R1946	Sub. Code
	502101

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Bioinformatics

INTRODUCTION TO BIOINFORMATICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Operating system is a (CO1, K1)
   (a) collection of hardware components
   (b) collection of input-output devices
   (c) collection of software routines
   (d) All of the above

2. A database of current sequence map of the human genome is called (CO3, K1)
   (a) OMIM (b) HGMD
   (c) Golden path (d) GeneCards

3. Medical related images and simulations available to educate patients is an example of (CO5, K1)
   (a) nursing call centers
   (b) video-conferencing
   (c) continuing medical education
   (d) remote monitoring of vital signs

4. Dx stands for? (CO5, K1)

(a) Disease (b) Disease process

(c) Diagnosis (d) Diagnostic Testing

5. The stepwise method for solving problems in computer science is called ———————— (CO4, K1)

(a) Flowchart (b) Algorithm

(c) Procedure (d) Sequential design

6. BankIt and Sequin are sequence submission tools in (CO3, K1)

(a) DDBJ (b) GenBank

(c) PDB (d) EMBL

7. BLOSUM matrices are used for (CO2, K1)

(a) Multiple sequence alignment

(b) Pair wise sequence alignment

(c) Phylogenetic analysis

(d) All of the above

8. Paclitaxel, the potent anticancer drug, was isolated from which natural source? (CO4, K1)

(a) The Pacific Yew tree

(b) The Pacific Ocean

(c) A fungus

(d) A bacteria

9. The term bioinformatics was coined by (CO1, K1)

(a) J D Watson

(b) Margaret Dayhoff

(c) Pauline Hogeweg

(d) Frederic Sanger

10. Phylogenetic relationship can be shown by (CO2, K1)

(a) Dendrogram

(b) Gene Bank

(c) Data retrieving tool

(d) Data search tool

Part B ($5 \times 5 = 25$)

Answer **all** the questions not more than 500 words each.

11. (a) Enumerate the bioinformatics resources on the web. (CO1, K2)

Or

(b) Explain the salient features of the UNIX/Linux operating system. (CO1, K3)

12. (a) What are the different scoring matrices used in sequence alignment? (CO2, K2)

Or

(b) Write a note on Global and local sequence alignments. (CO2, K3)

13. (a) Give an account on the Structural databases. (CO3, K2)

Or

(b) Explain the information retrieval tools in biological databases. (CO3, K3)

14. (a) Give an account on different chemical structure representations. (CO4, K3)

Or

(b) Write a note on the Chemical structure visualization tools. (CO4, K3)

15. (a) Discuss the role of informatics in pharmacy. (CO5, K3)

Or

(b) Explain the architecture of health information system. (CO5, K2)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Explain the role of computers in integrating biological data. (CO1, K3)

Or

(b) Discuss the different operating systems and their features. (CO1, K4)

17. (a) Explain briefly the algorithms employed in sequence alignment. (CO2, K3)

Or

(b) Describe the steps involved in Multiple sequence alignment. (CO2, K3)

18. (a) Discuss in detail, the classification of Biological databases. (CO3, K3)

Or

(b) Write a note on Entrez system for accessing databases. (CO3, K4)

19. (a) Discuss briefly the different tools used in cheminformatics. (CO4, K3)

Or

(b) Give a detailed account on the chemical databases and file formats. (CO4, K4)

20. (a) Explain in detail, the role of informatics in Health care management. (CO5, K5)

Or

(b) Explain the advantages of Medical transcription and coding. (CO5, K4)

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R1947	Sub. Code
	502102

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Bioinformatics

MOLECULAR CELL BIOLOGY AND BIOCHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. ———— is the region where double-stranded single circular DNA is found in the prokaryotic cell. (CO1, K2)

   (a) Protonucleus (b) Nucleus

   (c) Nucleoid (d) Nucleoplasm

2. In prokaryotic cells, ribosomes have ————subunits. (CO1, K2)

   (a) 70 S (b) 80 S

   (c) 60S + 40S (d) 50S + 40S

3. _____ and _____ coined the term "Meiosis". (CO2, K2)

   (a) Van Burin and Hertwig

   (b) Boveri and Stuka

   (c) Walleye and Hofmeister

   (d) Farmer and Moore

4. Which of the following occurs when there is an increase in the condensation of chromatin during the process of cell division———— (CO2, K2)

(a) Heterochromatin increases

(b) Euchromatin increases

(c) Differentiation of euchromatin and heterochromatin decreases

(d) Differentiation of euchromatin and heterochromatin increases

5. ———— is a reducing sugar (CO3, K4)

