CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations August-September 2022

Programme: M.Sc. Biotechnology **Session: 2021 - 2022**

Semester: Second **Max. Time: 3 hours**

Course Title: Genetic Engineering **Max. Marks: 70**

Course Code: SIAS BT 1 2 04 C 3003

Instructions:

1. Question no.1 has seven parts and the students need to answer any four. Each part carries three and a half marks.

2. Questions no. 2 to 5 have three parts and the students need to answer any two parts of each question. Each part carries seven marks.

Question no.1 Answer any four of the following: **(4 x 3.5 = 14 marks)**

(a) Describe the features of plasmids that make them suitable cloning vectors.

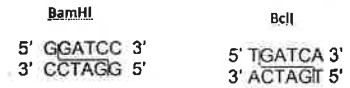
(b) What is the rationale for 'blue-white screening' of recombinants? Explain in detail.

(c) Describe any method of transgenesis through fertilized eggs or embryos for production of transgenic mice.

(d) Differentiate between Southern and Northern hybridization.

(e) Explain the principle of qRTPCR.

(f) Given below are the recognition sites of two enzymes, BamHI and BclI. Does cleavage by BamHI and BclI result in a 5' or 3' overhang?



If the following DNA was cut with BamHI, how many DNA fragments would you expect? Write out the sequence of these fragments

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5' ATTGAGGATCCGTAATGTGTCCTGATCACGCTCCACG 3'
3' TAACTCCTAGGCATTACACAGGACTAGTGCGAGGTGC 5'
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(g) List some applications of transgenic animals and plants.

Question no. 2 **(2 x 7 = 14 marks)**

(a) Describe the principle and application of following techniques: (2 x 3.5 = 7 marks)

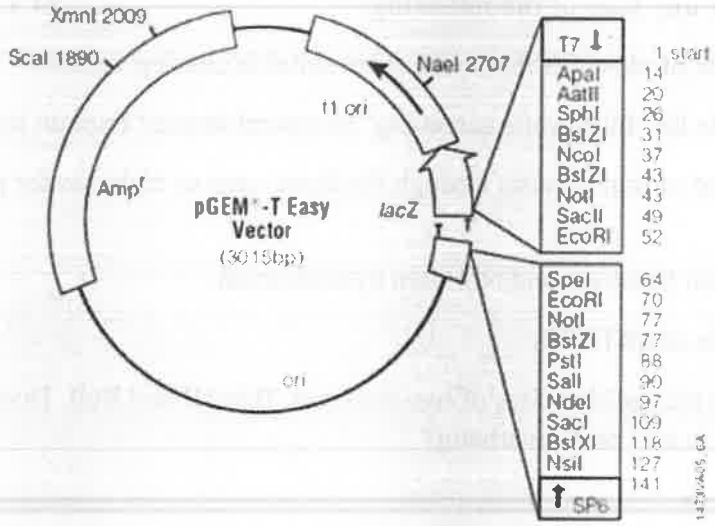
(i) RT-PCR (ii) Western blotting

(b) Describe the principle of genomic DNA and total RNA isolation from any biological system of your choice. Also explain how you would assess the quantity and quality of the isolated DNA and RNA.

(c) In which cycle do you expect to obtain the full target amplicon in a PCR reaction. Explain using a figure only. List any four different types of PCR reactions and their main principle and application in brief.

Question. 3 **(2 x 7 = 14 marks)**

(a) Observe the given figure for the vector pGEMT given below. Explain using a series of detailed steps, the procedure that you would use for cloning a desired insert, obtained through PCR, into this vector and confirming the clone and the correct sequence of the insert. What would happen if you digest a positive clone with EcoRI? Show using a figure.



