

(24)
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2994

Unique Paper Code : 32491402

Name of the Paper : Gene Organization, Replication
and Repair

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : IV

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **8** questions.
3. Attempt any **5** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) Justify the following statements :

- (i) The melting curve of the DNA increases by increase in ionic strength of the solution.
- (ii) Transposition causes rearrangement of segments of DNA.
- (iii) Ames test is called reversal of mutation.

P.T.O.

(iv) There is inverse correlation between organism complexity and gene density.

(v) DNA replication is coupled to pyrophosphate hydrolysis.

(b) Define the following :

(i) Chi sequences

(ii) Processivity

(iii) SSB proteins

(iv) Topoisomers

(v) Primase (10,5)

2. Differentiate between the following :

(i) Nucleotide Excision Repair and Base Excision Repair.

(ii) DNA Pol I and DNA Pol III.

(iii) Topoisomerase Type I and Topoisomerase Type II.

(iv) Centromere and Teleomere.

(v) Poly A retrotransposons and virus like retrotransposons (3×5)

3. (a) Telomerases are not required for circular chromosome replication however they are needed for linear chromosomes, why?

- (b) Mention various factors that stabilize the structure of DNA.
 - (c) How the DNA repair machinery ensures that the error correction is done on the newly made strand not on the parental strand during repair of replication errors.
 - (d) Water is an important component of DNA structure yet it can cause damage to DNA. Explain.
(3,3,4,5)
4. (a) Explain the mechanism of translesion synthesis during DNA damage.
- (b) Comment on various enzymes/proteins required for DNA replication in prokaryotes.
- (c) What does superhelical density means biologically?
(5,7,3)
5. (a) Explain the mechanism which ensures that DNA is replicated only once per cell cycle in eukaryotes.
- (b) What is the need for packaging of DNA into the chromosomes? Describe the condensation of DNA at "beads on string" level.
- (c) How is the Holliday junctions resolved in prokaryotes? Explain diagrammatically. (5,5,5)

6. (a) What would be the consequences, if Uracil was a natural base in place of Thymine in DNA?
- (b) What would be the change in absorbance at 260 nm when DNA is heated? Explain.
- (c) Compare A, B and Z forms of DNA.
- (d) What is a replicator? Explain its importance in initiation of replication by giving examples. (3,3,4,5)
7. (a) Give the mechanism of action of following chemical compounds and their use in medicine.
- (i) Novabiocin
 - (ii) Cisplatin
 - (iii) Azidothymidine
 - (iv) 6 mercaptopurine
 - (v) Acyclovir
- (b) Write down the steps of DNA processing by Rec BCD enzymes. (10,5)
8. Write short notes on the following : (3,4,4,4)
- (i) Serine recombinase
 - (ii) Polymerase switching in eukaryotes
 - (iii) Direct reversal of mutation
 - (iv) Mechanism of transposition

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Your Roll No.



Sr. No. of Question Paper : 3105

Unique Paper Code : 32491403

Name of the Paper : Metabolism of amino acids and nucleotides

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : IV

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **eight** questions.
3. Attempt any **five** questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.

1. (a) Explain the following statements (Any Five) :

- (i) Purine biosynthesis is impaired in Vitamin B12 deficiency.
- (ii) Arginine is essential in children but not in adults.
- (iii) Orotic aciduria is treated by feeding uridine to patients.
- (iv) Individuals with a genetic defect in phenylalanine hydroxylase require tyrosine in their diet for normal growth.
- (v) Serine is synthesized from glycolytic intermediates.
- (vi) Isoleucine is both glucogenic and ketogenic amino acid.

(b) Write the metabolic reactions inhibited by the following inhibitors :

- (i) 5-fluorouracil

(ii) Allopurinol

(iii) Trimethoprim

(c) Write the scientific contributions of the following
(Any Two) :

(i) John Buchanan

(ii) Archibald Garrod

(iii) G Elion & G Hitchings (10,3,2)

2. (a) Differentiate between :

(i) Transamination and oxidative deamination

(ii) Carbamoyl phosphate synthetase I and II

(iii) *De novo* synthesis of purine and pyrimidine nucleotides

(b) Why patients of phenylketonuria are not advised to take artificial sweeteners?

- (c) Write down the common reactions and enzymes associated with the breakdown of branched chain amino acids. Name the metabolic disorder caused by the genetic deficiency of branch chain keto acid dehydrogenase complex. (9,2,4)

3. (a) Explain why :

- (i) Plants do not possess δ -amino levulinic acid synthetase activity yet they require porphyrins for the synthesis of chlorophyll and other tetrapyrroles.
 - (ii) dATP at low concentration is an activator of ribonucleotide reductase whereas at higher concentration it inhibits its activity.
- (b) Regulation of glutamine synthetase is the primary point in bacterial nitrogen metabolism. Elaborate on the regulation of Glutamine synthetase in *E. coli*.

