



List of Revised Courses

Department : Biotechnology

Program Name : B.Sc. Ph.D.

Academic Year : 2018-2019

List of Revised Courses

Sr. No.	Course Code	Name of the Course
1.	LS/BT/C-101L	Cell Biology(core-1)
2.	LS/BT/C-101P	Laboratory-1 based on core-1
3.	LS/BT/C-102L	Biochemistry and Metabolism(core-2)
4.	LS/BT/C-102P	Laboratory-2 based on core-2
5.	LS/BT/GE-101/B&B-L	Bioethics and Biosafety(GE-1)
6.	LS/BT/GE-101/B&B-P	Laboratory-GE1 based on GE-1
7.	ECA	ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others
8.	LS/BT/C-203L	General Microbiology(core-3)
9.	LS/BT/C-203P	Laboratory-3 based on core-3
10.	LS/BT/C-204L	Genetics(core-4)
11.	LS/BT/C-204P	Laboratory-4 based on core-4
12.	LS/BT/GE-202/B &HW-L	Biotechnology and Human Welfare(GE-2)
13.	LS/BT/GE-202/B&HW-P	Laboratory-GE2 based on GE-2
14.	ECA	ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others
15.	Swayam / Swachhta / NSS / Industrial/ others	Summer Internship: 15 days



16.	LS/BT/C-305L	Molecular Biology
17.	LS/BT/C-305P	Laboratory-5 based on core-5
18.	LS/BT/C-306L	Bio-analytical Tools(core-6)
19.	LS/BT/C-306P	Laboratory-6 based on core-6
20.	LS/BT/C-307L	Chemistry-1(core-7)
21.	LS/BT/C-307P	Laboratory-7 based on core-7
22.	LS/BT/GE-303/IPRE-L	Intellectual Property Right and Entrepreneurship(GE-3)
23.	LS/BT/GE-303/IPRE-P	Laboratory-GE3 based on GE-3
24.	LS/BT/SEC-301/MT-L	Molecular techniques in disease diagnosis(SEC-1)
25.	LS/BT/SEC-301/MT-P	Laboratory-SEC1 based on SEC-1
26.	LS/BT/C-408L	Mammalian Physiology(core-8)
27.	LS/BT/C-408P	Laboratory-8 based on core-8
28.	LS/BT/C-409L	Immunology(core-9)
29.	LS/BT/C-409P	Laboratory-9 based on core-9
30.	LS/BT/C-410L	Chemistry-2
31.	LS/BT/C-410P	Laboratory-10 based on core-10
32.	LS/BT/GE-404/BME-L	Bio-management of Environment (GE-4)
33.	LS/BT/GE-404/BME-P	Laboratory-GE4 based on GE-4
34.	LS/BT/SEC-402/ACC -L	Animal Cell Culture (SEC-2)
35.	LS/BT/SEC-402/ACC -P	Laboratory-SEC2 based on SEC-2
36.	SwayamSwachhta / NSS / Industrial/ others	Summer Internship: 15 days