(b) (2 x 3.5 = 7 marks)

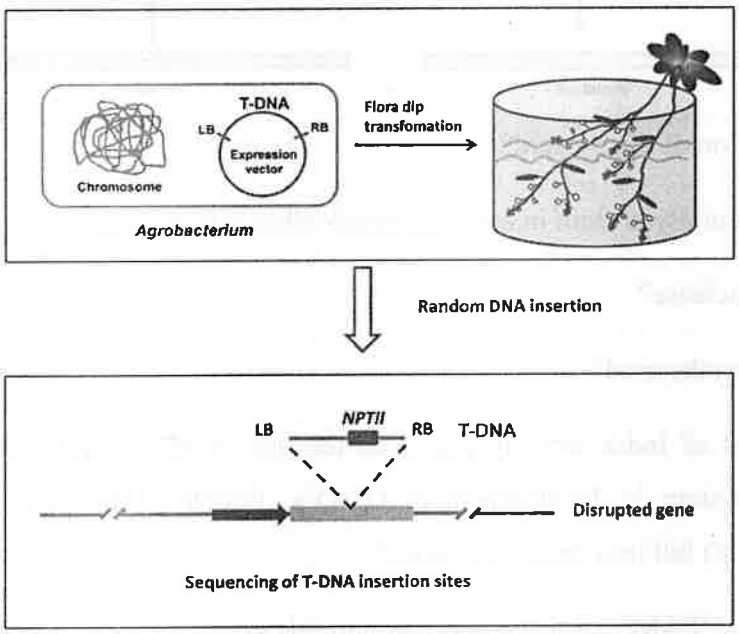
(i) For cloning a 2 kb gene into an expression vector, a researcher decides to amplify it. He/she has access to three different polymerases: T7 DNA polymerase, Pfu polymerase, and Taq polymerase. Which polymerase would be preferable to use for PCR and why?

(ii) Enumerate different steps involved in Gateway cloning.

(c) What are the essential features of a plasmid for expression and purification of a foreign gene in a bacterial system? Draw a schematic and elaborate. What makes expression of a protein in a mammalian system beneficial as compared to that in a bacterial system?

Question no. 4 **(2 x 7 = 14 marks)**

(a) Given below is a figure depicting floral dip method of transformation in *Arabidopsis*. Using this figure, answer the following briefly: (1 X 7 = 7)



(i) What is the function of 'LB' 'TDNA' and 'RB' in this expression vector?

(ii) What is the function of NPT II?

(iii) Why is the DNA integration 'random' here?

(iv) Is there any technique to make 'precise' DNA integration during transgenic plant development? Explain.

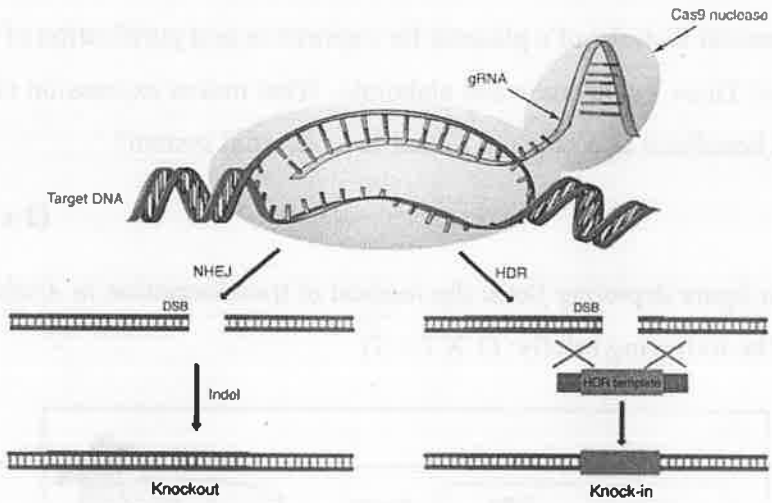
(v) Before sequencing, which method can you use for screening of the transformants?

(vi) After sequencing, which method can you use for checking the expression of the transgene?

(vii) Name one promoter that you can use to drive strong constitutive expression of the transgene here.

(b) Describe any one physical and one biological method of gene delivery in detail.

(c) Refer to the figure below and answer the questions briefly: (1 X 7 = 7)



(i) What is the function of this system?

(ii) Is this system naturally present in any organism? What is its function?

(iii) What is Cas9 nuclease?

(iv) How is gRNA synthesized?

(v) The Government of India recently approved the use of SDN1 and SDN2 type of events pertaining to this system in development of GMO's. Which of the two events shown here (knockout or knock in) fall into these categories?

(vi) What is meant by 'PAM' sequence in relation to this system?

(vii) If you have the option of developing knockout mice using this method vs cre-lox system, which one would you prefer and why?