(a) Galactose (b) Gluconic acid

(c) Sucrose (d) β – methyl galactosidase

6. Which of the following is a phospholipid? (CO3, K4)

(a) Sterol (b) Cholesterol

(c) Lecithin (d) Steroid

7. Rearrangement of DNA that involves the breakage and reunion of DNA is called ———— (CO4, K3)

(a) Replication (b) Recombination

(c) Translation (d) Transcription

8. Which of the following is site specific recombination? (CO4, K3)

(a) Modification (b) Transposition

(c) Holiday junction (d) Retrotransposons

9. ———— cells have uncontrolled cell division and differentiation (CO5, K4)

(a) Tumor cell (b) Immune cell

(c) Platelets (d) Stem cells

10. ———— is the process by which a malignant cell spread throughout normal cells? (CO5, K4)

(a) Transformation (b) Metastasis

(c) Invasiveness (d) Progression

Part B ($5 \times 5 = 25$)

Answer **all** the questions not more than 500 words each.

11. (a) Differentiate prokaryotic and eukaryotic cell. (CO1, K2)

Or

(b) Summarise the dynamics of eukaryotic cell. (CO1, K2)

12. (a) Describe about microtubules in spindle assembly. (CO2, K2)

Or

(b) Explain in detail about the events occurred during meiosis. (CO2, K2)

13. (a) Describe the diseases caused by the deficiency of fat-soluble vitamins (CO3, K4)

Or

(b) Write a detailed note on the structure of nitrogenous bases. (CO3, K4)

14. (a) Describe about the post-translational modification. (CO4, K3)

Or

(b) Write a short note on mendelian principles. (CO4, K3)

15. (a) Give an account on proto oncogenes. (CO5, K4)

Or

(b) Describe about acute promyelocytic leukemia. (CO5, K4)

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Write a detailed note on the organisation of prokaryotic genome. (CO1, K2)

Or

(b) Describe about the factors involved in the gene regulation. (CO1, K2)

17. (a) Explain in detail about cohesins and condensins in chromosome segregation. (CO2, K2)

Or

(b) Give a detailed note on the structure and function of centrosomes. (CO2, K2)

18. (a) Write a detailed note on the structure, functions, and biological properties of monosaccharides. (CO3, K4)

Or

(b) Elucidate the structural organisation of proteins. (CO3, K4)

19. (a) Describe about extrachromosomal inheritance. (CO4, K3)

Or

(b) Discuss about the linkage maps and tetrad analysis. (CO4, K3)

20. (a) Give an elaborate note on the tumor suppressor genes. (CO5, K4)

Or

(b) Explain in detail about the properties of malignant cells. (CO5, K4)

R1948

Sub. Code
502103

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Bioinformatics

MATHEMATICS AND STATISTICS FOR BIOLOGISTS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. In vector calculus, what does the curl of a vector field represent? (CO1, K1)

   (a) The rate of change of the divergence

   (b) The circulation or rotation of the vector field

   (c) The gradient of the vector field

   (d) The line integral of the vector field

2. Which numerical technique is commonly used for finding approximate solutions to equations that cannot be solved analytically? (CO1, K1)

   (a) Matrix multiplication

   (b) Lebesgue integration

   (c) Newton-Raphson method

   (d) Complex integration

3. In economics and statistics, the Lorenz curve is used to illustrate: (CO2, K1)

(a) The distribution of income or wealth among a population

(b) The relationship between two continuous variables

(c) The correlation between two categorical variables

(d) The variability in a sample mean

4. The following data represents the heights (in cm) of 8 students: 160, 165, 170, 175, 165, 172, 180, 168. What is the median height of the students? (CO2, K3)

(a) 165 (b) 168

(c) 170 (d) 172

5. Which concept describes the probability of rejecting a null hypothesis when it is actually true? (CO3, K2)

(a) Type I error (b) Type II error

(c) Power of a test (d) p-value

6. What is the primary application of the Central Limit Theorem in statistics? (CO3, K3)

(a) Estimating confidence intervals

(b) Testing the hypothesis of independence

(c) Analyzing the variability in data

(d) Describing the distribution of a sample mean

7. In bio statistics, which type of correlation coefficient is most appropriate for measuring the strength and direction of association between two variables that are measured on a nominal scale? (CO4, K2)

