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B. Sc. Bio-Technology 5th Sem. (N.S.) Examination – December, 2024

BIO-INFORMATICS

Paper : BT-501

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting ***one*** question from each Unit. Question No. 1 is ***compulsory***.

1. Write short notes on the following : $2.5 \times 4 = 10$

(a) Genbank

(b) Chromatograms

(c) MSA

(d) FASTA

UNIT – I

2. (a) What is Bioinformatics ? Explain its history in detail. 5

   (b) Write a short note on EMBL. 2½

3. (a) Explain the notion of Homology in detail. 5

   (b) Write a short note on Unigene. 2½

UNIT – II

4. Write a detailed note on Protein information resources available on web. 7½

5. (a) Briefly explain the working of PCR. 3½

   (b) Write short note on Microarray. 4

UNIT – III

6. (a) What is DNA sequence assembly ? Explain. 4

   (b) What are the different methods to perform Phylogenetic Analysis ? 3½

7. (a) What are substitution matrices ? Explain their role in sequence alignments. 4

   (b) Differentiate between Global and Local alignment. 3½

UNIT – IV

8. What is BLAST ? Explain its output format in detail. 7½

9. Write short notes on the following :

(i) SRS 4

(ii) Pattern and Repeat Finding 3½

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B. Sc. Bio-Technology 5th Sem. (N.S.) Examination – December, 2024

RE-COMBINANT DNA TECHNOLOGY

Paper : BT-502

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. **1** is ***compulsory***.

1. Write short notes on the following : $10 \times 1 = 10$

(a) Transformation

(b) Ultra-sonication

(c) Random mutagenesis

(d) Gene shuffling

(e) Immune modulators

(f) Transgenic animals

(g) Microlaser

(h) Agrobacterium rhizogene

(i) Electroporation

(j) Phage display

UNIT – I

2. What are bacterial conjugation and transduction processes and how these are triggered ? Discuss the importance of bacterial conjugation and transduction. 7.5

3. Describe the gene transfer methods– Micro projectile and short gun method. 7.5

UNIT – II

4. What is site directed mutagenesis ? Discuss types and importance of site-directed mutagenesis. 7.5

5. What are chimeric proteins ? Discuss the production of chimeric proteins. 7.5

UNIT – III

6. What are transgenic mice ? How they can be produced and what is importance of transgenic mice ? 7.5

7. What is the role of genetic engineering for the production of therapeutic products like blood proteins and vaccines ? 7.5

UNIT – IV

8. What is Agrobacterium mediated genetic transformation in plants ? Describe the mechanism of T-DNA transfer. 7.5

9. Discuss the direct gene transfer methods like particle bombardment and chemical methods. What are the advantages and disadvantages of these methods ? 7.5

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B. Sc. Bio-Technology 5th Semester (N.S.) Examination – December, 2024

IMMUNOLOGY

Paper : BT-503

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. **1** is ***compulsory***.

1. Describe the following : $10 \times 1 = 10$

(i) Immunoglobulins

(ii) Cytotoxic T-cell,

(iii) Somatic Mutation Hypotheses

(iv) Clonal selection theory

(v) avoidance of recognition

(vi) AIDS

(vii) adjuvants

(viii)DNA vaccines

(ix) Immunosorbent Assay (ELISA)

(x) Vaccination

UNIT – I

2. What is the primary function of the immune system in mammals ? Explain the difference between innate and adaptive immunity. 7.5

3. (a) What is V(D)J recombination, and why is it important for B-lymphocyte differentiation ? 3.5

(b) What is somatic recombination, and why is it essential for T-cell receptor (TCR) diversity ? 4

UNIT – II

4. (a) What is the process of immunoglobulin gene regulation, and how is it controlled during B-cell development ? 3.5

(b) What are allotypes, and how do they differ from isotypes and idiotypes ? 4

5. Describe the following :

(i) Heavy chain gene transcription 3.5

(ii) Genetic basis of antibody diversity. 4

UNIT – III

6. What are Class I and Class II MHC molecules ? Describe the structural differences and where these molecules are expressed in the body ? 7.5

7. Describe the following :

(a) Pathogen defense strategies 3.5

(b) Auto-immune diseases 4

UNIT – IV

8. What is a vaccine, and how does it work to protect against infectious diseases ? Differences between recombinant vaccines and viral vaccines. 7.5

9. (a) What is Radioimmunoassay (RIA), and how does it work ? 4

(b) What is active and passive immunization ? 3.5

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B. Sc. Bio-Technology 5th Semester (N.S.) Examination – December, 2024

GENOMIC AND PROTEOMICS

Paper : BT-504

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. 1 is ***compulsory***.