Question no. 5 **(2 X 7 = 14)**

(a) Describe the role of IBSC and GEAC committees in regulating the research related to GMOs. Describe the three different categories for GMO research based on the level of associated risks.

(b) Describe the application of genetic engineering in detail in the field of medical OR plant biotechnology using any example of your choice.

(c) Explain DNA fingerprinting and its applications in forensics.

CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations April 2022

Programme: M. Sc Biotechnology
Semester: First
Course Title: Principles of Biochemistry
Course Code: SIAS BT 1 1 02 C 4004

Session: 2021-22
Max. Time: 3 Hours
Max. Marks: 70

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a) What are aldoses and ketoses? Provide two examples of each.
b) Differentiate between the structure of glycogen and starch.
c) What are waxes? Draw a structure of typical biological wax.
d) Draw the structure of following amino-acids: Glycine, Aspartic acid, Histidine, Phenylalanine.
e) Draw the structure of ATP.
f) What is salvage pathway of nucleotide synthesis.
g) Name any two disorders of purine and pyrimidine metabolism.

Q 2. (2X7=14)

a) Explain gluconeogenesis in details?
b) Write a note on homo and hetero-polysaccharides.
c) Explain the process of glycolysis.

Q3. (2X7=14)

a) Explain the process of fatty acid synthesis.
b) Write a note on the following- sphingolipids, phospholipids, sterols and galactolipids.
c) The melting points of a series of 18-carbon fatty acids are: stearic acid, 69.6 °C; oleic acid, 13.4 °C; linoleic acid, -5 °C; and linolenic acid, -11 °C. (i) What structural aspect of these 18-carbon fatty acids can be correlated with the melting point? (ii) Draw all the possible triacylglycerols that can be constructed from glycerol, palmitic acid, and oleic acid. Rank them in order of increasing melting point. (iii) Branched-chain fatty acids are found in some bacterial membrane lipids. Would their presence increase or decrease the fluidity of the membranes (that is, give them a lower or higher melting point)? Why?

Q 4. (2X7=14)

a) What do you understand by enzyme kinetics and how it is important in drug discovery?
b) Explain the following processes of amino acids- oxidative deamination, transdeamination.
c) Explain the link between urea cycle and citric acid cycle.

Q 5. (2X7=14)

a) Explain the de novo synthesis of purine nucleotides.
b) Explain the catabolism of Pyrimidine nucleotides.
c) Explain in details, the structure of double stranded DNA.

CENTRAL UNIVERSITY OF HARYANA

Second Semester Examinations Aug-Sep 2022

Programme: M.Sc. Biotechnology | **Session: 2021-22**
Semester: Second Semester | **Max. Time: 3 Hours**
Course Title: Immunology | **Max. Marks: 70**
Course Code: SIAS BT 1 2 02 C 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. Write brief notes on (4X3.5=14)

a) Differentiate between antigen and immunogen, epitope and paratope.

b) Differentiate between innate and adaptive immunity.

c) Describe similarities and dissimilarities between B and T cells

d) Describe the purpose of tissue fixation in immunohistochemistry?

e) What are the types of Immunoglobulin? Write the typical features of each type of antibody.

f) Where and when hematopoiesis happens?

g) Describe in brief about five natural barriers of immune defence mechanism

Q 2. (2X7=14)

a) Explain the factors dictating immunogenicity.

b) What are the primary and secondary lymphoid organs? Describe their functions in brief.

c) What are monocytes? What are the major differences between monocytes and macrophages? Enumerate at least 10 tissue specific macrophages with their specific names.

Q3. (2X7=14)

a) A typical antibody molecule is a product of a single gene or multiple gene? Where are these genes located in the case of humans? How antibody diversity is produced by these genes?

b) What is ELISA? What are its advantages? What are the basic types of ELISA? Describe each of them with their basic steps? Enumerate 5 applications of this technique.

c) What is Western blot? Describe in brief 3 major steps of it? What is the role of SDS, Nitrocellulose Membrane and blocking agent in this technique? Enumerate five staining methods of it. Write five examples where it can be used as a research tool.

