs covered during lectures:

53. Describe the plasma proteins.
54. Outline the clinical enzymology and explain how plasma enzymes aid in diagnosis.
55. Describe the process of diagnostic endocrinology.
56. Outline non-blood body fluids diagnostics.

	Tutorial 2: *Problem-solving tutorial (LOBs for Week 5-8)* **Week 11** Students' Oral Presentations (Coursework) **Tutorial 3:** *Problem-solving tutorial (LOBs for Week 9-10)* **Week 12** Revision		
Prerequisites	Principles of Cellular Function & Biochemistry I	Required	None
Course Content	**Lecture Topics:** • Metabolism and Glycolysis • The Krebs Cycle and Oxidative Phosphorylation • Glycogen Metabolism • Amino acid Metabolism • Fatty Acid Metabolism • The Biosynthesis of Membranes, Lipids, and Steroids • The Biochemical role of vitamins and Trace Elements • The Integration of Metabolism • Hematology and Practical Laboratory Medicine • Clinical Biochemistry		
Teaching Methodology	Lectures, small group tutorials, and small group laboratory sessions.		

Year 1

Bibliography	

Authors	Title	Edition	Publisher	Year	ISBN
Jeremy M. Berg, Lubert Strayer	**Biochemistry**	**9th edition**	**WH Freeman**	**2019**	**978-1319114657**
Donald Voet, Judith G. Voet, Charlotte W. Pratt	**Fundamentals of Biochemistry**	**5th edition**	**Wiley**	**2016**	**978-1-118-91840-1**
Larry R. Engelking	Textbook of Veterinary Physiological Chemistry	2nd edition	Elsevier	2011	978-0-12-384852-9
Morag G. Kerr	Veterinary Laboratory Medicine	2nd edition	Blackwell Science	2002	0-632-04023-8

Assessment	Course assignment 30% (15% Scientific Essay, 15% Oral Presentation), final written exam 60% and 10% participation
Language	English