(a) Pearson's correlation coefficient

(b) Spearman's rank correlation coefficient

(c) Phi coefficient

(d) Point-biserial correlation coefficient

8. Which statistical test is used to assess the correlation between two continuous variables when the relationship is nonlinear? (CO4, K2)

(a) Pearson's correlation coefficient

(b) Spearman's rank correlation coefficient

(c) Chi-square test

(d) Kendall's tau correlation coefficient

9. Which of the following best describes the purpose of a confidence interval in bio statistics? (CO5, K2)

(a) To determine the power of a statistical test

(b) To estimate the range within which the true population parameter is likely to fall

(c) To assess the correlation coefficient between two variables

(d) To compare means across multiple groups

10. Which statistical test is appropriate for comparing the means of three or more independent groups in bio statistics? (CO5, K2)

(a) Paired t-test

(b) Chi-square test

(c) Analysis of Variance (ANOVA)

(d) Wilcoxon signed-rank test

Part B $(5 \times 5 = 25)$

Answer **all** the questions not more than 500 words each.

11. (a) State and prove DeMoivre's Theorem. (CO1, K5)

Or

(b) Evaluate the definite integral $\int_0^{\frac{\pi}{2}} x \cos(x)\, dx$

(CO1, K5)

12. (a) Given the data set: 4, 8, 6, 5, 3, 7, 9, calculate the inter-quartile range (IQR) and the coefficient of variation (CV). (CO2, K5)

Or

(b) Explain the concept of stratified random sampling and discuss its advantages over simple random sampling. (CO2, K4)

13. (a) Consider a random variable X with the following probability distribution:
$P(x = 1) = 0.2, P(x = 2) = 0.3, \quad P(x = 3) = 0.5$.
Calculate the expected value $E(x)$ and the variance var (X) (CO3, K5)

Or

(b) A diagnostic test for a certain disease has a probability of 0.95 of correctly identifying a person with the disease (sensitivity), and a probability of 0.90 of correctly identifying a person without the disease (specificity). If 1% of the population actually has the disease, what is the probability that a person has the disease given that the test result is positive? Use Bayes' theorem to solve. (CO3, K4)

14. (a) The following data shows the number of hours spent studying (X) and the corresponding exam scores (Y) for 10 students Calculate Karl Pearson's coefficient of correlation (CO4, K5)

Hours Studied (X)	Exam Score (Y)
3	65
5	70
7	75
4	68
6	72
2	60
8	78
5	71
4	67
6	73

Or

(b) A researcher is studying the relationship between the ranks of students based on their exam scores (X) and their corresponding ranks based on their attendance records (Y). The ranks are as follows (CO4, K5)

Exam Score Rank (X)	Attendance Rank (Y)
1	3
2	2
3	5
4	4
5	1

Calculate Spearman's rank correlation coefficient (Spearman's rho) and direction of the relationship between exam score ranks and attendance ranks.

15. (a) Compare and contrast the statistical software packages R, SAS, and PRISM in terms of their features, capabilities, and suitability for bio statistical analysis. (CO5, K4)

Or

(b) Explain the concept of regression analysis and its applications in biostatistics. (CO5, K4)

Part C $(5 \times 8 = 40)$

Answer **all** the questions not more than 1000 words each.

16. (a) Find the eigen values and corresponding eigenvectors of the matrix $A = \begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix}$ (CO1, K5)

Or

(b) Verify Stokes' theorem for the vector field $\vec{F} = (yz, xz, xy)$ over the surface of the plane $z = 0$ bounded by the circle $x^2 + y^2 = 1$. (CO1, K5)

17. (a) Given the following income distribution for a population of 5 households, plot the Lorenz curve and calculate the Gini coefficient. (CO2, K5)

Household	Income
1	5,000
2	7,000
3	9,000
4	20,000
5	40,000

Or

(b) Discuss the concept of measures of central tendency in detail with examples (CO2, K4)

18. (a) Define De Morgan's laws in set theory and provide proofs for both. Use examples to demonstrate the application of these laws in set operations. (CO3, K4)

Or

(b) A manufacturer claims that the average lifetime of a certain type of light bulb is 1200 hours. A consumer group decides to test this claim by taking a random sample of 36 bulbs and finding that the sample mean lifetime is 1180 hours with a sample standard deviation of 100 hours. Test the manufacturer's claim at a significance level of $\alpha = 0.05$ (CO3, K5)

19. (a) Explain the different types of correlations that can exist between two variables. Provide examples and discuss how each type of correlation affects the relationship between the variables. Include scenarios where each type of con-elation might be observed. (CO4, K4)

