MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc.Bioinformatics

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

Sem. (1)	Pt. I/II/ III/ IV/V (2)	Sub No. (3)	Subject Status (4)	Subject Title (5)	Con - tact Hrs./ Week (6)	**L** Hrs./ week (7)	**T** Hrs./ week (8)	**P** Hrs./ week (9)	**C** Cre- dits (10)
I	I	1	Language	Tamil/Other Language	6	6	0	0	4
	II	2	Language	English	6	6	0	0	4
	III	3	Core	Fundamentals of Biology	4	4	0	0	4
	III	4	Core	Basics of Computer Science	4	4	0	0	4
	III	5	Major Practical - I	Lab- 1: Lab in Basic Biology & Computer Science	2	0	0	2	2
	III	6	Allied - I	Introduction to Chemistry	4	4			4
	III	7	Allied Practical - I	Lab in Chemistry	2	0	0	2	2
	IV	8	Common	Environmental Studies	2	2	0	0	2
	Subtotal				**30**				**26**
II	I	9	Language	Tamil/Other Language	6	6	0	0	4
	II	10	Language	English	6	6	0	0	4
	III	11	Core	Molecular Biology	4	4	0	0	4
	III	12	Core	Programming in C	4	4	0	0	4
	III	13	Major Practical - II	Lab- 2: Lab in Molecular Biology & Programming in C	2	0	0	2	2
	III	14	Allied - II	Biophysics	4	4	0	0	4
	III	15	Allied Practical - II	Lab in Biophysics	2	0	0	2	2
	IV	16	Common	Value Based Education/ சமூக ஒழுக்கங்களும் பண்பாட்டு விழுமியங்களும்/ Social Harmony	2	2	0	0	2
	Subtotal				**30**				**26**

REGULATIONS - B.Sc. BIOINFORMATICS

Aim of the course: The course of B.Sc. (Bioinformatics) aims to introduce to the students the field of science in which biology, computer science, and information technology merge into a single discipline to analyses biological information using computers and statistical techniques. At the end of the course, the students are expected to have good knowledge in mathematics, statistics and computer science and also will gain knowledge in bioinformatics databases, tools and software in sequence alignment, phylogenetic analysis and protein structure prediction.

Eligibility for admission: Candidates for the admission to degree of B.Sc. Bioinformatics shall be required to have passed HSc., CBSE / equivalent examination with biology or computer science or mathematics as one of the subjects of study or an examination accepted as equivalent to there and 45% percentage of marks in aggregate, subject to such conditions as may be prescribed there for.

Lateral Entry: Not applicable.

Duration of the course: The course shall be of three year's duration spread over six semesters. The maximum duration to complete the course shall be Five years.

Eligibility for admission to examination: 75% of attendance will be required for admission to examination.

Medium: The medium of instruction shall be English.

Passing Minimum: Passing eligibility & classification for the award of the degree is as follows:

Passing eligibility: During the time of course the students have to score minimum 40% of marks in all the subjects including practical.

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FUNDAMENTALS OF BIOLOGY

UNIT-I

Introduction to cells: Cell as unit of life- Structure of prokaryotic and eukaryotic cells. Cell organelles (Mitochondria, chloroplasts, ER, Golgi, ribosomes, lysosomes and peroxysomes, nucleus and nucleolus) and their functions. Differences and similarities between plant and animal cells.

UNIT-II Cell transport: Cell transport across plasma membrane. Mechanisms of transport. Cell reproduction, cell cycle, Check points, Mitosis and Meiosis.

UNIT-III Cell Energetics: Aerobic oxidation and photosynthesis, Utilization of glucose, Role of ATP in energy cycle- Phosphorylation (oxdative & photo phosphorilations); glycolysis, TCA cycle, Urea cycle & Fatty acid metabolism.

UNIT-IV Taxonomic classification of Plant: Introduction-Definition and basic concepts of biosystematics and taxonomy. Plant identification – Plant ecology - Plant classification(Bentham and Hooker's) Cytotaxonomy – Chaemotaxonomy – Numerical Taxonomy – Nomenclature.

UNIT-V Taxonomic classification of animals. Animal classification –Animal kingdom – Kingdom, phylum, Class, order, family, Genus, species- Importance and application of taxonomic classification.

TEXT BOOKS:

1. Biology by Martha R. Taylor, Neil A. Campbell, Jane B. Reece, 2007, Pearson/Benjamin Cummings.
2. Biological science-D.J.Taylor, N.P.O.Green, G.W.Stout, III-Edition Cambridge University press, New Delhi, 2007.

