

Curriculum Framework

For

B.Sc. Biotechnology

(2022-23)



Date of BoS: 23/12/2022 (Friday)

Based on National Education Policy- 2020

DEPARTMENT OF BIOTECHNOLOGY

Doctor Harisingh Gour Vishwavidyalaya

(A Central University)

Sagar- Madhya Pradesh-470003

Department of Biotechnology
Dr. Harisingh Gour Vishwavidyalaya (A Central University)
Sagar (M.P.) 470003

1. Name of the Program : **B.Sc. Biotechnology**

2. Duration of the program:

(a) Minimum duration : 03 Years

(b) Maximum duration: 05 Years

3. Scheme of examination

(a) Mid Semester Examination : 20 Marks

(b) Internal Assessment : 20 Marks

(c) End Semester Examination : 60 Marks

4. Assessment:

1) Mid Semester Examination : Mid semester examination is composed of theory examination of 20 Marks including the objective type questions (6 marks), Small answer type questions (6 marks) and long answer type questions (8 marks).

Each mid semester examination also includes the practical examination also of 20 marks.

2) Internal Assessment:

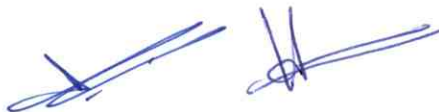
a) Theory

Each theory course must clearly mention the methodology of assessment i.e. written examination, written assignment, presentation, group discussion etc. depending on the number of students in the class and feasibility of adopting a particular methodology. The distribution of marks of internal assessments shall be as follows:

b). Practical: Practical examination will be conducted as per progress basis.

(i) Evaluation of the assignment

Presentation, group discussion etc. : 15 marks



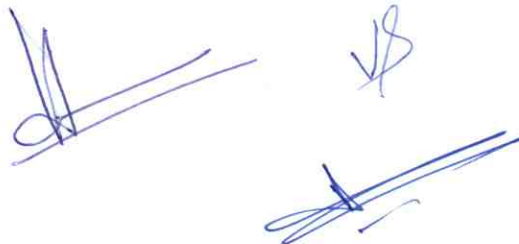
(ii) Attendance : 05 marks

The marks for attendance shall be awarded as follows:

- | | | |
|-------|-------------------|------------|
| (i) | 75% and below | : 00 Mark |
| (ii) | >75% and upto 80% | : 01 Mark |
| (iii) | >80% and upto 85% | : 02 Marks |
| (iv) | >85% and upto 90% | : 03 Marks |
| (v) | >90% and upto 95% | : 04 Marks |
| (vi) | >95% | :05 Marks |

3) End semester examination: Same in proportion of marks as of first Mid examination.

Note: To be eligible to appear in End Semester Examination a student must appear in Mid Semester Examination and Internal Assessment.



b) Practical/Lab Courses:

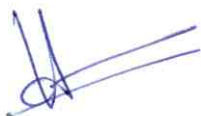
1. Evaluation of Practical/Lab Courses shall be as follows:

- (i) Performing and getting the experiment checked regularly and
Incorporating the suggestions in the practical note book : 15 Marks
- (ii) Attendance : 05 Marks

c) End Semester Examination for practical/Lab Courses:

It will consist of 60 marks as follows:

- (a) Assessment of performance in the Experiment : 50 Marks
- (b) Viva-Voce of Experiment : 10 Marks



Under Graduate Curriculum Framework

B.Sc. BIOTECHNOLOGY

Semeser-1

Nature of Course	Course code	Course title	Credit
Discipline Specific Major -I	BIT-DSM-111	Biochemistry (Th)	4
	BIT-DSM-112	Biochemistry (Pr)	2
Ability Enhancement Course	BIT-AEC-113	Environmental Biotechnology	2
Skill Enhancement Course	BIT-SEC-114	Fundamentals of Computers	2