(c) Name and draw the structure of alpha-keto acids resulting when each of the following amino acids undergoes transamination :

(i) Aspartate

(ii) Phenylalanine

(iii) Arginine

(iv) Glutamate

(4,7,4)

(a) What are different pathways for the breakdown and synthesis of glycine? Explain the protein components of glycine cleavage system and elaborate on the function of each these proteins of glycine cleavage system.

(b) Name the enzymes which are the part of a single trifunctional protein in pyrimidine biosynthesis and outline the reactions catalysed by them.

(c) Discuss the gamma-glutamyl cycle and write about its physiological significance.

(7,3,5)

P.T.O.

5. (a) Explain the biochemical basis and symptom the following metabolic disorders :
- (i) Hartnup's disease
 - (ii) Alkaptonuria
 - (iii) Hyperammonemia/Hyperinsulinemia (HA)
 - (iv) SCID
- (b) Explain the urea cycle with reactions involved discuss its physiological significance.
- (c) What is FIGLU excretion test? How is performed? (8)
6. (a) Write down the steps for the following metabolic conversions :
- (i) Inosine to uric acid
 - (ii) S-adenosyl Homocysteine to cysteine
 - (iii) Homogentisate to Fumarate
 - (iv) Glutamate to proline

- (b) Explain the regulation of biosynthesis of deoxyribonucleotides from ribonucleotides.
- (c) L-asparaginase is an effective chemotherapeutic agent. Justify. (8,5,2)
7. (a) Explain the following with reactions :
- (i) Krebs bicycle
 - (ii) Activated methyl cycle
- (b) Discuss three major biosynthetic reactions which utilize PRPP.
- (c) Explain why many patients with glucose 6- phosphatase deficiency have high serum levels of uric acid. (8,3,4)
8. (a) Elaborate on the mechanism of nitrogen fixation. Why do nitrogen fixing bacteria use a large amount of ATP to fix nitrogen? How do anammox bacteria contribute to nitrogen cycle?

(b) Explain the regulation of heme biosynthesis.

(c) Why are alanine and glutamine present in much higher concentrations in plasma than any other amino acids? (8,4,3)

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Your Roll No.



Sr. No. of Question Paper : 4052

Unique Paper Code : 2492012401

Name of the Paper : Metabolism of Amino Acids and Nucleotides

Name of the Course : B.Sc. (Hons.) Biochemistry

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **six** questions.
3. Attempt any **four** questions.
4. **All** questions carry equal marks.
5. Question no. 1 is compulsory.

1. (a) Explain the following :

(i) Cysteine and arginine are essential in children but not in adults.

P.T.O.

- (ii) L-asparaginase is an effective chemotherapeutic agent.
- (iii) S-adenosyl methionine (SAM) has a higher methyl group transfer potential than N^5 -methyl tetra hydro folate.
- (iv) Branch chain amino acid metabolism is affected by Vitamin 12 deficiency.
- (v) dATP is toxic to mammalian cells.

(b) Write the mode of action of the following inhibitors
(Any three) :

- (i) 6-Mercaptopurine
- (ii) 5-fluorouracil
- (iii) Methotrexate
- (iv) Allopurinol

(c) Give one significant contribution of the following scientists (Any two) :

- (i) John Buchanan
- (ii) P. Reichard
- (iii) A. Foiling

(10,3,2)

2. (a) Explain the mechanism of transamination reaction with the help of one example.

(b) Draw Gamma-glutamyl cycle and explain its physiological significance.

(c) Explain the biochemical basis and symptoms of the following metabolic disorders (any three) :

(i) Maple syrup urine disease

(ii) Orotic aciduria

(iii) Homocystinuria

(iv) SCID (4,5,6)

3. (a) Differentiate between the following :

(i) Transamination and oxidative deamination

(ii) Carbamoyl phosphate synthetase I and II

(b) What are the different pathways for the break down and synthesis of glycine? Describe the function of each protein of glycine cleavage system.

(c) What is FIGLU test? How is it performed?

(6,6,3)

4. (a) How is nitrogen from the biosphere assimilated into biomolecules?

(b) Explain the regulation of biosynthesis of deoxyribonucleotides.

(c) Write a short note on activated methyl cycle.

(5,5,5)

5. (a) Explain the regulation of Glutamine synthetase by covalent modification.

(b) Write the role of pyridoxal phosphate in amino acid metabolism.

