[This question paper contains 6 printed pages.]

16 Your Roll No. 2023

Sr. No. of Question Paper : 4502

Unique Paper Code : 32491601

Name of the Paper : Genetic Engineering and Biotechnology

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 **eight** questions.
3. Attempt any **five** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) State True or False and justify for your answer:

(i) Cosmids do not form plaques.

P.T.O.

(ii) DNA is treated with alkaline phosphatase before cloning.

(iii) Ligation of DNA with sticky ends is difficult compared to blunt ended DNA.

(iv) Electroporation does not require the preparation of competent cells.

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

(b) Enlist the uses of the following enzymes in genetic engineering :

(i) T4 polynucleotide kinase

(ii) Klenow fragment

(iii) Reverse transcriptase

(iv) Terminal deoxynucleotidyl transferase

(v) Sequenase (10,5)

2. (a) Discuss chemical and physical methods of DNA introduction into cells.

(b) What do you mean by α-complementation? How can it be used for differentiation between transformants from recombinants?

(c) Why is *Agrobacteruim tumefaciens* known as the nature's smallest genetic engineer? Give the salient features Ti plasmid? How is the vector disarmed? (5,4,6)

3. (a) With the help of an example, explain fusion proteins. Enlist the advantages of preparing recombinant fusion proteins.

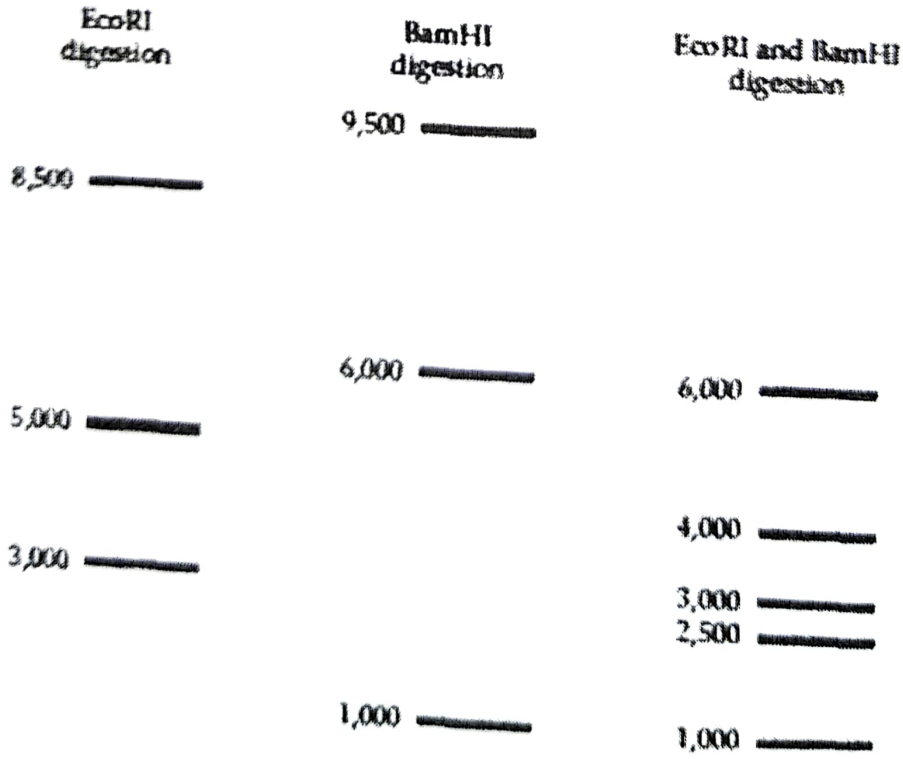
(b) A student carried out PCR amplification, but did not observe any amplification of required gene sequence. What are the errors that may occurred while designing the primers, which may have caused this? If the primer sequence is 5'AGACTCAGAACCC 3', Calculate its T_m.

(c) Write a short note on vectors based on M13 bacteriophages. What is a phagemid? (6,5,4)

4. (a) What do you understand by linkers and adapters? How are they useful in ligating blunt ended DNA?

(b) What is the principle of Sanger's method of DNA sequencing? What are the advantages of automating the technique?

(c) A purified, linear piece of DNA is cut with EcoRI and BamHI separately (single digestions) and then with both enzymes together (double digestion). The horizontal lines under the digestion conditions represent schematically the locations of the DNA fragments (bands) in the lanes of the gel after electrophoresis and staining of the DNA with ethidium bromide. The numbers denote the lengths of the digestion products (fragments) in base pairs. Draw a restriction map of the linear DNA.



(4,6,5)

5. Differentiate between the following :

(a) cDNA and Genomic libraries

(b) λ-insertion and λ-replacement vectors

(c) Binary and cointegrate Ti plasmid-based vectors

(d) Type I and II restriction enzymes

(e) Southern and Northern hybridisation (3×5)

6. (a) What the different types of yeast cloning vectors? Discuss the advantages and disadvantages of any three.