Or

(b) Differentiate between Karl pearsons and spearmans rank correlation in detail with examples. (CO4, K4)

20. (a) Discuss the application of ANOVA (Analysis of Variance) in biostatistics. Explain the three types of ANOVA models with examples. (CO5, K4)

Or

(b) Discuss the principles and applications of regression analysis in biostatistics. Explain the difference between simple linear regression and multiple linear regression. (CO5, K4)

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R1949

Sub. Code
502501

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Bioinformatics

Elective : GENERAL CHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Which of the following is not a polymer? (CO4, K2)

   (a) Starch (b) Teflon

   (c) Cellulose (d) Sucrose

2. _____ is a chemical property that describes the tendency of an atom or a functional group to attract electrons toward itself. (CO3, K2)

   (a) Delocalization (b) Electronegativity

   (c) Electrochemistry (d) Hyperconjugation

3. The helical structure of proteins is stabilized by (CO3, K4)

   (a) Peptide bond (b) Oxygen bond

   (c) Hydrogen bond (d) Nitrogen bond

4. What are hallucinogens? (CO1, K4)

   (a) Cannabinoids (b) Psychedelics

   (c) Opioids (d) Depressants

5. _____ are spherical, polymeric particles composed of natural or artificial polymers. (CO2, K2)

(a) Nanoparticles (b) Phenols

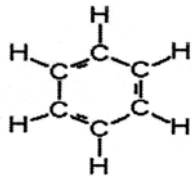
(c) Alcohols (d) Ketones

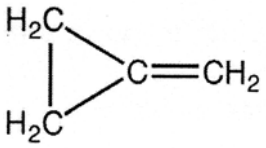
6. The protein located primarily in the striated muscles of the vertebrates? (CO1, K4)

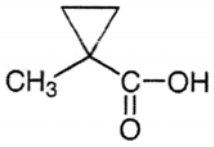
(a) Hemoglobin (b) Myoglobin

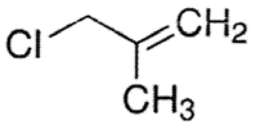
(c) Hemerythrin (d) Hemocyanin

7. Which of the following is Annulene? (CO1, K3)

(a) 

(b) 

(c) 

(d) 

8. Chlorambucil is used to treat ———— (CO2, K3)

(a) Myocardial infarction

(b) Alzheimer's disease

(c) Lymphatic leukemia

(d) Diabetes

9. The role of Electron Transport System (EST) is? (CO4, K3)

(a) To shuttle electrons from an electron donor to an electron acceptor in bacteria and plants

(b) To energize the production of ATP

(c) Help to create and regulate energy

(d) To prevent congenital abnormalities

10. Which law is used to find the molar absorptivity? (CO1, K3)

(a) Boyle's law (b) Charles law

(c) Avogadro's law (d) Beer–Lambert's law

Part B ($5 \times 5 = 25$)

Answer **all** the questions not more than 500 words each.

11. (a) Differentiate sigma and pi-bond. (CO2, K2)

Or

(b) Define Arrhenius theory of acid and base. (CO1, K2)

12. (a) Explain Huckel's rule and its applications. (CO3, K3)

Or

(b) Describe the working process of IR spectroscopy. (CO2, K3)

13. (a) Give a short note on fundamentals of drug nanoparticles. (CO1, K2)

Or

(b) Define the Structure and uses of polyvinyl alcohol and pyrrolidone. (CO3, K2)

14. (a) How do trace elements undergo biological oxidation and reduction reactions? (CO1, K4)

Or

(b) Explain the structure of vitamin B12 and its functions. (CO3, K4)

15. (a) Write a short essay on the sources and classification of drugs. (CO4, K3)

Or

(b) What are Aspirin and Paracetamol, and how are they synthesized? (CO5, K3)

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Briefly describe the types of chemical bond. (CO4, K2)

Or

(b) What is Molecular orbital theory? Write a note on its importance. (CO3, K2)

17. (a) Explain the Synthesis of alcohols, phenols, aldehydes and ketones. (CO2, K3)

Or

(b) Write an essay on the principle, mechanism and applications of UV spectroscopy. (CO1, K3)

18. (a) Write an essay on the dimensions of nanomaterials, comment on their stability and their properties. (CO2, K2)

Or

(b) Give a detailed note on the classification of polymers. (CO4, K2)

