

- (b) What are the different components of extracellular matrix? Explain briefly.
- (c) Explain the process of assembly, organization and role of intermediate filaments. (5,5,5)
5. (a) Give principle and merits of Phase contrast microscope over Bright field microscopy.
- (b) Explain the role of Ran GTP in the regulation of nuclear import and export.
- (c) Describe the organization of Tight Junctions and why are tight junctions important for Maintaining the integrity of polarized cell? (5,5,5)
6. Write Short notes on :
- (i) Mitochondrial Genome
- (ii) Functions of SER
- (iii) Focal adhesions
- (iv) Treadmilling of Microfilaments
- (v) Phagocytosis (5×3=15)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4147

H

Unique Paper Code : 2492011203

Name of the Paper : Basic Concepts of Cell Biology

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

Semester : II

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 4 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.

1. (a) Name the following :

- (i) An actin binding protein
- (ii) A protein forming nuclear lamina
- (iii) A Lysosomal storage disease

P.T.O.

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(iv) The place of ribosome assembly

(v) The disease caused due to defect in peroxisome biogenesis

(b) Define the following :

(i) Magnification

(ii) Importin

(iii) Fixative

(iv) MTOC

(v) Cell adhesion molecules

(c) Give the location and function of the following :

(i) Integrin

(ii) Catalase

(iii) Connexin

(iv) Succinate Dehydrogenase

(v) Keratin

(5,5,5)

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3

2. Differentiate between the following :

(i) Mitosis and Meiosis

(ii) Animal cell and plant cell

(iii) Peroxisomes and Lysosomes

(iv) Endocytosis and Exocytosis

(v) Gap junctions and Plasmodesmata (5×3=15)

3. (a) Chloroplast is a semi-autonomous organelle that has prokaryotic origin. Comment.

(b) Give the structure and function of Nuclear Pore Complex.

(c) What are actin binding proteins and how do they regulate the organization of Microfilaments.

(d) What property of Glycosaminoglycans allows them to form hydrated gel? (3,5,5,2)

4. (a) Define Resolution and what factors affect Resolution of a Microscope. Describe the different types of stain used in Light microscopy.

P.T.O.

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[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4071

H

Unique Paper Code : 2492011201

Name of the Paper : Enzymes

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

Semester : II

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) State whether the following statements are True or False and justify your answer :

(i) A purified enzyme has maximum specific activity.

P.T.O.

(ii) Higher concentration of enzyme gives rise to higher turnover number.

(iii) Competitive inhibition can be overcome by increasing substrate concentration.

(iv) All enzymes are protein in nature.

(v) Methotrexate is used in chemotherapy.

(b) Define the following terms :

(i) Catalytic perfection

(ii) Prosthetic group

(iii) Marker enzyme

(iv) Ribozyme

(v) Katal

(10,5)

2. (a) Derive the Michaelis-Menten equation and show under what conditions initial velocity is 80 % of maximum velocity.

(b) Explain enzyme classification giving suitable examples.

(c) What are mechanism based inhibitors. Explain with the help of an example. (5,6,4)

3. (a) Differentiate between the following (any 2) :

(i) Continuous and discontinuous enzyme assay

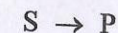
(ii) Lock and key and induced fit theory of enzyme catalysis

(iii) Eadie-Hofstee and Hanes plot

(b) Describe two methods of enzyme immobilization and give two applications of immobilized enzymes.

(c) Allopurinol is used in the treatment of Gout. Justify. (6,6,3)

4. (a) An enzyme E is known to catalyze the conversion of substrate S into product P.



The k_{cat} for the enzyme is $600s^{-1}$. When $[E_t]=20nM$ and $[S]=40\mu M$, the reaction velocity $V_0 = 9.6 Ms^{-1}$. Calculate the K_m of the enzyme for the substrate.

(b) Explain how the enzyme glycogen phosphorylase is regulated by covalent modification.

(c) Give a suitable example for each of the following:

(i) Enzyme regulated by feedback inhibition

(ii) A multienzyme complex

(iii) A competitive inhibitor

(iv) Zymogen

(6,5,4)

5. (a) What are coenzymes? Explain with suitable examples how TPP and PLP aid in enzyme catalysis.

