

**OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR
B. Sc. (Hons.) BIOINFORMATICS**

SEMESTER – V (SESSION: 2017-2018)

Paper Code	Lectures/week (Th+Prac)	Name of paper	Theory	Practical
BIN-5001	6+3	Internet Programming	75(60+15)	BIN-5051 25 (20+5)
BIN-5002	6+3	Fundamentals of Genomics	75(60+15)	BIN-5052 25 (20+5)
BIN-5003	6+3	Biosafety and IPR	75(60+15)	BIN-5053 25 (20+5)
BIN-5004	6+3	Genetics and Evolution	75(60+15)	BIN-5054 25 (20+5)
BIN-5005	6+3	Molecular Modeling and Computer Aided Drug Design	75(60+15)	BIN-5055 25 (20+5)
	Total Marks (Semester –V)		375	125

BIN-5001 INTERNET PROGRAMMING

Theory	: 60
Int. ass.	: 15
Time	: 3 Hours

Objective: *To explain Internet Programming concepts and related programming and scripting languages. To describe basic Internet Protocols. Explain JAVA and HTML tools for Internet programming. Describe scripting languages – Java Script. Explain dynamic HTML programming.*

General Instruction

- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT- I

Internet and WWW: Introduction to internet and its applications, Internet service providers, domain name server, internet address. World Wide Web and its evolution, uniform resource locator (URL). Introduction to Web servers & Proxy server, HTTP protocol.

HTML and Common tags: Document Structure Tags, Formatting Tags, Text Level formatting, Block Level formatting; Lists: ordered list Unordered List, definition List; Anchor tag, Hyperlink tags, Absolute and relative path, Tables and its attributes, Image and Image maps; Frames: Frame Tag, Nesting Frame Tag, Targeting named frames, creating floating frames, Using Hidden frames; Forms: Form Elements, Form Attributes – Action Attribute, Method Attribute, Name Attribute; Form Input Types and Input Restrictions; Form Input Attributes.

DHTML: Moving elements and Images, changing colors and hiding elements, moving between layers, mouse rollovers, Difference between HTML and DHTML.

STYLE SHEETS: Cascading style sheet, Different approaches to style sheets, Using Multiple approaches, Linking to style information in separate file using the <LINK> tag, embedded style information, Using <STYLE> tag, Cascading Order.

UNIT- II

Java Scripts: Introduction Benefits of java script, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security, Editing java scripts Displaying information, Alerls(), Prompts(), confirm box, Operators; **Statements:** Conditional Statements, Conditional loops; Functions, Arrays, Objects-math, string, date, Boolean, number, document, windows, regExp. **Document and its Associated Objects:** Document, Link, Area, Anchor, Image, Applet, Layer Events.

DHTML with java script, Object model collection, events in java script, filters and transitions-Flip filter, Image mask, shadow filter, alpha filter, Blur filter.

Event Handlers: General Information about Events, Defining Event Handlers, event, onAbort, onBlur, onChange, onClick, onDbClick, onDragDrop, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onMove, onReset, onResize, onSelect, onSubmit, onUnload

Recommended books:

1. Web Design The complete Reference, Thomas Powell, Tata McGrawHill
2. HTML and XHTML The complete Reference, Thomas Powell, Tata McGrawHill
3. JavaScript 2.0 : The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider
4. JavaScript: The Definitive Guide, David Flanagan, O'Reilly.
5. Beginning web programming HTML, XHTML and CSS, Duckett John, Wiley.

BIN-5051 INTERNET PROGRAMMING (PRACTICAL)

1. Design a web page using different text formatting tags.
2. Design a web page with links to different pages and allow navigation between pages.
3. Design a web page with Imagemaps.
4. Design a web page with different tables.
5. Design a webpage using frames.
6. Design a website using style sheets so that the pages have uniform style.
7. Using Java Script design a web page that prints factorial / Fibonacci series / any given series.
8. Design a form with a test box and a command button. Using Java Script write a program whether the number entered in the text box is a prime number or not.
9. Design a form and validate all the controls placed on the form using Java Script.

BIN-5002 FUNDAMENTALS OF GENOMICS

Theory : 60
Int. Ass. : 15
Teaching Hours : 60

Objective

The fundamentals of genomics dealing with gene structures and elements are covered.

General Instruction

- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT I

Human Genome as a model: History of Genome sequencing project. The human Genome project. Organization of the Human genome.