19. (a) Explain the structure and function of Hemoglobin, Myoglobin and Hemocyanin. (CO2, K4)

Or

(b) Explain structure and function of Iron-Sulphur proteins with example. (CO3, K4)

20. (a) Give a brief overview on the chemistry of Penicillin, Chloroquine, and Ampicillin, along with their modes of action and side effects. (CO1, K3)

Or

(b) Describe the design and synthesis of Antibacterial and Antifungal agents. (CO4, K3)

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R1950

Sub. Code
502301

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Bioinformatics

GENETICS AND GENETIC ENGINEERING

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. In which of the following condition, both the dominant and recessive alleles need to express themselves? (CO1, K2)

   (a) Dominance (b) Recessive

   (c) F2 generation (d) Codominance

2. In a monohybrid cross between two heterozygous individuals, percentage of pure homozygous individuals obtained in Fl generation will be (CO1, K2)

   (a) 25% (b) 50%

   (c) 75% (d) 100%

3. Who discovered blood groups? (CO2, K2)

   (a) Thomas Cooley (b) Karl Landsteiner

   (c) Camillo Golgi (d) Ernst Haecker

4. Name the phenomenon where two genes have the same expression of the character. (CO2, K2)

   (a) Pleiotropy (b) Phenocopy

   (c) Penetrance (d) Expressivity

5. Where does a repressor bind to an operon? (CO3, K5)

(a) Operator (b) Promoter

(c) Inducer (d) Catabolite activator site

6. Which of the following RNA molecules serve as an adaptor molecule during protein synthesis? (CO3, K5)

(a) rRNA (b) mRNA

(c) tRNA (d) t RNA and mRNA

7. ———————— is a process that involves transferring naked DNA fragments between bacteria. (CO4, K3)

(a) Transformation (b) Transduction

(c) Conjugation (d) Vectoring

8. Which of the following is NOT an example of aneuploidy? (CO4, K3)

(a) Turners syndrome (b) Downs syndrome

(c) Phenylketonuria (d) Klinefelters syndrome

9. The transformation method that uses tungsten or gold particle coated with DNA accelerated at high velocity is ———————— (CO5, K3)

(a) Acceleration method

(b) High velocity method

(c) Particle gun delivery method

(d) DNA particle delivery method

10. ———————— are a unique kind of primitive, immature cells that have a remarkable capacity to develop in to different kinds of cells. (CO5, K3)

(a) Stem cells (b) Epithelial cells

(c) Mesenchymal cells (d) Ectodermal cells

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Explain co-dominance with example. (CO1, K2)

Or

(b) Give an account on pedigree symbols. (CO1, K2)

12. (a) What is mutation and classify the types of mutation. (CO2, K2)

Or

(b) What is the difference between a dominant and recessive gene? (CO2, K2)

13. (a) Give an account of the basics concept of replication. (CO3, K5)

Or

(b) Explain the methods involved in the processing of DNA. (CO3, K5)

14. (a) Classify the types of pedigree analysis based on inheritance pattern. (CO4, K3)

Or

(b) Write a note on Karyotyping. (CO4, K3)

15. (a) Explain about Ti and Ri plasmid. (CO5, K3)

Or

(b) Write down the Applications of plant genetic engineering. (CO5, K3)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Discuss in detail about the Mendals law of inheritance. (CO1, K2)

Or

(b) Write a detailed note on recombination. (CO3, K2)

17. (a) Describe ABO blood grouping. (CO2, K5)

Or

(b) Describe about supplementary gene interactions in Ex grain color in maize. (CO2, K5)

18. (a) Describe in detail about eukaryotic genome organization. (CO3, K5)

Or

(b) Enumerate on Recombinant DNA technology. (CO3, K5)

19. (a) Explain the process of introduction of foreign DNA into host cell using transduction. (CO4, K3)

Or

(b) Describe the steps involved in mapping genes by interrupted mating. (CO4, K3)

20. (a) Describe the mechanism of T-DNA integration during *Agrobacterium*-mediated genetic transformation. (CO5, K3)

Or

(b) Describe the mechanism of fruit ripening. (CO5, K3)

———————

R1951

Sub. Code
502302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Bioinformatics

STRUCTURAL BIOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective-type questions by choosing the correct option.