1. Write short notes on the following : $1 \times 10 = 10$

(i) Chain termination sequencing method

(ii) Genome sequence assembly

(iii) BLAST

(iv) VISTA

(v) Native PAGE

(vi) Sedimentation coefficient

(vii) Sample preparation

(viii) Proteome

(ix) Gel filteration

(x) Genomics

UNIT – I

2. What is the Sanger method of DNA sequencing ? How it differ from Maxam-Gilbert sequencing method. 7.5

3. Describe the following :

(i) Shotgun & Hierarchical methods of genome sequencing

(ii) Genome sequence assembly software's

UNIT – II

4. What do you understand by ENSEMBL, VISTA and UCSC Genome Browsers ? Which web-based tool would be most suitable for comparative genomics ? 7.5

5. Write short notes on :

(i) NCBI 3

(ii) Selected Model Organisms Genomes 4.5

UNIT – III

6. Discuss the role of hydrogen bonds, hydrophobic interactions, ionic bonds, and disulfide bridges in maintaining protein structure. How these interactions contributes to the stability of protein structures. 7.5

7. Write short notes on :

(i) SDS-PAGE 3.5

(ii) Edman degradation. 4

UNIT – IV

8. What is proteomics ? Explain the major goals of proteomics in research. 7.5

9. Describe the followings :

(i) De novo sequencing of proteins 4

(ii) Mass spectrometry based methods for protein identification 3.5

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B. Sc. Bio-Technology 5th Semester Examination – December, 2024

PHYSICAL CHEMISTRY

Paper : BT-505

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. **1** is ***compulsory***. All question carry equal marks.

1. (a) What is zero point energy ? $8 \times 1 = 8$

(b) What are the condition which an eign functions must satisfy ?

(c) What is resolution of racemic mixture ?

(d) Define magnetic permeability.

(e) What are the number of modes of vibrations of CO_2. Name them.

(f) In which region of electromagnetic spectrum for pure rotational spectrum is observed ?

(g) What is Rayleigh scattering ?

(h) How dipole moment help in deciding cis and trans isomers ?

SECTION – A

2. (a) Explain all the postulates of quantum mechanics. 4

(b) How the variation of heat capacity of solids with temperature can be explained by quantum mechanics. 4

3. (a) Define Plank's radiations law and derive its expression. 4

(b) Explain the following : 4

(i) Compton effect

(ii) Photoelectric effect

SECTION – B

4. (a) Discuss and derive Clausius-Mosotti equation. 4

(b) Explain dipole moment and its unit. How can it be determined by Refraction method ? 4

5. (a) What is optical activity ? What is the cause of optical activity. Explain with example. 4

(b) What is magnetic permeability ? Differentiate between diamagnetic, paramagnetic and ferromagnetic substances in terms of magnetic permeability. 4

SECTION – C

6. (a) Write notes on the following : 4

(i) Degree of freedom of molecule

(ii) Oppenheimer approximation

(b) List the factors which affect the intensity of a spectral line. Explain briefly. 4

7. (a) Explain the following : 4

(i) Rotational spectra of diatomic molecules

(ii) Isotopic effect in rotational spectroscopy

(b) Write the maxwell relation for the population of molecules in various rotational energy levels. Explain. 4

SECTION – D

8. (a) Explain the selection rule for vibrational transition of an anharmonic oscillator. 4

   (b) How is infra-red spectra helpful in the identification of organic compounds ? 4

9. (a) Explain Raman spectra on the basis of polarizability of molecules. 4

   (b) Discuss quantum theory of Raman spectra. 4

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B. Sc. Bio-Technology 5th Semester (N.S.) Examination – December, 2024