(b) Why do bacteria have Restriction modification systems? How do bacteria protect themselves from these restriction endonucleases present in the cell?

(c) Discuss site-directed mutagenesis and its applications. Describe any one method of site-directed mutagenesis. (6,3,6)

7. (a) What are the major difficulties encountered in expressing animal genes in bacteria? How are these overcome?

(b) What do you mean by Next generation sequencing? Discuss its applications.

(c) Explain the industrial production of Insulin using recombinant DNA technology. (6,3,6)

8. Write short note on following **(Any 3)** :

(i) Primer designing for PCR

(ii) Gene therapy

(iii) Bt cotton

(iv) High-capacity vectors (5,5,5)

[This question paper contains 4 printed pages.]

(17) **Your Roll No.** 2023

Sr. No. of Question Paper : 4697

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

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) Give reason for following :

(i) The sickle cell mutation can offer protection against malaria

P.T.O.

(ii) ID50 dose of cholera is very high

(iii) Dimorphic nature of *C. albicans* helps in its pathogenesis

(iv) Reinfection of dengue can be fatal

(v) Vaccination for influenza is required every year

(b) Define the following terms :

(i) Hemozoin

(ii) Herd immunity

(iii) Pathogenicity island

(iv) Nosocomial infection

(v) Morbidity rate (10,5)

2. (a) Why do fungal diseases mostly cause opportunistic infections? Explain with help of an example.

(b) What are the causes and symptoms of amoebiasis? Mention two common methods to prevent this infection.

(c) What are the various biosafety levels? Explain. (15)

3. (a) Give the diagnostic test for following diseases :

(i) Typhoid

(ii) Diphtheria

(iii) HIV

(iv) Malaria

(v) Tuberculosis

(b) Draw the structure of hepatitis B virus. What are the differences between hepatitis A and hepatitis B viral diseases? (10,5)

4. Draw the life cycles of following pathogenic organisms.

(a) *Leishmania donovoni*

(b) *Mycobacterium tuberculosis*

(c) HIV (15)

5. Differentiate between the following :

(a) Antigenic shift and antigenic drift

(b) Latent and active tuberculosis

(c) Sporozoites and trophozoites

(d) Cholera toxin and diphtheria toxin

(e) Gram positive and Gram negative bacteria

(15)

6. (a) Compare and contrast the pathogenesis of :

(i) Malaria and Dengue

(ii) Rabies and Tetanus

(b) What is the mechanism of action of following drugs :

(i) Isoniazid

(ii) Amphotericin B

(iii) Chloroquine

(iv) Tamiflu (7,8)

7. (a) What are the various classes of vaccines? Explain with help of examples.

(b) What do you mean by reservoir, vector and intermediate host? Explain with the help of examples.

(c) What is the cycle of infectious disease? Also describe the course of an infectious disease. (15)

8. Write short notes on :

(a) Emerging and re-emerging diseases

(b) Koch's postulates

(c) Baltimorean classification

(d) Aspergillosis

(e) Trypanosomal infections (15)

[This question paper contains 6 printed pages.]

(18) Your Roll No. 2023

Sr. No. of Question Paper : 4698

Unique Paper Code : 32497907

Name of the Paper : Plant Biochemistry

Name of the Course : **B.Sc. (H) 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) Write true or false and justify your answer (**Any six**) :

   (i) Somatic embryogenesis is a process in which zygotic embryos resemble somatic cells.

P.T.O.

(ii) Succinyl-CoA synthetase in plants differs from that in animals.

(iii) Electron transport chain continues even in presence of potassium cyanide in plants.

(iv) C4 pathway can exist in single cells.

(v) VLFR are photoreversible.

(vi) Nitrogen fixation requires aerobic environment.

(vii) CAM plants show slow rate of mass production.

(b) Discuss the contribution of following scientists :

(i) Robert Hill

(ii) Guha and Maheshwari (12,3)

2. (a) Define the following terms :

(i) Totipotency

(ii) Red drop effect

(iii) Callus

(iv) Bacteroids

(v) Apical dominance

(vi) Absorption spectrum

(vii) Symbiosome

(viii) Photosynthetic efficiency

(ix) Saponins

(b) Alternative reactions provide flexibility to plant glycolysis. Discuss. (9,6)

3. (a) Explain the role of following :

(i) Leghaemoglobin

(ii) GOGAT

(iii) Glycine decarboxylase: Serine OH-methyl transferase

(iv) Vacuole in plant system

(v) Malic enzyme

(vi) Ethylene

(b) How do plants cope up with an abiotic stress caused due to floods? (12,3)

4. Illustrate the following diagrammatically/schematically :

(i) Photochemical reactions occurring in light reaction

(ii) Nitrogen cycle

(iii) Photorespiratory pathway (5,5,5)

5. (a) Explain the regulation of phosphoenol pyruvate carboxylase in C4 and CAM pathway.