(b) Explain the mechanism of action of chymotrypsin.

(c) Explain the use of HRP in enzyme immunoassay.

(6,5,4)

6. (a) What are bisubstrate reactions. Explain the different types of bisubstrate reactions with the help of suitable examples.

(b) Elaborate the use of Lineweaver-Burk plots to differentiate the following types of enzyme inhibitions :

(i) Competitive inhibition

(ii) Non-Competitive inhibition

(iii) Uncompetitive inhibition

What is apparent K_m and V_{max} in each case?

(c) Describe any two applications of enzymes as medicine.

(6,6,3)

(200)

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[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2922

H

Unique Paper Code : 32491601

Name of the Paper : Genetic Engineering and
Biotechnology

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

Semester : II/IV/VI

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.

P.T.O.

1. (a) State true or false and justify your answer.

(i) Insertional inactivation of the amp^R gene helps in identifying recombinant clones using pUC18 as cloning vector.

(ii) It is better to use an expression vector with an inducible promoter rather than a strong promoter.

(iii) Lambda insertion vectors are used to make genomic DNA libraries.

(iv) The enzyme sequenase is genetically modified version of Taq DNA polymerase.

(v) Recombinant Factor VIII expression can be easily done in prokaryotic host.

(vi) Disarmed vectors do not possess any virulence genes.

(b) Define the following :

(i) Star activity

(ii) Marker rescue

(iii) Adapters (12,3)

2. (a) What do you understand by in-vitro packaging of DNA? Explain.

(b) Which enzymes are used for the following processes? Justify your answer.

(i) Labeling of 5' end of DNA.

(ii) Joining blunt ended molecules

(iii) Adding homopolymer tails to DNA ends

(c) Discuss chemical and physical methods of DNA introduction into cells. (4,6,5)

3. Differentiate between :

(i) Cosmid and Plasmid

(ii) yEP and yIP vectors

(iii) Southern blot and Northern blot

(iv) Cointegrate and Binary Ti plasmid

(v) PCR and RT-PCR (3×5)

4. (a) What are fusion tags? Explain their uses with the help of two examples.

(b) The following gel profile is obtained on digesting a linear DNA fragment with two restriction enzymes :

EcoRI 4, 12, 34

BamHI 7, 15, 28

EcoRI + BamHI 4, 5, 7, 11, 23 (all fragment sizes are in kilobases)

Draw the restriction map of the given linear DNA.

(c) What are probes? Discuss any two methods of DNA probe preparation? (5,5,5)

5. (a) Explain Retroviral based gene therapy in animal cells with a suitable example.
- (b) What are pET vectors? How are they successful in ensuring tight regulation of expression from a gene of interest?
- (c) Describe the key features of different restriction modification systems in prokaryotes. (5,5,5)
6. (a) What are high-capacity vectors. Describe any two of them in details.
- (b) Explain the parameters that should be kept in mind while designing primers for PCR.
- (c) Give underlying principle of blue-white selection assay. (6,5,4)

7. (a) Describe any one method of site-directed mutagenesis.
- (b) What are the transient and permanent protection groups in the phosphoramidite method of DNA synthesis? What are the differences between the chemical and enzymatic methods of DNA synthesis?
- (c) What is the principle of Sanger's method of DNA sequencing? Draw the autoradiograph derived from dideoxynucleotide sequencing of 5'CCTTGAATCTTAGCCATG3'. (4,5,6)
8. Write short notes (any three) :
- (i) Recombinant Insulin

(ii) Genomic DNA libraries

(iii) qPCR

(iv) Yeast two hybrid system

(5×3)

(c) Name the key regulatory enzymes of TCA cycle.
Show how they are regulated by product inhibition
and allosteric feedback regulation. (4,5,6)

6. (a) Give the cause and symptoms of the following
diseases :

(i) Lactose intolerance

(ii) Pompe's disease

(iii) Cori's disease

(b) Give an overview of Starve feed cycle. (3×3, 6)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4109

H

Unique Paper Code : 2492011202

Name of the Paper : Metabolism of Carbohydrates

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

Semester : II

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 4 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.

1. (a) Give the biochemical basis of the following :

(i) Fructose 2, 6-bisphosphate activates glycolysis
but inhibits gluconeogenesis.