Total= 10 Credit

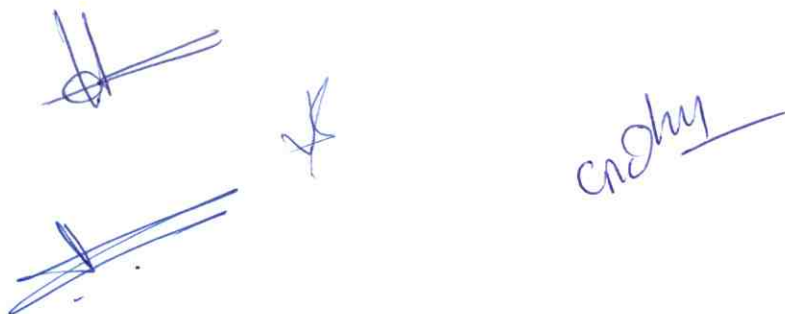
Semester-II

Nature of Course	Course code	Course title	Credit
Discipline Specific Major -I	BIT-DSM-211	Bioinstrumentation and Biostatistics (Th)	4
	BIT-DSM-212	Bioinstrumentation and Biostatistics (Pr)	2
Ability Enhancement Course	BIT-AEC-213	Food Biotechnology	2
Skill Enhancement Course	BIT-SEC-214	Basics of Bioinformatics	2

Total= 10 Credit

Note:

1. Skill development Course (SEC) courses will be flexible up to the limit 20% of the prescribed syllabus depending on the availability of the laboratory and experienced faculty in the respective college.
2. Practical courses will be flexible up to the limit 20% of the prescribed list of practical depending on the availability of the laboratory and experienced faculty in the respective college.

The block contains several handwritten marks in blue ink. On the left, there are two large, stylized signatures or initials. In the center, there is a small, simple mark resembling a cross or a star. On the right, there is a cursive signature that appears to read 'C. D. H. Y.'.

B.Sc. Ist Semester

Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	I	Discipline Specific Major –I BIT-DSM-111	Biochemistry (Theory)	Mid Sem 40 End Sem 60	04

Objectives: To build upon undergraduate level knowledge of biochemical principles with specific emphasis on different metabolic pathways.

Outcome: Students would be able to analyze and interpret various biomolecules, pathways of the cell and their significance in metabolism.

Unit1

12 hours

First and second laws of Thermodynamics. Definitions of Gibb's Free Energy, enthalpy, and Entropy and mathematical relationship among them, Standard free energy change and equilibrium constant.

Unit 2

12 hours

Biomolecules: configuration and conformation. Properties of water as biological solvent.

Carbohydrates: chemical structures, nature, properties, classification and importance in biological systems

Unit 3

12 hours

Amino acids: classification, properties, structure, nature. Proteins structure: primary, secondary, tertiary and quaternary structure, protein folding and function

Unit 4

12 hours

Lipids: structure, classification, properties and function. Cholesterol structure and function. Vitamins: fat-soluble and water-soluble; Nucleic acids: Bases, nucleosides and nucleotides, DNA& RNA structure,

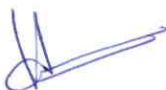
Unit 5

12 hour

Enzymes: Definitions of terms – enzyme unit, specific activity and turnover number; classification, characteristics, factors affecting enzyme activity. Enzyme kinetics, K_m & V_{max} , activation and inhibition of enzymes Multienzyme complex: lactate dehydrogenase, Effect of pH and temperature on enzyme activity. Enzyme inhibition: competitive, non-competitive.

Essential reading

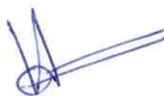
1. Lehninger's Principle of Biochemistry: DL Nelson & MM Cox
2. Biochemistry: Lubert Stryer
3. Text Book of Biochemistry: Devlin, Thomas M



4. Biochemistry: Geoffery, Zubay
5. Basic Biological Chemistry: Mahler and Cordes
6. Biochemistry: Keshav Trehan
7. Fundamental of Biochemistry: Dr.A.C. Deb

Suggested Reading:

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
1. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
- 2 MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGrawHill



Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	I	Discipline Specific Major –I BIT-DSM-112	Biochemistry (Practical)	Mid Sem 40 End Sem 60	02

Objective: To introduce and train students in various techniques used for biochemical analysis of biomolecules.

Outcomes: The students would be able to analyze biomolecules qualitatively and quantitatively.