37.	LS/BT/C-511L	Plant Physiology and Anatomy(core-11)
38.	LS/BT/C-511P	Laboratory-11 based on core-11
39.	LS/BT/C-512L	Recombinant DNA Technology(core-12)
40.	LS/BT/C-512P	Laboratory-12 based on core-12
41.	LS/BT/DSE-501L	Bioinformatics(DSE-1)
42.	LS/BT/DSE-501P	Laboratory-DSE1 based on DSE-1 (Bioinformatics)
43.	LS/BT/DSE-501L	Biostatistics(DSE-1)
44.	LS/BT/DSE-501P	Laboratory-DSE1 based on DSE-1 (Biostatistics)
45.	LS/BT/DSE-502L	Industrial Fermentations(DSE-2)
46.	LS/BT/DSE-502P	Laboratory-DSE2 based on DSE-2
47.	LS/BT/C-613L	Bioprocess Technology(core-13)
48.	LS/BT/C-613P	Laboratory-13 based on core-13
49.	LS/BT/C-614L	Genomics and Proteomics(core-14)
50.	LS/BT/C-614P	Laboratory-14 based on core-14
51.	LS/BT/DSE-603L	Microbial Technology (DSE-3)
52.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Microbial Technology)
53.	LS/BT/DSE-603L	Biodiversity and Bioprospecting(DSE-3)
54.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Biodiversity and Bioprospecting)
55.	LS/BT/DSE-604/PD	Dissertation
56.	101	Research Methodology and scientific communication (core)
57.	102	Analytical and Separation techniques (core)
58.	103A	Advances in Animal Cell Culture Technology (Elective)
59.	103B	Advances in Cancer Biology (Elective)
60.	103C	Advances in immunology (Elective)
61.	103D	Microbial resources and Products (Elective)
62.	103E	Enzyme and fermentation technology (Elective)



Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2018-2019

School : School of Studies of Interdisciplinary Education and Research

Department : Biotechnology

Date and Time : 13-04-2018 - 12:00 Noon

Venue : Room of Head, Department of Biotechnology

MINUTES OF THE MEETING OF BOARD OF STUDIES IN BIOTECHNOLOGY GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR HELD ON 13/04/2018

A Meeting of the Board of Studies in Biotechnology under School of Life Sciences was held on 13/04/2018 at 12:00 Noon under the chairmanship of Dr. Renu Bhatt, Head Department of Biotechnology for approval of the CBCS, B.Sc (Hons) courses in Biotechnology.


Any other matter by permission of the Chair.


To discuss and approve the course structure and scheme of examination of B.Sc. (Hons.) Biotechnology, following members were present:

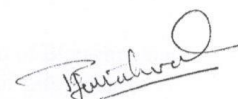
(i) Dr. Renu Bhatt, Head	Chairman
(ii) Prof. B.N. Tiwary, Professor	Member
(iii) Prof. Ragini Gothwal,	Expert
(iv) Ms. Alka Ekka, Assistant Professor	Member


At the very outset the HOD and Chairman of BOS welcomed all the esteemed members and placed the draft prepared for the course structure and scheme of examination of 3 year B.Sc. (Hons) degree course in biotechnology as per guidelines of the UGC for CBCS was discussed at length. The external subjects expert suggested that the semester wise title of papers may be slightly inter-changed for step wise academic development of undergraduate students. Accordingly, the semester-wise papers and course content was restructured. The members after a thorough deliberations approved the course structure and scheme of examinations of B.Sc. (Hons) to be implemented from the Academic session 2018-2019.

The meeting ended with a vote of thanks by the Chair


Dr. Renu Bhatt
Chairman


Prof. B. N. Tiwary
Member


Prof. Ragini Gothwal
Expert


Ms. Alka Ekka
Member



In the meeting of BOS-Biotechnology held on 13-10-2018, the following courses were revised in the of Syllabus of B. Sc. :

LS/BT/C-101L	Cell Biology(core-1)
LS/BT/C-101P	Laboratory-1 based on core-1
LS/BT/C-102L	Biochemistry and Metabolism(core-2)
LS/BT/C-102P	Laboratory-2 based on core-2
LS/BT/GE-10I/B&B-L	Bioethics and Biosafety(GE-1)
LS/BT/GE-101/B&B-P	Laboratory-GE1 based on GE-1
ECA	ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others
LS/BT/C-203L	General Microbiology(core-3)
LS/BT/C-203P	Laboratory-3 based on core-3
LS/BT/C-204L	Genetics(core-4)
LS/BT/C-204P	Laboratory-4 based on core-4
LS/BT/GE-202/B &HW-L	Biotechnology and Human Welfare(GE-2)
LS/BT/GE-202/B&HW-P	Laboratory-GE2 based on GE-2
ECA	ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others
Swayam / Swachhta / NSS / Industrial/ others	Summer Internship: 15 days
LS/BT/C-305L	Molecular Biology
LS/BT/C-305P	Laboratory-5 based on core-5
LS/BT/C-306L	Bio-analytical Tools(core-6)
LS/BT/C-306P	Laboratory-6 based on core-6
LS/BT/C-307L	Chemistry-1(core-7)