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BASICS OF COMPUTER SCIENCE

UNIT – I Computer Organization: Fundamentals of computers – Block diagram of computer (input and output devices) – History - Generations – Memory devices – Advantages, Limitations and Applications of Computers.

UNIT – II Operating System Concepts: Definition – Architecture – Functions and Services of operating system– Different types of operating system – Single user OS, Multi user OS, Multiprocessing OS, Multitasking OS & Real Time OS. Comparison of Client Server & Peer to peer OS.

UNIT – III Number Systems: Non – positional and Positional number system – converting from one number system to another – Fractional numbers. Computer Codes: BCD, EBCDIC, ASCII, Unicode.

UNIT – IV Information system and data storage system: Data – Information –Qualities of information –Data processing cycle – Types of data processing – Data processing system, Data storage system: Files - File organization-DBMS Advantage.

UNIT –V Network & Internet Technologies : Network – Different types - Internet definition – Brief History - Services – Internet Terminologies (WWW, web page, website, web browser, Domain name, HTML, HTTP, TCP/IP , URL, search engine) – Web browsers – Uses of Internet.

TEXT BOOKS:

1. Computer Fundamentals – Fourth Edition – Pradeep K. Sinha , Priti Sinha, BPB Publication-2007. 2. Basic Computer Skills made easy, by Sherman, J., 2001 Butterworth-Heinemann Ltd, USA

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LAB IN BASIC BIOLOGY and COMPUTER SCIENCE

Lab: Basic Biology

1. Identification of mitotic stages using Onion root tip.
2. Study of meiotic stage using pollen grains.
3. Isolation of Proteins (Caesin from Milk/ bacterial proteins/ plant proteins).
4. Estimation of chlorophyll pigments.
5. Paper chromatography.
6. Thin layer Chromatography.
7. Cell counting using Haemocytometer.

Lab: Computer Science

1. Command line interface – Basic DOS commands – Create and delete directories – View the contents of a directory – Renaming a directory – Changing directory.
2. Changing drives – Copying files – Copying a group of files – Renaming files – Deleting files – Viewing files – Formatting a disc.
3. Component of a GUI – Desktop operation – Shutdown operation – Taskbar operation – Opening a program – Finding files – locating most recent files – using windows explorer – moving/copying files to different folders – Renaming a file or folder.Copying files into CD.
4. Word processing, Spreadsheet, Presentation.
5. Searching online databases. Eg. Pubmed.

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INTRODUCTION TO CHEMISTRY

UNIT – I Physical chemistry: Introduction to physical chemistry: The nature of gaseous state: States of matter -gas, liquid, solid. Gas laws – Boyle's law, Charles law, Gay- Lussac's law, Avogadro's hypothesis. Dalton's law of Partial Pressure, Graham's law – Combined gas law – ideal gas – Kinetic theory of gases – Deviations from the ideal gas law – van der Waals equation – real gases.

UNIT – II Colloids: Definition, Classification, formation and properties of colloids – Dialysis and Ultrafiltration; Chemical energy: Heat of reaction – Definition, endothermic and exothermic reactions – Hess' law. First law of thermodynamics; Chemical equilibira: Arrhenius theory, ionization of water, ionic product of water, pH, pOH, pK – Bronsted-Lowry theory of acids and bases, acid-bases indicators.

UNIT – III Inorganic Chemistry: Atomic structure – Discovery of the sub-atomic particles: electrons, protons, neutrons; Radioactivity – Becquerel and Curies, types of radiation. Determination of nucleus of atom, isotopes, Bohr theory; quantum numbers – n,l,m and s; electronic configurations- orbital designations – s,p,d,f orbitals. Shapes of s and p orbitals.

UNIT – IV Types of chemical bonds: Ionic bonding – Covalent bonding- Orbital hybridization (Sp3, Sp2, Sp1 only) – Multiple valency – electro negativities and electron affinities – Geometry of simple covalent compounds – coordinate covalent bonds.

