U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 19BT4DCBAB **Max Marks: 100**
Course: Biochemistry & Bioenergetics **Date: 14.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Justify the statement "Standard free energy changes are additive" with a suitable example. **07**

b) Describe why the free energy change for ATP hydrolysis is large and negative. and explain the chemical basis for the large free-energy change associated with ATP hydrolysis. **07**

c) The steady-state concentrations of ATP, ADP and Pi in isolated spinach chloroplasts under full illumination at pH 7.0 and temperature of 37 °C are 120.0, 6.0 and 700 µM, respectively. Calculate the free-energy requirement for the synthesis of 1 mol of ATP under these conditions. (Given $\Delta G'^{0}$ = + 30.5 kJ/mol) **06**

UNIT - II

2 a) In an almost universal central pathway of glucose catabolism, in the first phase of reactions, the energy of ATP is invested, raising the free-energy content of the intermediates. The energy gain comes in the second phase. Write the sequential reactions of the pathway with their enzymes and explain. Calculate the energetics in aerobic conditions. **10**

b) Compare the $\frac{P}{O}$ ratios observed for mitochondrial respiration with the following substrates and condition. **05**

i. Oxidation of Succinate by O_2
ii. Oxidation of Ubiquinol (UQH_2) by O_2.

c) The TCA cycle is amphibolic in nature. As intermediates of the citric acid cycle are removed to serve as biosynthetic precursors, explain how they are replenished. **05**

OR

3	a)	An oxidation pathway that occurs in rapidly dividing cells also generates compounds needed for reductive biosynthesis or to counter the damaging effects of oxygen radicals. Write the sequential reactions of oxidation and the significance of the pathway in various tissues.	**08**
	b)	Justify the statement "Electron Transport Chain is coupled with ATP synthesis".	**08**
	c)	Explain how the three irreversible reactions of glycolysis are by passed during gluconeogenesis. List the key gluconeogenic precursors.	**04**

UNIT - III

4	a)	Illustrate and explain the C_4 pathway of CO_2 assimilation, which occurs through a four-carbon intermediate.	**06**
	b)	When a suspension of green algae is illuminated in the absence of CO_2 and then incubated with $^{14}CO_2$ in the dark, $^{14}CO_2$ is converted to [^{14}C] glucose for a brief time. What is the significance of this observation with regard to the CO_2-assimilation process, and how is it related to the light reactions of photosynthesis? Why does the conversion of $^{14}CO_2$ to [^{14}C] glucose stop after a brief time?	**08**
	c)	If a sugar cane plant is illuminated in the presence of $^{14}CO_2$, after about one second, more than 90% of all the radioactivity incorporated in the leaves is found at C-4 of malate, oxaloacetate and aspartate. Only after 60 seconds does ^{14}C appear at C-1 of 3-phosphoglycerate. Give the possible explanation.	**06**

UNIT - IV

5	a)	A molecule of C_{16} fatty acid is transported across the mitochondrial membrane and subsequently oxidized within the matrix. Explain the sequence of events and analyze the energetics associated with its complete oxidation.	**10**
	b)	Describe the structure of fatty acid synthase complex involved in the biosynthesis of fatty acid.	**05**
	c)	Write the reactions of ketone body formation that occur in the matrix of liver mitochondria.	**05**

UNIT - V

6	a)	Explain the biosynthesis of any two amino acids of oxaloacetate family.	**08**
	b)	Describe in detail how ammonia is transported to the liver cells and detoxified.	**08**
	c)	Explain how purine and pyrimidine bases are recycled by salvage pathways?	**04**

OR

7	a)	Define transamination. Explain the role of PLP in transamination.	**06**
	b)	Explain the biodegradation of purine nucleotides AMP and GMP.	**06**
	c)	List the different excretory forms of nitrogen.	**03**
	d)	Describe the feedback regulation of denovo biosynthesis of purine nucleotides.	**05**

****