(ii) Glycogenesis needs a primer to initiate itself.

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- (iii) Patients suffering from Von Gierke's disease manifest hypoglycemia.
- (iv) Iodoacetate is a suicide inhibitor of Glycolysis.
- (b) Give the reaction for the following :
 - (i) Give the reaction generating NADH in Glycolysis.
 - (ii) Reaction catalyzed by phosphoglucomutase.
 - (iii) Dehydration reaction in Glycolysis.
 - (iv) Reaction involved in substrate level phosphorylation in TCA cycle.
 - (v) Reaction that introduces branching in Glycogen. (2.5×4,1×5)
- 2. (a) Differentiate between the following :
 - (i) Catabolism and Anabolism
 - (ii) Aldolase A and Aldolase B
 - (iii) Lactose fermentation and alcohol fermentation
 - (iv) Hexokinase and Glucokinase (3,4,4,4)

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- 3. (a) Show schematically the role of 3 enzymatic activities and 5 Coenzymes in the conversion of Pyruvate to Acetyl CoA by Pyruvate dehydrogenase complex.
- (b) Show how Pyruvate is converted to Phosphoenol pyruvate. Give the enzymes, coenzymes and the regulators involved in the reactions.
- (c) Conversion of galactose 1- phosphate to glucose 1- phosphate requires two nucleotide derivatives. Explain. (6,6,3)
- 4. (a) Give the steps involved in Glycogenolysis with the generation of Glucose-1-P and glucose.
- (b) Show how Glycogenolysis and Glycogen synthesis are counter regulated to prevent futile cycles.
- (c) Give the ATP utilizing steps in Gluconeogenesis. (6,6,3)
- 5. (a) What are Anaplerotic reactions? Give examples.
- (b) Give the reactions of Oxidative phase of Pentose phosphate pathway. Give the biological importance of these reactions.

P.T.O.

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2940

H

Unique Paper Code : 32491401

Name of the Paper : Human Physiology

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.

P.T.O.

1. (a) Identify / name the following :

- (i) Decreased platelet levels in blood
- (ii) Volume of blood ejected from each ventricle per cardiac cycle
- (iii) The amount of air that moves in or out of the lungs with each respiratory cycle
- (iv) The sphincter in the duodenum that regulates the movement of pancreatic and biliary secretions
- (v) The capillary bed surrounding the loop of Henle, DCT and Collecting ducts
- (vi) The 'stiffening of death'
- (vii) The rapid movement of a depolarization/hyperpolarization signal through a myelinated axon
- (viii) The reflex that regulates the movement from small intestine to large intestine.
- (ix) The lipid rich remnants of the Graafian follicle after ovulation

- (x) The extracellular fluid that bathes the brain
- (xi) The process of conversion of spermatid to sperm
- (xii) Disorder when alveoli collapse, perforate and coalesce

(b) Comment on the following statements :

- (i) Cardiac muscles unlike skeletal muscles are resistant to tetany
- (ii) A blunt cut bleeds less as compared to a sharp cut
- (iii) Neural conductance is always unidirectional
- (iv) The structural organization of the nephron is crucial in regulating urine volume.
- (v) Placenta is called a maternal-fetal unit
- (vi) Enteric nervous system operates independent of the brain. (6,9)

2. (a) Expand the following and explain their physiological significance :

- (i) BER
- (ii) FEV1
- (iii) MAP
- (iv) EEG
- (v) GFR
- (vi) MLCK
- (vii) vWF
- (viii) EPSP

- (b) A boy went for a school trip and unfortunately got lost. He was relocated 3 days later by a search party with a deep cut on his thigh. He was badly disoriented, dehydrated with low blood pressure. What condition is the child suffering from. In the hospital he was given a bottle of dextrose and saline and also a bottle of 2% albumin. What is the reason for such a therapy. (12,3)

- (a) Identify the location of the following cells and briefly explain their physiological role :

- (i) Podocytes
- (ii) Interstitial cells of Cajal
- (iii) Trophoblasts
- (iv) Cholangiocytes
- (v) Alveolar type II
- (vi) Ependymal cells
- (vii) Sertoli cells
- (viii) Astrocytes