1. Which among the following has the strongest interaction? (CO2, K2)

   (a) Vander Waals interactions

   (b) Covalent bonds

   (c) Hydrogen bonds

   (d) Ionic bonds

2. Which of the following is the definition of chirality? (CO4, K2)

   (a) The superimposability of an object on its mirror image

   (b) A molecule with a mirror image

   (c) The non-superimposability of an object on its mirror image

   (d) A molecule that has a carbon atom with four different substituents

3. Which of the following parameters does not influence the likelihood of protein crystallization? (CO2, K2)

(a) Concentration of protein

(b) Temperature

(c) Volume of sample

(d) pH

4. Which of the following statements regarding NMR spectroscopy is wrong? (CO5, K4)

(a) NMR signals towards the left of the spectral chart correspond to larger chemical shifts

(b) Chemical shifts are larger when the frequencies of the radiation which induces the nuclear transitions are higher

(c) Chemical shifts are larger when shielding effects are greater

(d) A hydrogen signal splits into n + 1 peaks by spin-spin coupling when the number of equivalent hydrogen atoms on adjacent atom(s) is n, and no other neighbouring atoms are involved

5. Which crystal system has three perpendicular axes of equal length? (CO4, K2)

(a) Cubic (b) Tetragonal

(c) Orthorhombic (d) Monoclinic

6. The wavelength of X-rays used in X-ray crystallography is 8 × 10-10 m. It undergoes the first-order reflection at a glancing angle of 4.59°. What is the spacing between the atomic planes? (CO5, K3)

(a) 4×10^{-9} m (b) 15×10^{-9} m

(c) 10×10^{-9} m (d) 5×10^{-9} m

7. Left-handed alpha-helix allowed region is present in which of the following quadrants of the Ramachandran plot? (CO3, K2)

(a) Fourth quadrant (b) First quadrant

(c) Second quadrant (d) Third quadrant

8. X-rays are used in determining the molecular structure of crystals because: (CO1, K2)

(a) The energy of X-rays is high

(b) X-rays can penetrate the material

(c) The wavelength of X-rays is comparable to interatomic distance

(d) The frequency of X-rays is low

9. The R-factor is a common metric used for: (CO1, K2)

(a) Measuring the resolution of the data

(b) Assessing the quality of the crystal

(c) Evaluating the success of structure refinement

(d) Determining the number of atoms in the unit cell

10. Most proteins are soluble under physiological conditions, but as the concentration of solutes (ions. precipitants, etc.) rises, the protein becomes less soluble. Thus, it crystallizes or precipitates. What is this phenomenon known as? (CO3, K2)

(a) Resolubilization (b) Coagulation

(c) Salting in (d) Salting out

Part B (5 × 5 = 25)

Answer **all** the following questions note more than 500 words each.

11. (a) What is a crystal? Distinguish between single crystals, powder crystals, and amorphous solids and provide examples of each. (CO2, K2)

Or

(b) Explain the concept of Miller indices and the steps involved in calculating the Miller indices for a given plane. Deduce the Miller indices for the plane a, b, c whose intercepts on the x, y and z axis are 1, –3 and ∞. (CO4, K4)

12. (a) Describe the phase problem in X-ray crystallography and its significance in determining the crystal structure. (CO4, K2)

Or

(b) Describe the Synchrotron radiation and its importance in structure determination. (CO3, K2)

13. (a) Describe the process of crystallization of small molecules from synthetic compounds. Explain the factors that influence the crystallization process. Discuss the importance of optimizing crystallization conditions for obtaining high-quality crystals. (CO2, K2)

Or

(b) (i) Explain the process of data collection in single-crystal X-ray diffraction. What information is obtained from the collected data?

(ii) Describe the steps involved in data reduction. (CO2, K2)

14. (a) Describe the soaking method and the factors influencing the success of soaking experiments. (CO2, K2)

Or

(b) Discuss the process of heavy atom screening in protein crystallography and describe common heavy atoms used for screening and their properties. (CO3, K2)

15. (a) Write in detail about Ramachandran plot and its significance. (CO2, K2)

Or

(b) Write a short note on the following: (CO2, K2)

(i) R factors

(ii) B factors

(iii) Unit Map

Part C ($5 \times 8 = 40$)

Answer **all** the following questions not more than 1000 words each.