60 Hours

List of Practical

1. Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts
2. Qualitative/Quantitative tests for carbohydrates, reducing sugars, non reducing sugars
3. Qualitative/Quantitative tests for lipids and proteins
4. Study of protein secondary and tertiary structures with the help of models
5. Study of enzyme kinetics – calculation of V_{max} , K_m , K_{cat} values
6. Estimation of any one vitamin

Essential Reading:

- 1) H. Miller, et al., Molecular Biology Techniques, Elsevier Academic Press, 2011, 3rd edition
- 2) W. Ream and K. G. Field, Molecular Biology Techniques: An Intensive Laboratory Course, Elsevier Academic Press, 1998, 1st edition
- 3) David Plummer, An Introduction to Practical Biochemistry, Tata McGraw Hill Education; 3rd edition (2006)

Suggested Reading:

- 1) M. R. Green and J. Sambrook, Molecular Cloning: A Laboratory Manual (3 Volumes), Cold Spring Harbor Laboratory Press, 2012, 4th edition

B.Sc. Ist Semester

Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	I	Ability Enhancement Course BIT-AEC-113	Environmental Biotechnology	Mid Sem 40 End Sem 60	02

Objective: The course will enable students to understand the importance of environment and waste management skills.

Outcome:

This course will help students to understand the cause of pollution and control measures, and also understand the concept of sustainable development, sustainability indicators, and ecosystem restoration.

Unit 1

06 hours

Basic concept of Ecosystem- types, structure and functions. Renewable and non- renewable resources, Conservation of Biodiversity, An idea of biosensors, biopolymers, bio plastic and biochips

Unit 2

06 hours

Wastewater management- Treatment of municipal waste and industrial effluents, Solid waste and soil pollution management- Management of non-hazardous solid waste and medical solid waste, Management of hazardous waste, Air pollution and its control

Unit 3

6 hours

Conventional fuels (Firewood, coal, gas, animal oils) and their environmental impact. Modern fuels- Methanogenic bacteria & biogas, microbial hydrogen production, solar energy. Plant based petroleum industry Biopesticides- Bacteria & Fungal Biofertilizers- Nitrogen fixers, PSB, Mycorrhiza & VAM; vermicomposting

Unit 4

6 hours

Bioabsorption of metals- microorganisms and metal, absorption; bacterial metal resistance; mechanism of bioabsorption; Phytoremediation Bioremediation- microorganisms in bioremediation; bioremediation technologies.

Unit 5

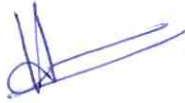
6 hours

Concept of biosafety in relation to Organism pathogenicity, Biological active biotechnology product, Release of GMOs to the environment, Genetic modification and food uses, Biosafety and recombinant DNA guidelines, Concept of GMP(Good manufacturing practices) & GLP (Good Laboratory practices)

Suggested readings:

1. Ritmann R and McCarty P L (2000). Environmental Biotechnology: Principle & Applications. 2nd Ed., McGraw Hill Science.
2. Thakur IS. (2011) Environmental Biotechnology basic concepts and applications. I.K. International Publishing House Pvt. Limited Srinivas TR (2008).

3. Environmental Biotechnology. New Age International Pvt. Ltd.
4. Evans GM and J. C. Furlong (2003). Environmental Biotechnology: Theory and Applications. Wiley Publishers.
5. Scragg A., (2005) Environmental Biotechnology. Pearson Education Limited.
6. Chapman JL Ecology: Principal & Application. Cambridge Univ. Press.
7. Odum E and Barret G. (2004) Fundamentals of Ecology. Nataraj Publication.



B.Sc. Ist Semester

Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	I	Skill Enhancement Course BIT-SEC-114	Fundamentals of Computers	Mid Sem 40 End Sem 60	02

Objectives: To introduce the students on various fundamental aspects of computer be used in the Biotechnology and other studies.

Outcome: The students would be able to understand the working behind the machine learning and basics language/ software of the computers.

Unit 1

History of development of computers, Generation of computers, Basic components of a computer, Input & Output devices, Classification of computers. Concept of computer languages- Introduction to basic concept of computer language, Importance of computer database in advance biological sciences

Unit 2

Computer Networking: Concepts, various configurations of a computer Network. Basic concepts of LAN, WAN, & MAN,

Unit 3

Microsoft office: MS-Word, MS-Excel, MS-Power Point, MS-Acces

Unit 4

Computer software- Operating system, Introduction to DOS and Windows, Introduction to scandisk, Defragmentation and Antivirus software, Prevention & cure of computer viruses and worms,