INORGANIC CHEMISTRY

Paper : BT-507

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. (a) Define crystal field stabilization energy. 1

(b) Give two examples of strong field ligands. 1

(c) What is trans-directing series ? 1

(d) What are labile complexes ? 1

P. T. O.

(e) Calculate the magnetic moment (spin only) for Mn^{+2}. 1

(f) What is Neel temperature in magnetism ? 1

(g) What is spectrochemical series ? 1

(h) Calculate the term symbol for the ground state of Ni. 1

SECTION – A

2. (a) Explain the limitations of valence bond theory. 3

(b) Differentiate between low-spin and high-spin complexes with suitable examples. 3

(c) Why the magnitude of crystal field splitting in tetrahedral complexes is smaller than octahedral complexes ? 2

3. (a) Calculate CFSE for the following systems : 2, 2

(i) d^4 Tetrahedral

(ii) d^8 Strong field octahedral

(b) Describe the various factors affecting the magnitude of crystal field splitting. 4

SECTION – B

4. (a) Differentiate between thermodynamic and kinetic stability of complexes. 4

   (b) Describe substitution reactions in square planar complexes of Pt(II). 4

5. (a) Explain the Trans effect. 4

   (b) How does the nature of the ligand affect the stability of complexes ? 4

SECTION – C

6. (a) What is magnetic susceptibility and magnetic moment ? How they are related to each other ? 4

   (b) Explain the Faraday method of measuring magnetic susceptibility. 4

7. Describe : 2, 2, 4

   (i) Temperature-independent paramagnetism

   (ii) Variation of magnetic susceptibility with temperature

   (iii) Ferromagnetism and anti-ferromagnetism

SECTION – D

8. (a) Explain the various selection rules for electronic transitions. 4

(b) Why do tetrahedral complexes of an element give much more intense d-d spectra than its octahedral complexes ? 4

9. (a) Describe : 2, 2

(i) L-S coupling

(ii) Vibronic coupling

(b) Explain the Orgel energy diagram of d^1 and d^9 octahedral complexes. 4

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B. Sc. Bio-Technology 5th Semester (N.S.) Examination – December, 2024

ORGANIC CHEMISTRY

Paper : BT-506

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. (a) Give the name of the two most widely used solvents in NMR spectroscopy. 1

(b) How many proton signals are expected in the NMR spectra of $CH_2 = CHCH_2OH$? 1

(c) What is anisotropy in NMR spectroscopy ? 1

(d) Give two examples of spin-active nuclei. 1

(e) What is malt sugar ? 1

(f) Draw the structure of 2-deoxyribose. 1

(g) What are non-reducing sugars ? Give example. 1

(h) What is Reformatsky reaction ? 1

SECTION – A

2. Explain : 2, 2, 4

(i) Chemical shift

(ii) Coupling constant

(iii) Upfield and downfield shifts

3. (a) Describe the rules of splitting of proton signals. 4

(b) Why aromatic protons are more deshielded than vinylic protons ? 4

SECTION – B

4. (a) Compare the NMR spectra of ethyl acetate and acetophenone. 4

(b) How can you differentiate between inter and intramolecular hydrogen bonding using NMR spectroscopy ? 2

(c) How can you distinguish between cis and trans-stilbene using NMR spectroscopy ? 2

5. Differentiate the following pairs of compounds using NMR spectroscopy : 4, 4

(i) Toluene and ethanol

(ii) Benzaldehyde and ethyl bromide

SECTION – C

6. Describe the mechanism of : 4, 4

(i) Mutarotation

(ii) Osazone formation

7. Explain : 3, 5

(i) Conversion of glucose into mannose

(ii) Kiliani-Fischer synthesis

SECTION – D

8. (a) Draw the structure of amylose and amylopectin and differentiate between them. 4

(b) What are disaccharides ? Discuss the structure of sucrose. 4

9. (a) How methyl lithium reacts with : 2, 2

(i) Acetaldehyde

(ii) Cyanogen chloride

(b) Compare the reaction of Grignard reagent and organolithium compounds with carbon dioxide. 4