16. (a) Define crystal systems and discuss their classification based on symmetry. Provide examples of crystals belonging to each system. (CO2, K2)

Or

(b) What is meant by the Fourier series? Derive electron density equation using Fourier series. (CO5, K2)

17. (a) Discuss the basic principles of NMR spectroscopy and its role in structure determination. (CO2, K2)

Or

(b) Briefly describe any two advanced X-ray diffraction techniques and their specific applications. Discuss the advantages and limitations of each technique compared to traditional X-ray diffraction. (CO3, K2)

18. (a) Discuss the principles of structure solution using the Patterson method. Explain how the Patterson method is applied to solve the crystal structures of small molecules. Discuss the advantages and limitations of using this method compared to other structure solution techniques. (CO4, K2)

Or

(b) Describe the techniques and criteria used for structure validation in crystallography and discuss the importance of validating crystal structures. (CO3, K2)

19. (a) Discuss any two crystallization methods used in macromolecular crystallography and mention their strengths and limitations. Provide examples of situations where each method is preferred. (CO1, K2)

Or

(b) Write in detail about various methods used for protein structure determination. Discuss the strengths and limitations of each method. (CO2, K2)

20. (a) Discuss the internal geometry parameters. How are these parameters measured and analyzed in crystal structures, and what do they reveal about molecular conformation? (CO2, K2)

Or

(b) Describe the different types of covalent and non-covalent interactions and their role in stabilizing molecular structures. (CO2, K2)

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R1952

Sub. Code
502303

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Bioinformatics

PHARMACOGENOMICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Major approach used in HGP for identifying genes were (CO1, K1)

   (a) BLAST (b) Expressed Sequence tags

   (c) GenBank (d) EBI

2. Which database contains information on known genetic variations and their association with diseases? (CO1, K1)

   (a) GenBank (b) dbSNP

   (c) ENCODE (d) FlyBase

3. The major factor causing variability in activity of drug-metabolizing enzymes among healthy people, making metabolism highly variable is (CO2, K1)

   (a) Environmental factor

   (b) Aging

   (c) Gender

   (d) Race

4. Which one of these Phase II metabolic processes exhibit polymorphism? (CO2, K1)

(a) Metabolism by Suiphotransferases

(b) Glucuronidation

(c) Sulphation

(d) Conjugation with an amino acid

5. Pharmacokinetics involve the study of (CO3, K1)

(a) what the drug does to a body

(b) the genome

(c) what the body does to a drug

(d) how well a drug is absorbed

6. What term is used to signify a preparation that appears identical to the preparation of an active drug but which has no biological activity? (CO3, K1)

(a) Dummy (b) Placebo

(c) Peptidomimetic (d) Gazebo

7. ———————— is a technique used by molecular biologists to produce a snapshot of the messenger RNA population. (CO4, K1)

(a) OMIM (b) SNP

(c) SIFT (d) SAGE

8. What is the simplest way to download the entire GWAS Catalog to create local database? (CO4, K1)

(a) downloading the Catalog summary statistics

(b) downloading the entire TSV file of the Catalog

(c) accessing the data through the REST API

(d) accessing the catalog from log file

9. Which of the following are mechanisms by which oncogenic viruses cause cancers? (CO5, K1)

(a) E6 and E7 oncoproteins expressed by HPVs inactivate p53 and pRB functions respectively

(b) Downregulation of telomerase through integration of HBV genome

(c) Inactivation of the NER DNA repair pathway

(d) Chronic inflammation resulting from persistent infection

10. Pharmacologically inactive compounds are called ————————. (CO5, K1)

(a) Prodrug (b) Predrug

(c) Postdrug (d) Biodrug

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Enumerate the methods for gene prediction in Prokaryotes. (CO1, K3)

Or

(b) Give an account on Metagenomics. (CO1, K2)

12. (a) Explain the Cluster of orthologous groups. (CO2, K2)

Or

(b) Write a note on Mega blast algorithms. (CO2, K3)

13. (a) Give an account on adverse drug reactions. (CO3, K3)

Or

(b) Explain the tools used for PK and PD analysis. (CO3, K3)

14. (a) Give an account on microarray databases. (CO4, K2)

Or

(b) Write a note on SNP arrays and its role in pharmacogenomics? (CO4, K3)

15. (a) Write a note on the role of informatics in cancer. (CO5, K4)

Or

(b) Explain the methods of estimating Survival analysis. (CO5, K3)

Part C ($5 \times 8 = 40$)

Answer **all** questions not more than 1000 words each.