Unit 5

Binary representation of data algorithm and flow charts, Internet & its applications, Basic languages including C, C++, Python etc

Suggested readings:

Yashwant Kanitkar; Let us C: BPB publications 2017

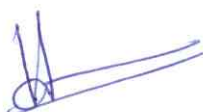
Hayes, J. P. Computer architecture and Organization; 3rd Edition MGH

Goyal A. Computer Fundamentals; Pearson



Semester-II

Nature of Course	Course code	Course title	Credit
Discipline Specific Major -I	BIT-DSM-211	Bioinstrumentation and Biostatistics (Th)	4
	BIT-DSM-212	Bioinstrumentation and Biostatistics (Pr)	2
Ability Enhancement Course	BIT-AEC-213	Food Biotechnology	2
Skill Enhancement Course	BIT-SEC-214	Basics of Bioinformatics	2



B.Sc. II Semester

Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	II	Discipline Specific Major -I BIT-DSM-211	Bioinstrumentation and Biostatistics (Theory)	Mid Sem 40 End Sem 60	04

Unit1: Microscopy

12 hours

light microscopy, bright & dark field microscopy, fluorescence microscopy, phase contrast microscopy, TEM, SEM

Unit 2: Spectroscopy

12 hours

Spectroscopy: Principle, types and instrumentation, (colorimeter, UV-Visible spectrophotometer, InfraRed spectrophotometer), NMR techniques- Basic principle and applications

Unit 3: Centrifugation and Chromatography techniques

12 hours

Centrifugation – Basic principle of centrifugation, RCF and sedimentation coefficient, types and application; Separation & identification of biomolecules - concept of chromatography their types and applications

Unit 4: Molecular Biology techniques

12 hours

Tools and Techniques of plasmids and genomic DNA isolation, Electrophoresis- Principle, method and application, Hybridization techniques: northern, southern, western Blotting techniques; Sequencing methods; enzymatic DNA sequencing; chemical sequencing of DNA

Unit 5: Biostatistics

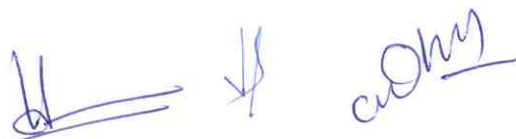
12 hours

Introduction and definition of biostatistics, tabulation and classification of data, frequency distribution and graphical distribution of data, Measures of central tendencies, mean, median, mode and their properties, measure of dispersion: mean deviation, variance, coefficient of variance and standard deviation, Concepts and problems on probability: probability distribution function, binomial distribution

Essential Reading:

1. Biochemical Techniques theory and practice: White R
2. Analytical Chemistry: Christion GD
3. An Introduction to Practical Biochemistry: Plummer DT
4. Undergraduate Instrumental Analysis: Robinsan, JW
5. Biophysical chemistry: Upadhya and Nath
6. Principles of Biostatistics: Mishra BN and Mishra SN

Suggested Reading:



- 1) K. Wilson and J. Walker, Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, 2013.
- 2) B Sivasankar, Instrumental Methods of Analysis, Oxford University Press, 2012
- 3) B. Williams and S. Sawyer, using information technology: a practical introduction to computers & communications, McGraw Hill Education, 2005, 6th edition
- 4) R. Greenlaw, online/online: fundamentals of the internet & the World Wide Web, McGraw Hill Education, 2005, 2nd edition

Pawan K Dhar

(Pawan K Dhar)
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B.Sc. II Semester

Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	II	Discipline Specific Major -I BIT-DSM-212	Bioinstrumentation and Biostatistics (Practical)	Mid Sem 40 End Sem 60	02

60 Hours

List of Practical

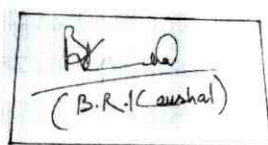
1. Isolation of Plasmid, Genomic DNA and Electrophoresis of isolated Nucleic acid- Method and protocol
2. Visualization of cells, tissues etc using different microscopy with basic principle
3. Application of Centrifugation in the laboratory with experimental protocol of isolation of biomolecules
4. Application of UV-VIS spectrophotometer in the laboratory with any choice of experiments
5. Study of enzyme kinetics – calculation of V_{max} , K_m , K_{cat} values
6. Estimation of any one vitamin