- b) Inulin and para-amino hippuric acid are infused into the blood stream of a 40 kg ape. The following measurements were made during the course of the infusion, and were noted to be constant throughout the experiment: arterial plasma concentration of inulin 0.15 mg/ml, of para-amino hippuric acid 0.2 mg/ml; renal venous plasma concentration of para-amino hippuric acid 0.0015 mg/ml; urine flow 2 ml/min; urinary concentration of inulin 9.0 mg/ml, of para-amino hippuric acid 50 mg/ml. Calculate the GFR. (12,3)

4. Differentiate between :

- (a) Fast and slow muscle fibers
- (b) Arteries and veins
- (c) Sympathetic and parasympathetic nervous system
- (d) COPD and ARDS
- (e) Spermatogenesis and Oogenesis (3×)

5. Outline the following using a flow chart :

- (a) Blood pressure regulation is an interplay of neural and endocrine events involving both the heart and the kidneys
- (b) The regulation of blood pH is controlled by both the kidneys and the lungs.
- (c) Thrombin is important in both procoagulant, anticoagulant as well as fibrinolytic cascade.
- (d) Wigger's diagram showing relationship between ECG, Cardiac Cycle, Ventricular volumes and heart sounds. (4,3,4,4)

6. Explain the biochemical basis for the events.

- (a) Prevention of polyspermy
- (b) Voluntary control of micturition
- (c) Pulmonary edema in left ventricular congestion
- (d) Capacitance of a sperm
- (e) Swallowing of food
- (f) Aspirin and warfarin are both used as blood thinners (2.5×6)

7. Comment on the following statements.

- (a) Neurons cannot divide but can regenerate.
- (b) Ventilation can be controlled by pO_2 , pCO_2 and H^+ concentration
- (c) In liver, blood and bile do not mix
- (d) Diuretics are used to treat anuria and hypertension
- (e) Neuroendocrine factors regulate gastric acid secretion.

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(5)

(f) EDV regulates the cardiac output.

(2.5×6)

8. Write short notes on the following :

(a) Atherosclerosis

(b) Lung compliance

(c) Pain perception

(d) Counter current mechanism in the kidney

(e) Neurophysiology of Sleep

(3×5)

(200)

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[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4090

H

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.

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2

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

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3

(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)

5. (a) β -D-glucose and α -D-glucose have different specific rotations. When either anomer is dissolved in water, their rotation change until a fixed value results. Name the term used to describe this change and discuss the mechanism.
- (b) Briefly explain the various components present in nucleic acids.
- (b) Write a note on hydrogenation of oil. (5,5,5)
6. (a) Draw the structures of disaccharide sucrose and lactose. How is the nature of linkages between 2 monosaccharide units established?
- (b) Write short note on :
- (i) Cellulose
- (ii) Omega-3 and Omega-6 fatty acids
- (iii) Lipid Membranes
- (c) Give the biological importance of triglycerides. (4,6,5)

(500)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4045

H

Unique Paper Code : 2173522006

Name of the Paper : DSE : Biomolecules – I

Name of the Course : B.Sc. (Prog.)

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. Attempt any **four** questions out of **six**.
 3. **All** questions carry equal marks.
 4. Attempt **all** parts of a question together.
-
1. (a) Give the mechanism of osazone formation for D-glucose. D-Glucose and D- Fructose give the same osazone. Explain.

P.T.O.

- (b) Distinguish between reducing and non-reducing sugars. Draw the Fischer projection and Haworth projection structure of anomers of glucose and fructose.
- (c) Give the biological functions of lipids? (5,5,5)
2. (a) Convert the following :
- (i) D-Fructose to D-Glucose
- (ii) D-Glucose to D-Arabinose
- (b) What are nucleotide and nucleoside? Give the name and draw the structure of nucleotide & nucleoside having adenine as a base found in DNA.
- (c) Write a short note on oil and fats.
- (d) What are biochemical functions of steroid hormones? (4,3,4,4)
3. (a) Outline a sequence of reaction by which Maltose can be converted into 2,3,4,6- Tetra-O-methyl-D-glucose and 2,3,5,6-Tetra-O-methyl-D-gluconic acid. Draw all the configurational structures.