(b) Explain the structure, mechanism and regulation of Nitrogenase enzyme.

(c) List and describe briefly about *any five* metabolite translocators of the mitochondrial inner membrane. (5,5,5)

6. Differentiate between the following (**any three**) :

(i) Form 1 and Form 2 of Rubisco

(ii) Micropropagation and plant cell culture

(iii) Nitrate reductase and Nitrite reductase

(iv) NADP-ME and NAD-ME pathway

(5×3=15)

7. (a) Explain how atmospheric inorganic nitrogen from the biosphere is assimilated into bio-molecules.

(b) How do nodules control the internal concentration of oxygen in rhizobia infected cells?

(c) Classify alkaloids and discuss their important role in plants? (4,5,6)

8. Write short note on :

(i) Non-phosphorylating electron transport chain

(ii) Role of Terpenoids in plants

(iii) Controlled infection

(iv) Phytoalexins

(4, 4, 4, 3)

[This question paper contains 4 printed pages.]

19 **Your Roll No.** 2023

Sr. No. of Question Paper : 4782

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

1. (a) Fill in the blanks with appropriate answers :

   (i) _____ are the first cells to reach the inflammatory site.

   (ii) _____ mediators are released in the development of type I hypersensitive reactions.

P.T.O.

(iii) Colostrum is rich in _____ .

(iv) _____ complement component acts as an opsonin.

(v) _____ most potent professional antigen-presenting cells

(b) Comment on the following statements :

(i) Levels of IgG antibody rise sharply in secondary response.

(ii) Passive immunization is fast but lasts for a short duration.

(iii) Human skin is resistant to colonization by *E.coli* despite constant exposure to it.

(iv) Unlike CTLs, NK cells can kill IgG-coated target cells.

(v) Activation of complement cascade results in the development of inflammatory reactions. (5,10)

2. Differentiate between :

(i) MHC I and MHC II

(ii) T cell and B cell epitope

(iii) Active immunization and Passive immunization

(iv) Primary and Secondary lymphoid organs

(4,4,4,3)

3. (a) Describe the Alternate Pathway for complement activation till MAC formation.

(b) Innate immunity collaborates with adaptive immunity to protect the host. Discuss this collaboration, naming key points of interaction between the two systems.

(c) Explain with the help of a diagram, the mechanism of class switching of B cells. (5,5,5)

4. (a) Explain different phases of development of Delayed type hypersensitivity response.

(b) Briefly describe B cell development and differentiation in the bone marrow.

(c) Elaborate briefly on major events in the inflammatory response. (5,5,5)

5. (a) Describe the cytosolic pathway for processing and presentation of antigen to T lymphocytes.

(b) Discuss briefly all the characteristics of an antigen to be immunogenic.

(c) Draw a well-labelled cross-section of a portion of the thymus. Depict the location of different types of cells in different regions of the thymus.

(6,5,4)

6. (a) Name the autoantigens, major effectors and explain the immunological mechanism of the following diseases along with the symptoms.

(i) Systemic lupus erythematosus

(ii) Hashimoto's thyroiditis

(b) Explain the cytotoxic activity of CD8+ T cell.

(c) Describe how the adjuvants enhance the immune response.

(6,5,4)

7. (a) Describe the Immunological basis of allograft acceptance and rejection. Why autografts are generally accepted?

(b) Draw a neat well labelled diagram of the T cell receptor along with its co-receptor

(c) Explain the technology used to produce monoclonal antibodies.

(5,5,5)

8. Write short notes on :

(i) Superantigens

(ii) Erythroblastosis fetalis

(iii) DNA vaccines

(iv) TLR

(4,4,4,3)

[This question paper contains 4 printed pages.]

(20) **Your Roll No.** 2023

Sr. No. of Question Paper : 4820 **E**

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

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) Give reasoning for following :

   (i) Diphtheria is diagnosed clinically

   (ii) ID50 dose of cholera is very high

P.T.O.

(iii) Zoonotic diseases are majorly rising as new emerging diseases

(iv) Candidiasis is common in AIDS patients

(v) Rabies can be prevented by vaccination

(b) Define the following terms :

(i) Recrudescence

(ii) Dimorphic fungi

(iii) Pathogenicity island

(iv) Nosocomial infection

(v) Tetanospasmin (10,5)

2. (a) Answer the following questions :

(i) There are various immunological tests for tuberculosis. Describe any two.

(ii) Describe the Widal test.

(iii) Which antigenic proteins are first detected during HIV infection? What is their significance in diagnosis?