(c) Explain urea cycle and discuss its physiological significance.

(5,5,5)

6. (a) Explain Glucose-Alanine cycle. What is its significance in cellular metabolism?

(b) Write the steps to accomplish the following conversion :

(i) dUMP to dTTP

(ii) Phenylalanine to Homogentisate

(iii) Tryptophan to NAD

(iv) Arginine to creatine

(c) Explain Purine nucleotide cycle and its significance.

(4,8,3)

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Your Roll No.....



Sr. No. of Question Paper : 4090

Unique Paper Code : 2492012402

Name of the Paper : Hormones: Biochemistry and Function

Name of the Course : B.Sc. (Hons.) Biochemistry

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **six** questions.
3. Attempt any **4** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) Justify the following statements (**any 6**) :

(i) Thyroxine is called a permissive hormone.

(ii) POMC is a prohormone.

P.T.O.

- (iii) Somatomedins have a role in bone growth.
- (iv) Beta-blockers are administered to cardiac patients.
- (v) Cholecalciferol plays a dual role in physiology.
- (vi) Hyperglycemia is not a confirmatory symptom of diabetes mellitus.
- (vii) Oral contraceptive pills contain synthetic estrogen & progesterone like steroids.

(b) Define the following (**any 3**) :

- (i) Incretins
- (ii) Paracrine
- (iii) Synergistic effect
- (iv) Tropic hormone (12,3)

2. (a) Explain the role of oxytocin, estrogen & progesterone during parturition?

(b) Draw a well labeled diagram of hypothalamic hypophyseal portal system.

(c) What are the consequences of increased growth hormone secretion? (6,4,5)

3. (a) Describe the effect of epinephrine and cortisol in stress.

(b) Discuss the pathophysiology associated with hypersecretion of adrenocortical hormones.

(c) Differentiate between diabetes insipidus and diabetes mellitus. (6,4,5)

4. (a) Describe the role of insulin in regulating the fuel metabolism.

(b) Discuss the role of calcitonin and PTH in maintaining calcium homeostasis.

(c) Explain why TSH levels are low in Grave's disease and high in Hashimoto's thyroiditis? (6,5,4)

5. (a) Discuss the interplay of hormones in the follicular and luteal phases of the ovarian cycle.

(b) Explain the direct and indirect effects of growth hormone.

- (c) With example explain the long loop and short loop feedback regulatory mechanisms of hormone secretion. (6,5,4)

6. Write short notes on the following :

- (i) Biochemical action of thyroxine
- (ii) Renin-Angiotensin system
- (iii) Secretin family hormones (5×3)

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Your Roll No.

Sr. No. of Question Paper : 4128

Unique Paper Code : 2492012403

Name of the Paper : Gene Organization, Replication and Repair

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **six** questions.
3. Attempt any **4** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) Name the prokaryotic protein and its eukaryotic counterpart with the following function in DNA replication and repair:

(i) Primer synthesis

P.T.O.

- (ii) Leading strand synthesis
- (iii) Mismatch repair
- (iv) DNA unwinding
- (v) Lagging strand synthesis

(b) State True or False and explain :

- (i) Eukaryotic chromosomes have multiple origins of replication.
- (ii) Transposition is also termed as illegitimate recombination.
- (iii) Sliding clamp increases DNA polymerase processivity.
- (iv) Microsatellites are mutational hot spots that can serve as biomarkers for diseases.
- (v) Linking number of an unwound DNA molecule equals to Twist. (5,10)

2. (a) Differentiate between the following :

- (i) Topoisomerase I and Topoisomerase II
- (ii) Replicative and Non-replicative Transposition
- (iii) Z-DNA and A-DNA

(iv) Translesion Repair and NHEJ

(v) Serine and Tyrosine recombinase

(b) Briefly explain the following terms :

(i) Okazaki Fragments

(ii) Hypochromicity

(iii) Superhelical density

(iv) Replicator

(v) Cooperative binding (10,5)

3. (a) With the help of a diagram, explain how mismatch repair removes errors that escape proofreading.

(b) Explain how eukaryotic chromosomes are replicated exactly once per cell cycle.

(c) What is the end-replication problem and how is it solved? (5,4,6)

4. (a) Briefly describe the features of B form of DNA structure and explain the forces that contribute to its stability.

(b) Explain how the following chemicals or conditions cause mutations?

(i) 5-Bromouracil

- (ii) Exposure to UV radiations
- (iii) Deamination of 5-methyl Cytosine
- (iv) Depurination of Guanine
- (v) Ethidium bromide

(c) Diagrammatically explain the key steps of Homologous recombination. (5,5,5)

5. (a) What is a Replisome? Explain the sequence of events that take place at the replication fork in an *E. coli* cell that allow DNA to replicate.