16. (a) Explain the role of bioinformatics in identifying disease genes and SNPs. (CO1, K5)

Or

(b) Discuss the concept of Genome sequencing, assembly and annotation. (CO1, K5)

17. (a) Explain in detail, the tools used for comparative genomics. (CO2, K4)

Or

(b) Describe the prediction of structural changes due to polymorphisms. (CO2, K5)

18. (a) Discuss in detail, the process involved in structural pharmacogenomics? (CO3, K5)

Or

(b) Explain the importance of Personalized medicine with examples. (CO3, K5)

19. (a) Discuss briefly the steps involved in the analysis of gene expression data. (CO4, K5)

Or

(b) Give a detailed account on the NGS techniques and its applications. (CO4, K5)

20. (a) Discuss the methods for detecting copy number variations in cancer. (CO5, K5)

Or

(b) Discuss the salient features of the cancer specific databases. (CO5, K4)

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R1953	Sub. Code 502508

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Bioinformatics

Elective : PROGRAMMING IN C AND C++

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

Answer **all** the following objective questions by choosing the correct option.

1. Which of the following is not a valid C variable name? (CO3, K2)

(a) int number; (b) float rate;
(c) int variable count; (d) int $main;

2. How many times following loop will be executed? (CO1, K2)

```
void main()
{
    int i = 32766;
    while (i<= 32767)
    {
    printf("%d\n", i);
    i = i+1;
    }
}
```

(a) 2 times
(b) 1 time
(c) infinite times
(d) loop will not be executed

3. scanf() is a predefined function in ———— header file. (CO4, K6)

(a) stdlib.h

(b) ctype.h

(c) stdio.h

(d) stdarg.h

4. Arguments passed to a function in C language are called? (CO3, K6)

(a) Definite Arguments

(b) Actual Arguments

(c) Formal arguments

(d) Ideal Arguments

5. What is the keyword used to define a structure? (CO5, K2)

(a) struct

(b) record

(c) class

(d) object

6. What is the function of the mode ' w+'? (CO1, K2)

(a) create text file for writing, discard previous contents if any

(b) create text file for update, discard previous contents if any

(c) create text file for writing, do not discard previous contents if any

(d) create text file for update, do not discard previous contents if any

7. Which feature of OOP indicates code reusability? (CO2, K6)

(a) Abstraction

(b) Polymorphism

(c) Encapsulation

(d) Inheritance

8. What is C++? (CO4, K6)

(a) C++ is an object-oriented programming language

(b) C++ is a procedural programming language

(c) C++ supports both procedural and object-oriented programming language

(d) C++ is a functional programming language

9. Which keyword is used to define a friend function in a C++ class? (CO3, K5)

(a) private

(b) public

(c) friend

(d) Protected

10. Why do we need to handle exceptions? (CO1, K5)

(a) To avoid unexpected behavior of a program during run-time

(b) To let compiler, remove all exceptions by itself

(c) To successfully compile the program

(d) To get correct output

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Write a C program to read the input from user and write it to a file. (CO2, K2)

Or

(b) Explain various types of loops (for, while, do-while). (CO3, K2)

12. (a) Explain the process of passing a pointer to a function in C. (CO1, K6)

Or

(b) What are built-in library functions in C? Provide examples for built-in library functions? (CO1, K6)

13. (a) How to access the data for structure variables using member operator („.“)? Explain with an example. (CO2, K2)

Or

(b) What are the standard functions in the C graphics module? (CO1, K2)

14. (a) Briefly explain the if-else and switch statement in C++ with an example. (CO1, K6)

Or

(b) Define encapsulation in OOPS. Provide a simple C++ example. (CO2, K6)

15. (a) Brief note about a class and an object. (CO3, K5)

Or

(b) Explain the constructor and types of constructor with example. (CO3, K5)

Part C ($5 \times 8 = 40$)

Answer **all** the questions not more than 1000 words each.

16. (a) Explain the concept of structured programming in C. Why is it important in application and software development. (CO1, K2)

Or

(b) Write a C program to find a GC content in the given sequences using conditional and control statements. (CO1, K2)

17. (a) Discuss detail about Call by reference. (C03, K6)

Or

(b) What are the Different methods of initializing arrays? Explain each with example program. (CO1, K6)

18. (a) Compare and contrast structures and unions in C. Provide examples. (CO1, K2)

Or

(b) What are the various file input and output operations. Explain in detail with example. (CO3, K2)

19. (a) Explain polymorphism in OOPS. Provide a C++ example of method overloading and method overriding. (CO1, K6)

Or

(b) What are OOPs and list its concept? Discuss about any three OOPs concepts. (CO3, K6)

20. (a) How pointers are used in C++? (CO4, K5)

Or

(b) Write an essay on characteristics and different forms of Constructor. (CO2, K5)

———————