Q 4. (2X7=14)

a) What is complement system? Describe the detailed mechanism of complement activation by MBL, classical and alternative pathways?

b) Explain the structure of MHC Class I and Class II protein? Describe the cytosolic and endocytic pathways of antigen processing and presentation?

c) Explain detailed mechanism of T-cell differentiation? Explain inheritance of MHC and deficiencies of complement system? Discuss classifications and functions of T-cells?

Q 5. (2X7=14)

a) Differentiate between antibody mediated cytotoxic hypersensitivity and immune complex mediated hypersensitivity? What is autoimmune disease? Describe about any five autoimmune diseases in brief.

b) Explain the detailed mechanism of induction of autoimmunity? Describe IgE mediated hypersensitivity?

c) What are active and passive immunization with example? Explain the vaccine and types of vaccines with example?

CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations August-September 2022

Programme: M.Sc. Biotechnology | **Session: 2021 - 2022**

Semester: Second | **Max. Time: 3 hours**

Course Title: Omics in Biotechnology | **Max. Marks: 70**

Course Code: SIAS BT 1 2 06 C 4004

Instructions:

1. Question no.1 has seven parts and the students need to answer any four. Each part carries three and a half marks.

2. Questions no. 2 to 5 have three parts and the students need to answer any two parts of each question. Each part carries seven marks.

Question no.1 Answer any four of the following: **(4 x 3.5 = 14 marks)**

(a) Explain what is implied by Next Generation Sequencing.

(b) Describe the method of Sanger sequencing in detail.

(c) List some applications of transcriptomics.

(d) What is iTRAQ?

(e) Discuss Mascot software.

(f) Write short notes on - Targeted Metabolomics.

(g) Briefly explain the Human Metabolome Database (HMDB).

Question no. 2 **(2 x 7 = 14 marks)**

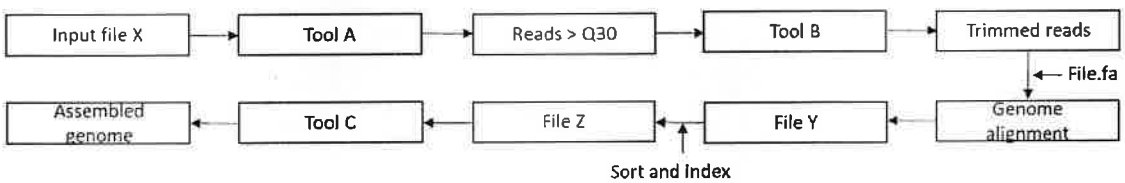
(a) Give a detailed comparative account of different sequencing platforms - Sanger, Illumina, Nanopore, and PacBio.

(b) Shotgun and clone contig approaches were widely used in early genome sequencing projects. How are these approaches used for genome sequencing? Explain in detail. What are the major limitations of shotgun sequencing?

(c) Describe the main steps involved in Illumina based reference genome sequencing project. Describe all procedures from wet lab to dry lab analysis to obtain the complete genome sequence.

Question. 3 **(2 x 7 = 14 marks)**

(a) Consider following pipeline for genome assembly starting from the input file containing raw reads from Illumina sequencing: (1 x 7 = 7 marks)



(i) What is the file format for Input file X?

(ii) List any example of tool A and C.

(iii) What is meant by Q30?

(iv) What are the file formats for file Y and Z?

(v) Name one metric that you can use to assess the quality of assembled genome.

(vi) What is meant by trimmed reads?

(vii) Name a tool that you can use for genome alignment.

(b) What are long non-coding RNAs? How can they be detected in a transcriptome data? Describe the complete pipeline.

(c) What is meant by the following terms? Write in very brief. (1 x 7 = 7 marks)

(i) Normalization (ii) Fold change (iii) Pathway mapping (iv) De novo assembly (v) Differential expression analysis (vi) Heatmap (vii) Gene ontology

Question no. 4 **(2 x 7 = 14 marks)**

(a) Describe the gel based and gel free techniques in proteomics.

(b) Describe the basic workflow and pipeline for the identification and quantification of proteins.

(c) Write down the applications of proteomics in drug discovery, biomarker discovery and agriculture biotechnology.

Question no. 5 **(2 x 7 = 14 marks)**

(a) What do you mean by Metabolomics & lipidomics? Describe the essential steps in metabolomics data analysis.