LS/BT/C-307P	Laboratory-7 based on core-7
LS/BT/GE-303/IPRE-L	Intellectual Property Right and Entrepreneurship(GE-3)
LS/BT/GE-303/IPRE-P	Laboratory-GE3 based on GE-3
LS/BT/SEC-301/MT-L	Molecular techniques in disease diagnosis(SEC-1)
LS/BT/SEC-301/MT-P	Laboratory-SEC1 based on SEC-1
LS/BT/C-408L	Mammalian Physiology(core-8)
LS/BT/C-408P	Laboratory-8 based on core-8
LS/BT/C-409L	Immunology(core-9)
LS/BT/C-409P	Laboratory-9 based on core-9
LS/BT/C-410L	Chemistry-2
LS/BT/C-410P	Laboratory-10 based on core-10
LS/BT/GE-404/BME-L	Bio-management of Environment (GE-4)
LS/BT/GE-404/BME-P	Laboratory-GE4 based on GE-4
LS/BT/SEC-402/ACC -L	Animal Cell Culture (SEC-2)
LS/BT/SEC-402/ACC -P	Laboratory-SEC2 based on SEC-2
SwayamSwachhta / NSS / Industrial/ others	Summer Internship: 15 days
LS/BT/C-511L	Plant Physiology and Anatomy(core-11)
LS/BT/C-511P	Laboratory-11 based on core-11
LS/BT/C-512L	Recombinant DNA Technology(core-12)
LS/BT/C-512P	Laboratory-12 based on core-12
LS/BT/DSE-501L	Bioinformatics(DSE-1)



LS/BT/DSE-501P	Laboratory-DSE1 based on DSE-1 (Bioinformatics)
LS/BT/DSE-501L	Biostatistics(DSE-1)
LS/BT/DSE-501P	Laboratory-DSE1 based on DSE-1 (Biostatistics)
LS/BT/DSE-502L	Industrial Fermentations(DSE-2)
LS/BT/DSE-502P	Laboratory-DSE2 based on DSE-2
LS/BT/C-613L	Bioprocess Technology(core-13)
LS/BT/C-613P	Laboratory-13 based on core-13
LS/BT/C-614L	Genomics and Proteomics(core-14)
LS/BT/C-614P	Laboratory-14 based on core-14
LS/BT/DSE-603L	Microbial Technology (DSE-3)
LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Microbial Technology)
LS/BT/DSE-603L	Biodiversity and Bioprospecting(DSE-3)
LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Biodiversity and Bioprospecting)
LS/BT/DSE-604/PD	Dissertation
101	Research Methodology and scientific communication (core)
102	Analytical and Separation techniques (core)
103A	Advances in Animal Cell Culture Technology (Elective)
103B	Advances in Cancer Biology (Elective)
103C	Advances in immunology (Elective)
103D	Microbial resources and Products (Elective)
103E	Enzyme and fermentation technology (Elective)

The following new courses were introduced in the Syllabus of B. Sc. and M.Sc. Ph.D. Course work:

Sr. No.	Course Code	Name of the Course
1.	LS/BT/C-102L	Biochemistry and Metabolism(core-2)