- (b) What is RNA? Briefly explain the three functional types of RNA.
- (c) What is rancidity? Differentiate between oxidative and hydrolytic rancidity. (5,5,5)
4. (a) What product will be formed when glucose is
- (i) reacted with HCN.
- (ii) reacted with phenyl hydrazine.
- (iii) reacted with dil. HNO_3 .
- (iv) heated with HI in presence of phosphorus.
- (v) reduced with sodium-alcohol.
- (b) What are epimers? Explain using suitable examples. Suggest a method to convert D-(+)-Glucose to D-(+)-Mannose.
- (c) Define iodine number. What is its significance. Calculate the iodine number of triolein whose molecular weight is 884.
- (d) What are liposomes and how are they utilized in various fields? (5,3,3,4)

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6. Write a short note on any **three** of the following :

(5×3=15)

- (a) Excitation-Contraction coupling
- (b) Chloride shift
- (c) Counter-current Mechanism
- (d) Transport of Carbon dioxide

(1000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4023

H

Unique Paper Code : 2232522401

Name of the Paper : Fundamentals of Human Physiology

Name of the Course : B.Sc. (Prog) Life Sciences

Semester : IV (DSC)

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. Attempt any **FOUR QUESTIONS** in all and **QUESTION NO. 1** is **COMPULSORY**.
3. Draw Well labelled diagram wherever necessary.

1. (a) Define following (**Any three**): (3)
 - (i) Chyme
 - (ii) Sinoatrial (SA) node
 - (iii) Glomerular filtration rate (GFR)
 - (iv) Lung compliance

P.T.O.

(b) Differentiate between the following. (6)

(i) Primary active transport and secondary active transport.

(ii) Action potential and Graded potential.

(iii) Spermiogenesis and spermatogenesis.

(c) Give the location and function of the following :

(3)

(i) Papillary muscles

(ii) Chief cells

(iii) Gonadotrophs

(d) State whether the statement is true or false. (3)

(i) The oxytocin and antidiuretic hormone (ADH) are synthesized by posterior pituitary.

(ii) Pepsinogen is converted to pepsin by the action of HCl secreted from parietal cells.

(iii) A rightward shift in the O_2 -Hb saturation curve indicates decreased affinity of hemoglobin for oxygen, making it easier for oxygen to dissociate from hemoglobin.

2. (a) Explain chemical digestion and absorption of proteins with detailed account of enzymes involved.

(8)

(b) Draw ultrastructure of a sarcomere and briefly discuss three classes of proteins of a sarcomere.

(7)

3. (a) Explain the O_2 -Hb dissociation curve? Describe various factors affecting this curve.

(8)

(b) Describe origin and conduction of action potential in myelinated and non-myelinated nerve fiber. Which of the conduction is more efficient and why?

(7)

4. (a) Give a detailed account of the events occurring during menstrual cycle along with hormonal control.

(10)

(b) Describes events of a cardiac cycle in detail.

(5)

5. (a) Explain the process of origin and conduction of cardiac impulse.

(6)

(b) Give a detailed account of the factors responsible in regulating of glomerular filtration rate (GFR).

(9)

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

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2994

H

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.

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2

(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 Telomere.

(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?

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(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)

P.T.O.

- (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)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4128

H

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

(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)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3105

H

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

- (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?

3105

6

5. (a) Explain the biochemical basis and symptoms of the following metabolic disorders :

(i) Hartnup's disease

(ii) Alkaptonuria

(iii) Hyperammonemia/Hyperinsulinemia (HA/HI)

(iv) SCID

(b) Explain the urea cycle with reactions involved and discuss its physiological significance.

(c) What is FIGLU excretion test? How is it performed? (8,5,2)

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

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3

(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?

P.T.O.

- (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)

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)

- (b) What is the basic principle behind protein fragment complementation assay? Write any two different types of reporters used in the process.
- (c) What is the basic methodology behind protein microarray? Support your answer with a diagram. (5,5,5)
6. Differentiate between the following :
- (a) LC/MS and MS/MS
- (b) In situ hybridization and Colony hybridization
- (c) Western blotting and southern blotting (5,5,5)
7. (a) What do you understand by Chromatin immunoprecipitation (ChIP)? How is it different from ChIP on chip?
- (b) What do you understand by yeast 2 hybrid assay? Discuss the general methodology by which it is performed.
- (c) Write a short note on cell transfection. (5,5,5)
8. With the help of schematic diagrams explain the methodology, advantages and limitations of the following techniques :
- (a) Immunoprecipitation
- (b) Luciferase assay
- (c) ELISA (5,5,5)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3020

H .