UNIT – V Crystallography: Solids (Crystalline & Amorphous) – Unit cell – Characteristic parameters – Body centered cubic structure (eg. CsCl) – Face centered cubic structure (eg. NaCl)

TEXT BOOKS:

1. G.S.Manku, Theoretical Principles of Inorganic Chemistry, McGraw-Hill Education, New Delhi-1982.
2. J.D.Lee. Concise Inorganic Chemistry, 5th Edition., Blackwell Science Ltd, Oxford, 2002.
3. J.E.Spice, Chemical bonding and structure, MacMillan, London 1964.
4. M.J.Winter, Chemical bonding, 1996, Oxford University Press

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Lab in Chemistry

1. Acidimetry and alkalimetry a) Strong aciod vs strong base b) Weak acid vs strong base

2. Permanganimetry a) Estimation of ferrous sulphate b) Estimation of oxalic acid

3. Iodometry a) Estimation of copper b) Estimation of potassium dichromate c) Estimation of potassium permanganate

4. Gravimetric analysis – Soluble carbonate.

5. Preparation of Buffer and pH determination, pKa & PI determinations.

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Molecular Biology

Unit I: DNA as a genetic material : Griffths transformation, forms of DNA & RNA, types of restriction enzymes. Structure, properties and function; DNA, forms; RNA: tRNA & mRNA, Organization of Genomes – Viral, Bacterial. Eukaryotic genomes: Chromosomal organization and structure. Euchromatin, eterochromatin, centromere, telomere. Chromatin structure (nucleosomes) – histone, non-histone proteins.

Unit II: Definition of gene – introns/exons, Regulatory sequences, promoters, enhancers. DNA replication. Experiments of Messelson and stahl, okazaki, Rollong circle model, Prokaryotic and Eukaryotic DNA replication. Enzymes and accessory proteins involved in DNA replication. C-value paradox.

Unit III: Genetic Code: Characteristic features of the Genetic code. Transcription and translation in prokaryotes & eukaryotes. Mutations in genetic code.

Unit IV: Regulation of gene expression: positive and negative control – operon concept, TVP. Operon-Control-catabolic repression. Bacterial transformation.

Unit V: Genetic code, Molecular events of protein synthesis in prokaryotes and Eukaryotes. Regulation of protein sunthesis. Genomics, Proteomics – Gene pool & Gene library – with definition and concept only. Post-transnational modifications and transport of proteins.

REFERENCES:

1. Freifelder, D and Malcinski, G.M, 1993 Essentials of Molecular Biology, II ED, Jones, Bartlett, Publishers Inc, London.
2. J.D. Watson *et al.,* 1987 Molecular Biology of the Gene, 4th ed, The Benjamin/Cummings Publ. California.
3. Benjamin Lewin, 2002. Gene VII. Oxford University Press, USA; 7th edition
4. Maniatis *et al.,* 2000. Molecular Cloning : a laboratory Manual. Cold Spring, Harlor Laboratory Press, NY.
5. R.A. Meyers, 1995. Molecular Biology & Biotechnology – A comprehensive desk references. VCH Publishers NY.
6. Gerald Karp, 1996. Cell and Molecual Biology. John Wiley NY.
7. Benjamin Lewin. 2003 Genes VIII. Benjamin Cummings; United States ed edition
8. T.A. Brown. 2002 Genome 2. Garland Science; 2nd edition

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Programming in C

Unit I: History of C – Character Set –Keywords and Identifiers – Constants and Variables – Data Types – Declaration of Variables – Declaration of Storage Class – Defining Symbolic Constants – Declaring Variables as Constant

Unit II: Operators – arithmetic, unary, relational, logical, assignment, conditional, bitwise and special operators - Type Conversions in Expressions - Hierarchy of operators - Input and output statements - character, string and Formatted input and output - Arrays – one- , two- and multi-dimensional arrays - character arrays and strings comparison of strings – mathematical and string library functions.

Unit III: Control Statements in C – Branching Statements if-else, Switch-case, and goto - Looping statements while, do while and for statements

Unit IV: User Defined Functions in C - Defining and Accessing Functions - Passing Arguments – Function prototypes – scope and visibility of variables.

Unit V: Defining and Opening a File – Closing a File – Input/Output Operations on Files – Error Handling During I/O Operations.