The human genome sequence: annotation – Repeats, coding regions, non-coding regions. Genome sizes. Genome Annotation. Single Nucleotide Polymorphisms (SNPs)

DNA sequencing methods – manual & automated: Maxam and Gilbert and Sangers method. Chain termination method, Pyrosequencing

Next Generation Sequencing: Principle and Applications of Solexa, 454.

UNIT II

Genome Sequencing methods: Shotgun & Hierarchical (clone contig) sequencing, Computer tools for sequencing projects: Genome sequence assembly- De novo and Reference assembly, Genome assembly software.

Managing and Distributing Genome Data: Web based servers and softwares for genome analysis: ENSEMBL, VISTA, UCSC Genome Browser, NCBI genome. Selected Model Organismal Genomes and Databases.

Recommended books:

1. Setubal Joao and Meidanis Joao. Introduction to Computational Molecular Biology, PWS Publishing Company (An International Thomson Publishing Company), 1997 Indian low priced edition
2. David Mount, Bioinformatics, Cold Spring Harbor Laboratory, 2009.
3. Genomics: The science and Technology behind the Human Genome Project (2000). Edited by C.Cantor and C.L Smith, Wiley-Inter science, NY.
4. Genome Mapping – A Practical Approach by P.H. Dear, Oxford University Press, Oxford, 1997
5. Principles of Genome analysis and Genomes by Primrose & Twyman. 3rd Edition, Blackwell Publishers (2002).
6. Post-Genomic Informatics by M. Kanehisa, Oxford University Press, (2001).

BIN 5052 FUNDAMENTALS OF GENOMICS (PRACTICAL)

Max. Marks 25 (20+5)

1. Use of SNP databases (dbSNP)
2. Use of OMIM database
3. Using ENSEMBL, NCBI Genome
4. Detection of Open Reading Frames using ORF Finder
5. Use of Saccharomyces Genome Database (SGD)

Theory	: 60
Int. ass.	: 15
Time	: 3 Hours

Objective:

General Instruction

- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT I

Biosafety: Biosafety and risk assessment issues; Regulatory framework; National biosafety policies and law, The Cartagena protocol on biosafety, WTO and other international agreements related to biosafety.

General principles for the laboratory and environmental biosafety.

Biosafety from GMOs and LMOs: Procedures for GMOs intended for direct use-risk assessment-risk management-handling, transport, packaging and identification of GMOs - Biosafety Clearing House unintentional trans-boundary movement of GMOs.

UNIT II

IPR: Meaning, need of IPR, Relevance, Protection of Intellectual Property, International treaties for protection of IP – Bern, Paris, TRIPS, WIPO treaties, Biodiversity convention, etc

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright and Geographical Indications.

Process of Patenting and Development: Technological Research, Innovation, Patenting, Development, International Cooperation on Intellectual Property, Procedure For Grants of Patents, Patenting Under Pct, Scope of Patent Rights, Licensing and Transfer of Technology.

Patent information and databases.

Recommended books:

1. Sasson, A. (1988) “Biotechnologies and Development”, UNESCO Publications
2. Sasson, A. (1993) “Biotechnologies in developing countries present and future”; UNESCO Publishers
3. Singh, K. “Intellectual Property Rights on Biotechnology”; BCIL, New Delhi 4. Halbert, (2007) “Resisting Intellectual Property” Taylor & Francis Ltd
5. Ramappa T., “Intellectual Property Rights Under WTO”, S. Chand
6. IPR, Biosafety and Bioethics by Deepa Goel and Shomini Parash.

BIN 5053 BIOSAFETY AND IPR (PRACTICAL)

Max. Marks 25 (20+5)

1. Exploring Patent Databases:
 - a. PATENTSCOPE
 - b. EPO
 - c. InPASS
2. Proxy filing:
 - a. Proxy filing of Indian Product patent
 - b. Proxy filing of Indian process patent

BIN-5004

GENETICS AND EVOLUTION

Theory : 60
Int. Ass. : 15
Time : 3 Hours

Objective

Introduction to the Principles of genetics will help students to acknowledge the phenomena which results in gene diversity and evolution.

General Instruction

- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT I

Introduction: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance.

Mendelian Genetics: Mendel's experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses, Chromosomal theory of inheritance

Allelic interactions: Incomplete dominance, co-dominance, semi-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity.

Non allelic interactions: Interaction producing new phenotype complementary genes, epistasis (dominant & recessive), duplicate genes and inhibitory genes.

Genetic organization of prokaryotic, eukaryote and viral genome.