(iv) How are parasitic diseases historically diagnosed? Describe Montenegro test.

(v) What are Koch's postulates? (15)

3. (a) Describe the drugs used in the DOTS therapy? What is MDR-TB and XDR-TB?

(b) What is HAART? How can AIDS be cured completely?

(c) Draw the structure of influenza virus. What is the function of hemagglutinin and neuraminidase? (15)

4. Draw the life cycles of following pathogenic organisms :

(a) Plasmodium

(b) *Entameoba histolytica*

(c) HIV (15)

5. Differentiate between the following :

(a) Antigenic shift and antigenic drift

(b) African sleeping sickness and chagas disease

(c) Endotoxin and exotoxin

(d) Hepatitis A and hepatitis B

(e) Oral and injectable polio vaccine (15)

6. (a) How was the BCG vaccine developed? Why is it ineffective in adulthood?

(b) Which diseases are prevented by DPT vaccine? What is the composition of DTaP?

(c) Why is there no vaccine for HIV till now?

(d) Which mechanism prevents vaccine development for dengue?

(e) What is the difference between active and passive immunization? (15)

7. (a) Which are the 3 major toxins involved in pathogenesis of anthrax? Describe their mechanism of action.

(b) What are the three types of leishmaniasis? How are amastigotes different from promastigotes?

(c) What is the cycle of infectious disease? Also describe the course of infectious diseases. (15)

8. Write short notes on :

(a) Re-emerging diseases

(b) Biosafety levels

(c) Source, reservoir and transmission of pathogen

(d) Sporotrichosis

(e) Giardiasis (15)

[This question paper contains 6 printed pages.]

(21)

Your Roll No. 2023

Sr. No. of Question Paper : 4821

E

Unique Paper Code : 32497907

Name of the Paper : Plant Biochemistry

Name of the Course : **B.Sc. (H) 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) Indicate whether True or False with justification **(Any six)** :

(i) Meristem cultures are infected with viruses.

P.T.O.

(ii) Plant respiration is completely inhibited by inhibitors like cyanide and azide.

(iii) Low fluence responses are non-photoreversible.

(iv) Migration of bacteria towards roots of the host plant is a chemotactic response.

(v) Atmospheric nitrogen is directly accessible to the living organisms.

(vi) In plants the control of glycolysis comes from the "bottom up".

(vii) Stomata remain closed during daytime in CAM plants.

(b) Discuss briefly the contribution of the following scientists :

(i) Emerson and Arnold

(ii) Murashige and Skoog (12,3)

2. (a) Define the following terms :

(i) Rhizosphere

(ii) Enhancement effect

(iii) Callus

(iv) High irradiance response

(v) Apical dominance

(vi) Absorption spectrum

(vii) Infection thread

(viii) Elicitors

(b) Discuss the unique features of the Electron transport chain found in the inner membrane of the plant mitochondria. What flexibility does it impart to the plants in coping up with stress? (8,7)

3. Explain the role of following in plants **(any six)** :

(i) Nitrite reductase

(ii) GOGAT

(iii) Glycine decarboxylase: Serine OH-methyl transferase

(iv) Rubisco inhibitor

(v) Vacuoles in plant system

(vi) PEP carboxylase

(vii) Auxin

(viii) Allelopathy (15)

4. Illustrate the following diagrammatically/schematically :

(i) Nitrogen cycle

(ii) Flow of electrons in Z scheme

(iii) Different phases of CAM pathway (5,5,5)

5. (a) Discuss in detail, how Calvin cycle is regulated in the presence of light?

(b) Explain the structure, mechanism and regulation of Nitrogenase enzyme.

(c) What is the significance of oxidative pentose phosphate pathway in plants? (5,5,5)

6. Differentiate between :

(i) PS 1 and PS 2

(ii) Organogenesis and Somatic embryogenesis

(iii) Nitrite reductase and nitrate reductase

(iv) C3 and C4 plants

(v) Primary and secondary ammonia assimilation in plants (15)

7. (a) What is the significance of nitrogen fixation? Mention the different ways by which nitrogen fixation occurs in the environment? Give an example of each of the following :

(i) an aerobic free-living nitrogen-fixing bacteria

(ii) an anaerobic free living nitrogen-fixing bacteria

(iii) a symbiotic nitrogen-fixing bacteria

(iv) a symbiont with woody plants

(b) Explain the role of secondary metabolites in the defence mechanism of plants.

(c) Discuss the various physical and biochemical mechanisms that help the plants to create anaerobic environment for carrying out nitrogen fixation. (5,5,5)

P.T.O.

8. Write short note on :

(i) Protoplast culturing

(ii) Xanthophyll Cycle

(iii) Q cycle

(iv) Process of nodule formation

[4, 3, 4, 4]