Unique Paper Code : 32497601

Name of the Paper : Advanced Methodologies (DSE-3)

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

Semester : VI

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 :

- (i) All the water must be removed from the samples of electron microscopy.
- (ii) The secondary antibody recognizes and binds to the species-specific portion of the primary antibody.

P.T.O.

- (iii) Blocking of wells is important in ELISA.
- (iv) DNaseI is commonly used to study DNA protein interactions in DNA footprinting.
- (v) Microarray techniques are used for high throughput analysis in biology.
- (vi) The western blotting membrane is often stained initially with Ponceau Red.

(b) Give the full form of the following :

- (i) NGS
- (ii) TUNEL
- (iii) 2D-DIGE (12,3)

2. (a) Give the role of the following :

- (i) Glutaraldehyde in electron microscopy
- (ii) Dichroic mirror in fluorescence microscopy
- (iii) Osmium tetroxide in transmission electron microscopy
- (iv) Metal grid in electron microscopy
- (v) Phosphotungstic acid in electron microscopy

(b) Confocal microscopy is used to determine the 3D structure of a specimen using optical sectioning effect. How does this method help in determining

the structure and what are the special components present in this microscope which are used in this process? (10,5)

3. (a) Both flow cytometry as well as FACS are used to study cell populations, describe the variation in their methodology along with the limitation as well as the advantages of the two techniques.

(b) Fluorescent labeling is presently being used extensively in biological studies. What are the advantages of these labels over the radioactive labeling? Mention any 2 examples each of fluorescent and radioactive labels. (8,7)

4. (a) Discuss the methodology behind pulsed field gel electrophoresis. What are the advantages of this technique?

(b) Elaborate the methodology of the 2D PAGE technique.

(c) Name any two soft ionization techniques used in mass spectrometry. Discuss any one of them. (5,5,5)

5. (a) What is the procedure behind RNA sequencing? How is direct and indirect RNA sequencing different from each other?

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2976

H

Unique Paper Code : 32491602

Name of the Paper : Immunology

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

Semester : VI

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. All questions carry equal marks. Question no. 1 is compulsory.

1 (a) Name the following :

- (i) Most potent professional APC.
- (ii) A cell surface molecule that initiates respiratory burst.
- (iii) A cytokine that is an endogenous pyrogen.
- (iv) A co-stimulatory signal molecule on the surface of T-cell that interacts with B7 on APC
- (v) Only immunoglobulin can cross the placental barrier.

P.T.O.

- (b) State whether the following statements are true or false. Justify your answer :
- Haptens are Immunogens.
 - During blood transfusion MHC compatibility is not checked.
 - Leukocyte extravasation involves multiple interactions between cell adhesion molecules.
 - Active immunization can be achieved by injecting a person with preformed antibodies.
 - Release of sequestered antigens can result in the development of autoimmune diseases.
- (5,10)
2. (a) Elaborate the defence mechanisms that operate in the mucus membrane lining the digestive tract.
- (b) Describe the mechanism of cytotoxic action on target cells by CTLs.
- (c) List the factors that contribute to the immunogenicity of a molecule. (5,5,5)
3. (a) Describe the sequence of events involved in the differentiation and maturation of progenitor B cells (pro-B cells) to precursor B cells (pre-B cells) in the bone marrow.

- (b) What are vaccines? What are the advantages and disadvantages of using attenuated organisms as vaccines?
- (c) What are superantigens, and how do they influence T cell activation and T cell maturation? (5,5,5)
4. (a) Differentiate between the following :
- Primary and Secondary Immune Response
 - Innate and adaptive Immunity
 - Naive B cell and Memory B cell
 - Class I and Class II MHC molecule
 - Thymus dependent and Thymus independent antigens
- (5×3=15)
5. (a) Draw and label the structure of lymph nodes along with the role of various immune cells.
- (b) What is a B cell receptor complex? How does it enhance B cell response?
- (c) Briefly describe the result of IgE interaction with mast cells. What are the chemical mediators of type I hypersensitivity reactions? (5,5,5)
6. (a) Describe five different ways to generate antibody diversity.