UNIT II

Chromosome Morphology: Concept of euchromatin and heterochromatin. packaging of DNA molecule into chromosomes, chromosome banding pattern, karyotype, giant chromosomes.

Chromosome and gene mutations: Definition and types of mutations, causes of mutations, Ames test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants.

Variations in Chromosomes Structure: deletion, duplication, inversion and translocation.

Evolution and population genetics: In breeding and out breeding, Hardy Weinberg law (prediction, derivation), allelic and genotype frequencies, changes in allelic frequencies, evolutionary genetics, natural selection.

Recommended books:

1. Principles of Genetics by Gardner E.J, Simmons M.J, Slustard DP, Eighth edition, John Wiley & Sons, (1991).
2. Genetics by Strickberger, Third edition, Prentice Hall, (2002).
3. Genetics by P. Weaver and R. Hedrick, 3rd. edition, McGraw Hill Publishers, (2002).
4. Genetics – Analysis of Genes and Genomes D.L. Hartl & E.W. Jones, Jones and Bartlett Publication, 6th Edition, (2008)
5. Biology by Neil A. Campbell, Jane B. Reece, Published by Benjamin Cummings Co. Sixth Edition (2004)

BIN-5054 GENETICS AND EVOLUTION (PRACTICAL)

Max Marks :25 (20+5)

1. Demonstration of Law of Segregation (use of coloured beads)
2. Demonstration of Law of Independent assortment (use of coloured beads)
3. Calculation of variance in respect of pod length and numbers of seeds/pods.
4. Calculation of gene frequencies (use of coloured beads)
5. Numerical based on Gene Interactions

BIN-5005 MOLECULAR MODELING AND COMPUTER AIDED DRUG DESIGN

Theory	: 60
Int. ass.	: 15
Time	: 3 Hours

Objective:

To understand the basic concepts of molecular modeling and computational approaches of drug design.

General Instruction

- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT – I

Introduction to Chemoinformatics: Aim & Scope. Role of Chemoinformatics in pharmaceutical/chemical research

Chemical Structure representation: 1D, 2D and 3D structures representation using ChemSketch.

Molecular file formats: (SMILES, SDF, and MOL)

Introduction to Molecular Modeling: Molecular Structure and Internal Energy, Molecular Graphics, Coordinate Systems, Understanding Concept of Potential Energy Surface, Local and Global Energy Minima.

Concepts of Molecular Mechanics: Molecular Mechanics Force Field, Bond Stretching, Angle Bending, Torsional Terms, Non-Bonded Interactions; Energy Minimization Methods; Introduction to Molecular Dynamics Simulation and its Applications; Molecular Docking and Scoring.

UNIT – II

Introduction to Drug Designing and Discovery: An Overview of Drug Development Process, High Throughput Screening; Concept of Therapeutic Drug Targets, Hits, Leads and Drugs.

Computer Aided Drug Design: Chemical Databases, Basic Concepts of ADME (Absorption, Distribution, Metabolism and Excretion) in reference to Drug Handling by the body, Lipinski's rule of five, Structure Based Drug Design – Active Site Prediction, Protein-Ligand Interactions, Virtual Screening. Difference between Structure Based and Ligand Based Drug Designing.

QSAR: Introduction to QSAR, Basic Principle & Applications of 2D and 3D QSAR. Concept of Molecular Descriptors (1D, 2D and 3D).

Recommended books:

1. R. Leach, molecular modeling principle & application, (2010) Pearson Education India.
2. Text book of drug designing and discovery (2002) by Povl Krogsgaard Larsen, Tommy Liljefors (CRC Press).
3. Burger's medicinal chemistry and drug discovery, 6 Volume Set, (2003) edited by Donald J. Abraham (John Wiley & Sons, Inc., New York).
4. Smith and Williams' Introduction to the Principles of Drug Design and Action, Fourth Edition: edited by H. John Smith, CRC Press.
5. An Introduction to Medicinal Chemistry by Graham L Patrick 2009 Oxford University press New Delhi.
6. Leach Andrew R., Valerie J. Gillet. An introduction to chemoinformatics. Publisher: Kluwer academic, 2003. ISBN: 1402013477.

**BIN-5055 MOLECULAR MODELING AND COMPUTER AIDED DRUG DESIGN
(PRACTICAL)**

Max Marks 25 (20+5)

1. Chemical structure representation and storage in SMILES file formats
2. Structure representations of Carbohydrates and Amino Acids using ChemSketch
3. Exploring Therapeutic Drug Targets Database (PDTD)
4. Exploring Database of Chemical Compounds
5. Protein-Ligand Docking