(b) With the help of a diagram, explain the principle behind Ames Test.

(c) Explain two mechanisms of direct repair of DNA. (6,4,5)

6. Write short notes on the following :

(a) Polymerase switching

(b) Xeroderma pigmentosum

(c) DNA Glycosylases

(d) Positive and Negative supercoiling of DNA

(e) Inhibitors of DNA replication (2,2,3,4,4)

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Your Roll No.....

Sr. No. of Question Paper : 4170

Unique Paper Code : 2493012005

Name of the Paper : DSE Nutritional Biochemistry

Name of the Course : B.Sc. (H) Biochemistry

Semester : IV

Duration : 2 Hours

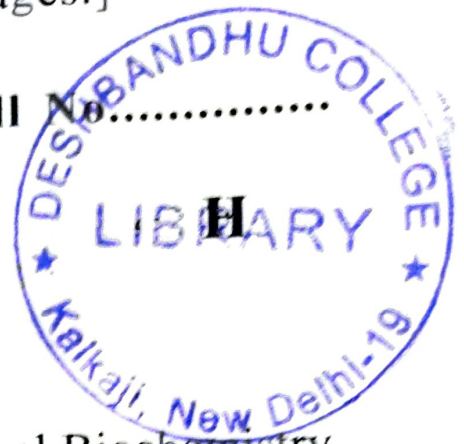
Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are 6 questions.
3. Attempt any **four** questions.
4. **Q1** is compulsory.
5. **All** questions carry equal marks.

1. (a) Define

- (i) SDA
- (ii) BMI
- (iii) PEM
- (iv) RDA



(v) SCFA

(b) Comment on the following (any 5)

- (i) The active form of vitamin D acts as a hormone
 - (ii) The respiratory quotient of fats is lower than that of carbohydrates
 - (iii) Hypomagnesemia can cause neuromuscular irritability and changes in a normal ECG
 - (iv) Chronic alcoholics are more prone to thiamine deficiency
 - (v) Newborns are often deficient in vitamin K
 - (vi) Leafy vegetables inhibit calcium absorption
 - (vii) PUFAs exhibit an anti-atherogenic effect
- (5,10)

2. (a) Elaborate on the various classes of dietary fiber and explain the advantages and disadvantages of including too much or too little fiber in the diet?
- (b) Explain amino acid antagonism with examples.
- (c) Megaloblastic anaemia is caused by either folic acid or Vitamin B12 deficiency. How is the differential diagnosis done to identify the deficient micronutrient?
- (5,5,5)

3. (a) What are essential and conditionally essential amino acids? Discuss the various nutritional indices used to assess the quality of dietary proteins and which amongst them is most preferred.
- (b) Define glycemic index and glycemic load. Explain why though watermelon and doughnut both are high glycemic index foods (GI of watermelon: 80; GI of doughnut: 75); consumption of 25 g of both leads to a varied glycemic load in the body.
- (c) Write a short note on how calcium is involved in bone mineralization and the various bone metabolic disorders. (5,5,5)
4. (a) What do you understand by essential fatty acids? Mention their sources and their physiological role.
- (b) A 3-year-old boy was presented with dry flaky skin, mild pitting edema in both legs, cheliosis, pale and easily pluckable hair. The mother complained that the child frequently suffered from cold and cough. Biochemical examination revealed plasma albumin levels of 1.2 g/dl and markedly reduced serum levels of the essential amino acids. Dietary history revealed that the child was fed just rice-water. Diagnose the condition and explain the biochemical basis of the symptoms. Also suggest treatment of the disease.

(c) Elaborate the role of vitamin A in Wald's visual cycle. (5,5,5)

(a) A 54-year-old male was admitted with moderate cognitive impairment and diarrhoea. His vital signs were normal and there were no abnormalities in electrolytes and blood counts. He had prominent pigmentation around the neck. He was given antipsychotics but without any improvement. In fact, after three days, his diarrhoea worsened and he became more mentally unstable. Give reasoning for the symptoms, diagnose the condition and suggest a probable treatment approach.

(b) Discuss the biological role of selenium and physiological manifestations of its deficiency. How is selenium related to vitamin E?

(c) What is BMR? Discuss the factors affecting it. (5,5,5)

(a) What is meant by Specific Dynamic Action of food? How does it vary for the various macronutrients?

(b) Differentiate between Wilson's disease and Menke's disease.

(c) What is the RDA of Vitamin C? Describe 2 important functions of vitamin C with biochemical explanation. (5,5,5)