Suggested reading:

- 1) B. Williams and S. Sawyer, using information technology: a practical introduction to computers & communications, McGraw Hill Education, 2005, 6th edition
- 2) R. Greenlaw, inline/online: fundamentals of the internet & the World Wide Web, McGraw Hill Education, 2005, 2nd edition



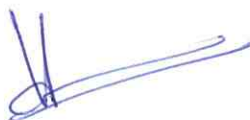
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B.Sc. II Semester

Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	II	Ability Enhancement Course BIT-AEC-213	Food Biotechnology	Mid Sem 40 End Sem 60	02

Course objective: Students will understand the concepts of food biotechnology and would be able to relate the role of biotechnology in the food industry.

Learning outcome: Students will understand the concepts regarding, food components, preservation, fermentation, spoilage and microbes involved in fermentation and spoilage

Unit 1: 06 Hours

Introduction to Food Biotechnology, Historical Background of Food technology, Traditional fermented foods (meat, fish, bread, sauerkraut, soy bean, coffee, cocoa, tea), codex guidelines, nutritional labeling in India, FSSAI guidelines, Functional foods and their importance.

Unit 2 06 Hours

Enzymes in Food Industry: Carbohydrases, Proteasase, Lipases, Modification of food using enzymes, Role of endogenous enzymes in food quality, Enzymes use as processing aid and ingredients

Unit 3 06 Hours

Food Fermentations: Common fermented foods - Cheese, Butter, Yoghurt, fermented/condensed milk and kefir. Alcoholic beverages (Beer, Wine, Whisky), Pickles, Soy products, Tea, coffee etc.

Unit 4 06 Hours

Food preservation: Food adulteration and prevailing food standards in India. Source of microorganisms in milk and their types, Microbiological examination of milk (standard plate count, direct microscopic count, reductase and phosphatase test), Dehydration and pasteurization of milk.

Unit 5 06 Hours

Value addition products: Value addition products like High Fructose Syrup, Invert Sugars etc. SCPs (e.g. Spirulina, Yeast etc.) as food supplements, Edible fungus: Mushrooms. Potential of Probiotics. Organic acids (Citric acid, Acetic acid) and their uses in foods/food products

Suggested Reading:

1. Ray B and Bhunia A. 2008. Fundamental Food Microbiology, 4th Ed., CRC press,
2. Suggested Books Martin RA and Maurice OM. 2008. Food Microbiology, 3rd Ed., The Royal Society, Taylor and Francis Group, USA.



3. James M J. 2000. Modern Food Microbiology, 6th Ed. Aspen Publishers, Inc., of Chemistry, Cambridge, UK. 4. Frazier WC, and Westhoff DC. Food Microbiology. Fourth edition, MacGraw Hills Gaithersburg, Maryland, USA. publication

B.Sc. II Semester

Department of Biotechnology						
Class	Subject	Semester	Course Code	Course Title	Marks	Credit
B.Sc.	Biotechnology	II	Skill Enhancement Course BIT-AEC-213	Basics of Bioinformatics	Mid Sem 40 End Sem 60	02

Objectives: To provide students with the theory and practical experience of various bioinformatics tools used in the Biotechnology and also the use of common computational tools and databases which facilitate investigation in modern area of biology.

Outcomes: The student would be able to use various tools of the bioinformatics.

Unit 1

What is Bioinformatics and its relation with molecular biology Examples of related tools(FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pubmed, PDB) and software(RASMOL ,Ligand Explorer)

Unit 2

Biological Database and its Types, Introduction to data types and Source. Population and sample, Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Database., Use of statistics in solving biological problems.

Unit 3

Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary), Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum).

Unit 4

Sequence Alignments and Visualization, Introduction to Sequences, alignments and Dynamic Programming, Local alignment and Global alignment

Unit 5

Gene Expression and Representation of patterns and relationship, General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites.

Essential Reading:

- 1) Sharma, Munjal and Shanker, Text book of Bioinformatics: Rastogi publisher, India 2017
- 2 Attood, Parry-Smith and Phukan, Introduction to Bioinformatics, Fourth edition, Pearson Publisher

Suggested Reading:

- 1) B. Williams and S. Sawyer, using information technology: a practical introduction to computers & communications, McGraw Hill Education, 2005, 6th edition

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