(b) "Applications of metabolomics are huge in Medical and Agricultural Biotechnology". Explain with suitable examples.

(c) What are the various statistical tests that can be implemented for metabolomics data analysis?

Central University of Haryana

End Semester Examinations August-September, 2022

Programmes: M.Sc. Biotechnology **Session: 2021-22**

Semester: Second **Max. Time: 3 h**

Course Title: Environmental Biotechnology **Max. Marks: 70**

Course Code: SIAS BT 1 2 03 DCEC 3003

Instructions: Question no. 1 has seven parts and students need to answer any four. Each part carries equal (3.5) marks. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each question carries seven marks.

Q.1. Answer the following questions 3.5x4=14

i. Briefly explain the role of biosorption in bioremediation process.
ii. Briefly differentiate between natural and engineered bioaugmentation.
iii. Briefly describe the role of carbon in waste water treatment.
iv. Write short note on role of enzymes in bioremediation.
v. Draw flow diagram (only) for the treatment of effluent of any industry.
vi. Explain green house effect. How it is related to global warming.
vii. Briefly explain the mechanism of bioremediation.

Q.2. a) Explain any three in-situ strategies of bioremediation. 7

b) Describe the role of plants and microbes in bioremediation of heavy metal pollution. 7

c) Briefly describe the factors affecting the bioremediation of toxic pollutants. 7

Q.3. a) Explain the role of oxidation ponds and activated sludge process in waste water treatment. 7

b) Briefly describe the microbiology and biochemistry of anaerobic bioremediation. 7

c) Write short note on roles of membrane technology and rotating biological contactor in waste water treatment. 7

Q.4. a) Describe the process of vermicomposting with the help of diagram. 7

b) Explain any two physical strategies/methods for management of solid waste. 7

c) Briefly describe how agricultural waste (rice straw) can be utilized for value-added products using microorganisms. 7

Q.5. a) What are xenobiotic compounds. Explain with examples the degradation of aliphatic and aromatic hydrocarbons. 7

b) Describe the role of solar radiations in the treatment of industrial effluents. 7

c) What is an eco-friendly technology. Explain the role of biosurfactant and biofertilizer in the management of environmental pollution. 7

CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations Aug-Sept, 2022

Programme: M.Sc. Biotechnology **Session: 2021-22**

Semester: Second **Max. Time: 3 Hours**

Course Title: Pharmaceutical Biotechnology

Course Code: SIAS BT 1 2 01 DCEC 3003 **Max. Marks: 70**

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a) What to you understand by the term 'Biogenerics'?
b) What are the biosimilars?
c) Name first biosimilar product approved in India, USA and EU.
d) What do you understant by term INN?
e) Why most of drugs do not see the light of approval licence?
f) On what grounds one can start 'Challenging originator"s patents' proceedings?
g) Name two products of vaccine.

Q 2. (2X7=14)

a) What do you understand by rational drug discovery? Explain.
b) With the help of appropriate examples explain the traditional drug discovery.
c) Explain the process of biosimilar development in EU.

Q3. (2X7=14)

a) What are antibody based drugs. Provide examples of four drugs with mechanism of action.
b) What are fast, intermediate and slow acting insulin. Explain the rationale for these.

c) Write a note of the following biopharmaceuticals- Interferons, CSF, Hormones.

Q 4. (2X7=14)

a) Write the characteristics, active substance and indication of following biopharmaceuticals (a) Humira, (b) Avastin, (c) Enbrel

b) Write a note on following industrial enzymes- Penicillin amidase, lipase, nitrilase.

c) How would you choose the target products for biosimilar development?

Q 5. (2X7=14)

a) Explain the process of identification and validation of drug targets for communicable and life style diseases?

b) What are the different approaches of target discovery?

c) Write short note on Comparative genomics for target discovery of life style diseases.