- (b) Explain the formation of MAC complex by the classical pathway.
- (c) Mention only auto-antigens, major effectors, and the associated symptoms for the following diseases :
- (i) Myasthenia gravis
 - (ii) Grave's Disease
- (5,5,5)
7. (a) What are the clinical manifestations of allograft acceptance and rejection?
- (b) Describe the type II hypersensitivity reactions that can occur in an Rh-positive infant of an Rh-negative mother.
- (c) Innate immunity collaborates with adaptive immunity to protect the host. Discuss this collaboration, naming key points of interaction between the two systems. (5,5,5)
8. Write short notes on (any 5) :
- (i) NK Cells
 - (ii) Systemic Lupus Erythematosus
 - (iii) Azathioprine and Cyclosporin
 - (iv) DNA Vaccines
 - (v) Class switching
 - (vi) Adjuvants
- (5×3=15)
- (200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3020

H

Unique Paper Code : 32497601

Name of the Paper : Advanced Methodologies
(DSE-3)

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

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
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1. (a) Justify the following :

(i) All the water must be removed from the samples of electron microscopy.

(ii) The secondary antibody recognizes and binds to the species-specific portion of the primary antibody.

P.T.O.

- (iii) Blocking of wells is important in ELISA.
- (iv) DNaseI is commonly used to study DNA protein interactions in DNA footprinting.
- (v) Microarray techniques are used for high throughput analysis in biology.
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- (v) Phosphotungstic acid in electron microscopy

(b) Confocal microscopy is used to determine the 3D structure of a specimen using optical sectioning effect. How does this method help in determining

the structure and what are the special components present in this microscope which are used in this process? (10,5)

3. (a) Both flow cytometry as well as FACS are used to study cell populations, describe the variation in their methodology along with the limitation as well as the advantages of the two techniques.
- (b) Fluorescent labeling is presently being used extensively in biological studies. What are the advantages of these labels over the radioactive labeling? Mention any 2 examples each of fluorescent and radioactive labels. (8,7)
4. (a) Discuss the methodology behind pulsed field gel electrophoresis. What are the advantages of this technique?
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- (c) Name any two soft ionization techniques used in mass spectrometry. Discuss any one of them. (5,5,5)
5. (a) What is the procedure behind RNA sequencing? How is direct and indirect RNA sequencing different from each other?

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- (b) What do you understand by yeast 2 hybrid assay? Discuss the general methodology by which it is performed.
- (c) Write a short note on cell transfection. (5,5,5)
8. With the help of schematic diagrams explain the methodology, advantages and limitations of the following techniques :
- (a) Immunoprecipitation
 - (b) Luciferase assay
 - (c) ELISA

(5,5,5)

(200)

- (b) Describe the technique used for the production of monoclonal antibodies. (8)
4. (a) Describe the initiation and activation of the classical pathway of complement system. (7)
- (b) What is Immunogenicity? Discuss the factors which influence immunogenicity. (5)
5. (a) Describe the immune mediator, immune mechanism and typical manifestation of delayed type hypersensitivity. (7)
- (b) Describe the various properties and functions of cytokines. (5)
6. (a) Describe the pathway for processing and presentation of endogenous antigen. (6)
- (b) Describe the structure of antibody molecule. What are different types of antigenic determinants present on immunoglobulins? (6)
7. Write short note on *any three* of the following:
(3x4=12)
- (a) Hematopoiesis
- (b) DNA vaccine
- (c) Sandwich ELISA
- (d) AIDS

(700)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3211

H

Unique Paper Code : 42237904

Name of the Paper : Immunology (DSE)

Name of the Course : B.Sc. (P) Life Sciences (LOCF)

Semester : VI

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. Attempt **five** questions in all, including **Question No. 1** which is compulsory
 3. Draw well labelled diagram wherever necessary
1. (a) Define the following: (6)
 - (i) Antigenicity
 - (ii) Clonal selection theory
 - (iii) Phagocytosis

P.T.O.

