THE OPEN UNIVERSITY OF SRI LANKA

B.Sc DEGREE PROGRAM 2016/2017

LEVEL 5 – FINAL EXAMINATION

CMU 3126 – BIOCHEMISTRY

DURATION: TWO HOURS

Date: Thursday 18th January 2018 Time: 1.30-3.30 pm

Instructions to candidates:

This paper consists of six (06) questions. You are required to answer four questions out of six.

1. A) I. a) What is meant by anabolism? Explain.
b) Give three examples of anabolic pathways of fats/lipids.

(15 marks)

II. a) There are many ways of producing acetyl CoA. What are they?
b) Briefly explain the fate of acetyl CoA in the citric acid cycle.
c) What are the importance of citric acid cycle?
d) Give three steps where oxidation-reduction reactions take place in the citric acid cycle.
e) What are the different forms of reducing equivalents producing in citric acid cycle?
f) Give the isomerization reaction takes place in the citric acid cycle.
g) Why do we call Aconitase as a stereospecific enzyme?
h) Transformation of succinate to fumarate takes place in the presence of FAD (E^0 = -0.219V). Explain why NAD^+ (E^0 = -0.320V) is not used as the redox coenzyme in this transformation?

(85 marks)

2) (A) I. a) What are the three stages of oxidation of glucose?
b) Electron transport chain consists of five complexes. Briefly describe their functions.

II. a) What are the two photosystems present in chloroplasts?
b) Explain the events that take place when electrons flow through these two photosystems.

(71 marks)

(B) Michealis-Menten equation for enzyme- catalyzed reaction is as follows.

$$V = \frac{V_{max}[S]}{K_m + [S]}$$

a) Name all the terms in the above equation.
b) Give the steady state approximation used to derive above expression.
c) Define V_{max} and explain the reason for achieving V_{max} in enzymatic reactions.

(29 marks)

3) (A) I. Compare the difference in the binding pattern of an uncompetitive inhibitor with a competitive inhibitor.
II. Michealis-Menten equation for uncompetitive inhibition is,

$$V_0 = \frac{V_{max}[S]}{K_m + \alpha'[S]}$$

a) Define α' of the above expression.

b) Derive the expression to draw Lineweaver Burke plot and show that the value of V_{max} changes with inhibitor concentration.

(50 marks)

(B) I. What is meant by an allosteric site?

II. a) Briefly describe the differences between the product inhibition and the feed back inhibition.
b) What is the advantage of product inhibition?

III. a) What is meant by covalent modification of an enzyme?
b) What is a cascade mechanism?
c) Explain how compartmentalization can regulate enzyme activity considering browning of cut vegetables as an example.

(50 marks)

4. A) Fatty acids are long chain carboxylic acids. Initial step of the fatty acid synthesis is the transport of acetyl CoA from mitochondria to cytosol.

i) Explain the process of transporting acetyl CoA from mitochondria to cytosol giving relevant equations.

(40 marks)

ii) Compare the synthesis and β oxidation of fatty acids.

(40 marks)

B) Carbon skeletons of degraded amino acids enter citric acid cycle for further reactions.

i) Name two amino acids which are degraded to oxaloacetate in the citric acid cycle.

(10 marks)

ii) What is meant by transamination?

(10 marks)

5. Pentose phosphate pathway (PPP) is a secondary metabolic pathway of glucose.

i) Give the advantages of Pentose phosphate pathway in the cell.

(10 marks)

ii) Give the end products of oxidative and non-oxidative reactions of Pentose phosphate pathway.

(20 marks)

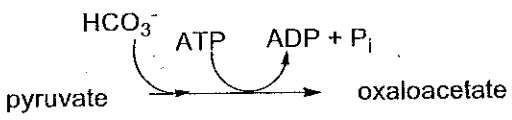
iii) There are three main modes of Pentose phosphate pathway operations in the body in maximizing different products. Explain the pathway which maximize the production of ATP in the cell.

(30 marks)

iv) Explain how glycerol is used to synthesize glucose in the cell.

(40 marks)

6. Pyruvate carboxylase is an example for allosteric enzymes in producing oxaloacetate in the citric acid cycle as follows,



i) What do you mean by an allosteric enzyme?

(10 marks)

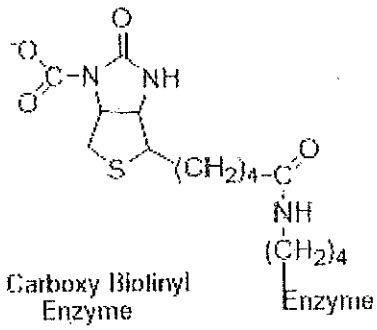
ii) What are the main characteristics of an allosteric enzyme?

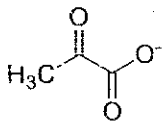
(20 marks)

iii) Why does this reaction proceed in two phases?

(10 marks)

iv) Carboxy biotinyl enzyme is the product of phase I of the above reaction. Give a possible mechanism for the phase II reaction.





(40 marks)

v) Explain the symmetry model of the allosteric enzymes.

(20 marks)