REFERENCES:

1. S. Parthasarathy, Essentials of programming in C for Life Sciences, Second Edition, Ane Books India, New Delhi, 2011.

2. E.Balagurusamy, *Programming in ANSI C*, Fourth Edition, Tata McGraw-Hill Publishing Company Limited, 2002.

3. Byron S. Gottfried, *Schaum's Outline of Programming with C*, McGraw-Hill Publications. 1996.

4. Herbert Schidlt, *The Complete Reference C*, Fourth Edition, Tata McGraw-Hill Publishing Company Limited.

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Lab in Molecular Biology and Programming in C

Lab: Molecular Biology

1. Preparation of acidic, basic and Neutral buffers.
2. Preparation of stock solutions and working solution - %, Molar, ppm, and normality.
3. Agarose gel Electrophoresis techniques.
4. PCR amplication – Demonstration
5. Blotting Techniques – Demonstration
6. DNA isolation – (a) Plamid from bacteria, (b) Genomic DNA from plant and animal tissues.
7. Preparation of Protein lysate in Non-denaturation and denaturation condition.
8. Non-denaturation and denaturation protein separation by Polyacrylamide gel.
9. Finding size of protein using SDS-PAGE.
10. Preparation of Competent Cell.

Lab: Programming in C

1. Compute the area and the circumference of the circle
2. Compute the volume of a cylinder and cone
3. Convert the given Fahrenheit value to centigrade scale (or vice versa)
4. Find the biggest of three given numbers using if-else statement
5. Find the molecular weight of a DNA with n base pairs in length
6. Find the sum of n natural numbers
7. Find the factorial of a given integer number
8. Find the pH of a solution given the concentration of H^+ (or) OH^- ions. Also print the nature of the solution based on the pH value using if-else statement.
9. Write a C Program to find sum of digits of a given number
10. Write a C program to arrange a series of numbers in ascending order
11. Arrange the given names in alphabetical order
12. Write a C Program to check whether a string is palindrome or not
13. Write a C Program to find Matrix Addition
14. Write a C Program to calculate nCr of given n and r value, using function
15. Write a C Program to copy contents from one file to another.

MSU/ 2017-18 / UG-Colleges / Part-III (B.Sc. Bioinformatics) / Semester –II / Allied - II

Biophysics

Unit I: Introduction to amino acids: nomenclature, structure, Properties. Property of water: vapour, liquid and solid, important of H-bond, types of bonds, bond length, bond angle, torsion angle.

Unit II: Peptide bond information, Structure of peptide unit, dipeptide structure, Ramachandran's contact criteria, Ramachandran plot, polypeptide structure, stabilizing force in Biomolecular structure.

Unit III: Primary structure of a protein, Secondary structure of a protein (α – helix, β - strand, β-turn), tertiary structure of protein. Functional property of Protein with antibody as example. Protein stability and denaturation and structural change of protein due to mutation with example of Haemoglobin

Unit IV: Nucleic acid structure, Structural elucidation of DNA double helix, Stabilizing force in DNA double helix, radiation effect of DNA. Different structure of DNA.

Unit V: Enzymes – Definition, Nomenclature, Classification of enzymes, Properties of enzymes, specificity of enzymes, Structure and function of enzymes. Units of enzyme activity and turnover number, Kinetics and mechanism of enzyme action. Biological oxidation – Electron transport chain, Photophosphorylation. Photosynthesis.

REFERENCES:

1. Cell & Molecular Biology 1998, Roberties and Roberties K.M.Varghese Publication.

2. Cell and Molecular Biology 1996, Gerald Karp, Blackwell Pub. UK

3. Introduction to cell biology, 1998, Sundarajan, Vikas Pub.

4. Benjamin Lewin, 2002. Gene VII. Oxford University Press, USA; 7th edition

5. Principles of genetics, 1999, Gardner/Simmons/Shustad 8th edition.

6. Biochemistry, 1993, Lehinger J. CB.S. Publications

7. Biochemistry, 1995, D.Voet and JG Voet. John Wiley & Sons. Inc 2 Ed.

8. Fundamentals of Biochemistry, 2000, Jain J.L. chand & co, New Delhi.

9. Biochemistry, 1999. Davidson, V.L. & Sitlmon, D.L., 4th ed. Lippincoth Wiliam & Willeing.

MSU/ 2017-18 / UG-Colleges / Part-III (B.Sc. Bioinformatics) / Semester –II / Allied Practical - II

Lab in Biophysics

1. Calculation of Moles, Millimoles, Micromoles and nanomoles.
2. Estimation of Free amino acids.
3. Estimation of protein.
4. Estimation of blood sugar.
5. Estimation of Glycogen
6. Estimation of Lipid.
7. Estimation of Nucleic acid
8. Qualitative tests for Carbohydrate, Protein and Lipid.
9. Effects of substrate concentration, pH, Temperature on the activity of any enzyme.