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(iv) Cross reactivity

(v) Autoimmunity

(vi) Avidity

(b) Differentiate between the following: (10)

(i) Primary Immunodeficiency and Secondary Immunodeficiency

(ii) Humoral Immunity and Cell mediated Immunity

(iii) Immediate hypersensitivity and delayed type hypersensitivity

(iv) Primary lymphoid organs and Secondary lymphoid organs

(v) Polyclonal antibodies and Monoclonal antibodies

(c) Mention the contribution of the following scientists: (4)

(i) Louis Pasteur

(ii) Jules Bordet

(iii) Edward Jenner

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(iv) Rolf Zinkernagel and Peter Doherty

(d) Explain the function of the following: (4)

(i) Antigen presenting cells

(ii) Immunoproteasome

(iii) CLIP

(iv) Bence Jones proteins

(e) Expand the following: (3)

(i) TAP

(ii) PAMPs

(iii) ISCOM

(iv) IFN

(v) ADCC

(iv) SCID

2. (a) Describe the various barriers of the innate immune system. (6)

(b) Describe the structure and function of Lymph Node. (6)

3. (a) Describe the structure and function of MHC class II molecule. (4)

P.T.O.

- (ii) Why are fungal infections difficult to treat as compared to bacterial infections?
- (iii) Pneumonia can have varied causative agents. Justify.
- (iv) What is the basis of viral classification?
(6,3,3,3)
7. (a) Explain in brief the mechanism of action of the following drugs :
- (i) Isoniazid
- (ii) Penicillin
- (iii) Chloroquine
- (iv) Tamiflu
- (v) Amphotericin B
- (b) Discuss in brief a serological diagnostic method for Tuberculosis.
- (c) Vaccination is the best strategy to control a disease spread. Justify this statement with appropriate examples.
(10,2,3)
8. Draw the following :
- (a) Life cycle of *Plasmodium vivax*
- (b) Mechanism of action of any 2 exotoxins
- (c) Structure of HIV
(7,5,3)
(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3128

H

Unique Paper Code : 32497904

Name of the Paper : Molecular Basis of Infectious Diseases

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

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

- Write your Roll No. on the top immediately on receipt of this question paper.
 - There are 8 questions.
 - Attempt any 5 questions.
 - All questions carry equal marks. Question no. 1 is compulsory.
1. (a) Define the following :
- Nosocomial infections
 - Zoonosis
 - Viremia
 - Reservoir
 - Vector
- (b) Explain in brief :
- Antibody enhancement effect

P.T.O.

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2

- (ii) Toxoid
- (iii) Pathogenicity islands
- (iv) Molecular diagnostics
- (v) Opportunistic infections (5,10)

2. (a) Differentiate between : (15)

- (i) Antigenic shift and antigenic drift
- (ii) African Sleeping sickness and American sleeping sickness
- (iii) Gram positive and Gram negative bacteria
- (iv) Salk and Sabin vaccine
- (v) Emerging and Re-emerging diseases

3. Give the causative agent, characteristic symptoms and diagnostic indicators of the following : (15)

- (a) Rabies
- (b) Anthrax
- (c) Giardiasis
- (d) Ringworm
- (e) Tetanus

4. (a) Write short notes on :

- (i) Candidiasis
- (ii) Pertussis

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3

(iii) Hepatitis C viral infection

(b) Give the treatment regime of new cases of TB. Give the molecular mechanism behind MDR development. (9,6)

5. (a) Justify the following :

- (i) Periodic fever in malaria is not always a definite diagnostic indicator.
- (ii) Polymorphic form of fungi helps in its pathogenesis.
- (iii) Acyclovir is ineffective against latent Herpes infection.
- (iv) A new flu-shot is introduced every year.
- (v) Hepatitis D is an incomplete virus.
- (vi) Mantoux test is not a reliable diagnostic test for TB.

(b) Draw a diagram of Varicella Zoster virus. (12,3)

6 (a) Answer the following :

- (i) Discuss the anti-retroviral therapy used against HIV infections. Explain why rapid resistance to antivirals is observed in case of HIV treatment?

P.T.O.