18305

BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – M.Sc.(BT)-2025
Course Name – Biomolecules and Biochemistry
Course Code - MBT10403
(Semester I)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Identify the type of supercoiling in E. coli chromosomes.
a) Positive b) Linear
c) Negatively supercoiled d) Relaxed

(ii) Select the condition that would most delay DNA reannealing in Cot analysis.
a) Low complexity b) High repeat content
c) Low DNA concentration d) High concentration of probes

(iii) Select the DNA packaging structure in metaphase chromosome.
a) 10 nm fiber b) 30 nm fiber
c) Scaffold loops d) Naked DNA

(iv) Select the technique used to measure DNA reassociation kinetics.
a) PAGE b) Cot curve analysis
c) Southern blotting d) Microarray

(v) Select the DNA groove where transcription factors primarily bind.
a) Minor groove b) Internal groove
c) Major groove d) Helical turn

(vi) Choose the reason base analogs are mutagenic.
a) They intercalate between bases b) They form abasic sites
c) They mispair due to structural differences d) They only affect RNA

(vii) Choose the best explanation for why degenerate codons reduce mutation effects.
a) They form more hydrogen bonds. b) They are always silent.
c) They often code for the same amino acid. d) They are unrecognized by tRNA.

(viii) Predict the amino acid that donates a nitrogen group in purine biosynthesis.
a) Glutamine b) Glycine
c) Histidine d) Alanine

(ix) Choose the amino acid synthesized via the urea cycle in mammals.

a) Tyrosine
b) Glutamate
c) Arginine
d) Alanine

(x) Choose the amino acid that is not synthesized in humans.

a) Leucine
b) Glutamate
c) Proline
d) Serine

(xi) Select the correct sequence of coenzymes involved in ribonucleotide reduction.

a) NADPH → GSH → Thioredoxin
b) NADPH → Thioredoxin → Ribonucleotide reductase
c) GSH → NADPH → SAM
d) SAM → ATP → GSH

(xii) Identify the fate of pyruvate under anaerobic conditions in skeletal muscle.

a) Ethanol production
b) Acetyl-CoA formation
c) Lactate production
d) Glucose synthesis

(xiii) Select the metabolite that allosterically inhibits pyruvate kinase in the liver.

a) AMP
b) Acetyl-CoA
c) Glucose 6-phosphate
d) ADP

(xiv) Infer the metabolic condition under which fructose 2,6-bisphosphate levels would be high in the liver.

a) Prolonged starvation
b) After high carbohydrate meal
c) During beta-oxidation
d) Under hypoxic stress

(xv) Identify the effect of TGF-β signaling in advanced cancer.

a) Inhibits EMT
b) Promotes proliferation
c) Promotes EMT
d) Induces apoptosis

Group-B

(Short Answer Type Questions) 3 x 5=15

2. What is a Cot curve, and how does it provide insights into the complexity and abundance of nucleic acid sequences in a given sample? (3)
3. Differentiate between base stacking and hydrogen bonding as stabilizing forces in the DNA double helix. (3)
4. Determine how glutamine contributes to both amino acid and nucleotide biosynthesis. (3)
5. Differentiate between substrate-level phosphorylation and oxidative phosphorylation. (3)
6. Evaluate the effectiveness of HER2-targeted therapies in managing breast cancer. (3)

OR

Assess how activation of the Hippo pathway impacts cancer progression. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Assess the functional importance of nucleotide excision repair enzymes in prokaryotic systems. (5)
8. Explain how the metabolic fate of amino acids is linked to gluconeogenesis and energy production. (5)
9. Describe the hierarchical levels of DNA packaging in eukaryotes. (5)
10. Distinguish the chromatin structure in sperm cells from that in somatic cells. (5)
11. Explain how DNA-binding proteins distinguish specific sequences without unwinding the DNA helix. (5)
12. Assess the impact of EMT on chemoresistance and cancer relapse. (5)

OR

Summarize how Notch and Hedgehog signaling pathways support tumorigenesis. (5)

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