CENTRAL UNIVERSITY OF HARYANA

Second Semester Examinations Aug-Sep 2022

Programme: M.Sc. Biotechnology **Session: 2021-22**

Semester: Second Semester **Max. Time: 3 Hours**

Course Title: Biosafety, Bioethics and IPR **Max. Marks: 70**

Course Code: SIAS BT 1 2 03 C 3003

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Question No1. Brief note on the followings (4 × 3.5=14)

a) GMOs
b) Biosafety level-4
c) Informed consent in health care bioethics
d) Advantages of patent pooling
e) Enumerate four examples of biological inventions which are not patentable in India.
f) Differentiate between invention and discovery.
g) Prenatal Diagnosis

Question No. 2. (2 × 7=14)

a) What do you mean by Biosafety and its various levels? What is recommended biosafety level of infectious agents & animals?
b) Why regulations are required in Biological research? What are the major regulatory bodies of Bio-safety assessment in India at various levels?
c) What is Cartagena protocol; Explain Environment Protection Act (EPA) and rules.

Question No. 3. (2 × 7=14)

a) What are the main principles of Bioethics? Which ethical principles a researcher must obey while conducting a biomedical research.

b) What do you mean by Euthanasia? What is Active and Passive Euthanasia. Is there any ethical consideration when a human is subjected to Euthanasia?

c) Detailed note on (i) Genetically Engineered Food (ii) Biopiracy.

Question No. 4. (2 × 7=14)

a) Describe salient features of Indian Patent Law ? How is Indian patent law different from US patent law?What changes have been made in the Indian Patent Act 1970 and why?

b) Can your thesis based biological database be protected for its intellectual property, if yes then how? Can we have patents on software in India like the USA? How the ineffectual property protection of software differs between these two countries?

c) What is Budapest Treaty? Why this was made? What is the subject matter of the deposits? What are the functions of IDA? Give two examples of Indian culture collection centers.

Question No. 5. (2 × 7–14)

a) What is the difference between voluntary and compulsory licensing of patents? Who can grant it? What are the conditions for it? Describe India's stand on compulsory licensing of covid related patents.

b) What is patent infringement? Describe this by case studies of Bayer's or Novartis' or Merck's case.

c) Can we patent a tribal plant based medicine? How does Indian patent law deal with it? Who will be the owner of such intellectual property? Describe with one Indian case study.

CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations Aug-Sept, 2022

Programme: M. Sc Biotechnology **Session: 2021-22**
Semester: Second **Max. Time: 3 Hours**
Course Title: Cell and Molecular Biology **Max. Marks: 70**
Course Code: SIAS BT 1 2 01 C 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a. Differentiate between bacteria and archae.

b. Draw the structures of various phospholopids present in plasma membrane.

c. Distinguish between microtubules and microfilaments.

d. What are the different unusual bases present in RNA?

e. What do you understand by supercoiling of DNA and chromosome?

f. Distinguish between DNA polymerse I and DNA polymerase III

g. Write a short note on 1. phosphodiester bond 2. major and minor groove of DNA.

Q 2. (2X7=14)

a) Discuss fluid mosaic model, membrane proteins and membrane fluidity in detail.

b) Discuss passive and active transport. Write note on P-type, F-type, V-type and ABC transporters.

c) Write a note on structure and function of nucleus, mitochondria and lysosome.

Q 3. (2X7=14)

a) Write a detailed note on cell-cell and cell-matrix interactions.

b) What do you understand by the term 'cell signalling'? Explain the role of G-protein coupled receptors, tyrosine receptors, c-AMP, c-GMP, IP3, DAG and Ca^{+2} in signalling?

c) Write a note on cytoskeleton and its proteins.

Q 4. (2X7=14)

a) Write a short note on the following (7 marks)

(i) Chargaff's rule? (1 marks)

(ii) Transformation? (2 marks)

(iii) Transduction? (2 marks)

(iv) Semi-conservative DNA replication? (2 marks)

b) (i) Distinguish between prokaryotic and eukaryotic DNA replication? (3 marks)

(ii) Explain Theta model and Trombone model of DNA replication? (4 marks)

c) (i) Describe name and role of the enzymes involved in prokaryotic and eukaryotic DNA replication? (3 marks)

(ii) Explain the mechanism of DNA repair? (4 marks)

Q 5. (2X7=14)

a) Write a detailed note on the followings- RNA polymerase, inhibitors of transcription, mechanism of transcription in prokaryotes.

b) Write a detailed note on the followings- RNA splicing, cap addition and polyadenylation.

c) Explain the detailed mechanism of translation in prokaryotes.