2.	LS/BT/C-102P	Laboratory-2 based on core-2
3.	LS/BT/GE-10I/B&B-L	Bioethics and Biosafety(GE-1)
4.	LS/BT/GE-101I/B&B-P	Laboratory-GE1 based on GE-1
5.	ECA	ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others
6.	LS/BT/GE-202/B &HW-L	Biotechnology and Human Welfare(GE-2)
7.	LS/BT/GE-202/B&HW-P	Laboratory-GE2 based on GE-2
8.	ECA	ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others
9.	Swayam / Swachhta / NSS / Industrial/ others	Summer Internship: 15 days
10.	LS/BT/C-306L	Bio-analytical Tools(core-6)
11.	LS/BT/C-307L	Chemistry-1(core-7)
12.	LS/BT/C-307P	Laboratory-7 based on core-7
13.	LS/BT/GE-303/IPRE-L	Intellectual Property Right and Entrepreneurship(GE-3)
14.	LS/BT/GE-303/IPRE-P	Laboratory-GE3 based on GE-3
15.	LS/BT/SEC-301/MT-L	Molecular techniques in disease diagnosis(SEC-1)
16.	LS/BT/SEC-301/MT-P	Laboratory-SEC1 based on SEC-1
17.	LS/BT/C-408L	Mammalian Physiology(core-8)
18.	LS/BT/C-408P	Laboratory-8 based on core-8
19.	LS/BT/C-410L	Chemistry-2
20.	LS/BT/C-410P	Laboratory-10 based on core-10



21.	LS/BT/GE-404/BME-L	Bio-management of Environment (GE-4)
22.	LS/BT/GE-404/BME-P	Laboratory-GE4 based on GE-4
23.	LS/BT/SEC-402/ACC -L	Animal Cell Culture (SEC-2)
24.	LS/BT/SEC-402/ACC -P	Laboratory-SEC2 based on SEC-2
25.	SwayamSwachhta / NSS / Industrial/ others	Summer Internship: 15 days
26.	LS/BT/C-511L	Plant Physiology and Anatomy(core-11)
27.	LS/BT/C-511P	Laboratory-11 based on core-11
28.	LS/BT/DSE-502L	Industrial Fermentations(DSE-2)
29.	LS/BT/DSE-502P	Laboratory-DSE2 based on DSE-2
30.	LS/BT/C-613L	Bioprocess Technology(core-13)
31.	LS/BT/C-613P	Laboratory-13 based on core-13
32.	LS/BT/C-614L	Genomics and Proteomics(core-14)
33.	LS/BT/C-614P	Laboratory-14 based on core-14
34.	LS/BT/DSE-603L	Microbial Technology (DSE-3)
35.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Microbial Technology)
36.	LS/BT/DSE-603L	Biodiversity and Bioprospecting(DSE-3)
37.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Biodiversity and Bioprospecting)

Signature & Seal of HoD



Scheme and Syllabus

Semester	Course Opted	Course Code	Name of the course	Credit	Hour / week
I	Core-1	LS/BT/C-101L	Cell Biology	4	4
	Core -1'Practical	LS/BT/C-101P	Laboratory-1 based on core-1	2	4
	Core -2	LS/BT/C-102L	Biochemistry and Metabolism	4	4
	Core -2 Practical	LS/BT/C-102P	Laboratory-2 based on core-2	2	4
	Generic Elective - 1 (GE- 1)	LS/BT/GE-101/B&B-L	Bioethics and Biosafety	4	4
	Generic Elective - Practical	LS/BT/GE-101/B&B-P	Laboratory-GE1 based on GE-1	2	4
	Ability Enhancement Compulsory Course (AECC)	LS/BT/AE-101/EC	English Communication / MIL (Hindi Communication)	4*	4
	ECA		ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others	2	(2)
TOTAL				24	28

II	Core-3	LS/BT/C-203L	General Microbiology	4	4
	Core -3 Practical	LS/BT/C-203P	Laboratory-3 based on core-3	2	4
	Core -4	LS/BT/C-204L	Genetics	4	4
	Core -4 Practical	LS/BT/C-204P	Laboratory-4 based on core-4	2	4
	Generic Elective -2 (GE-2)	LS/BT/GE-202/B&HW-L	Biotechnology and Human Welfare	4	4
	Generic Elective - Practical	LS/BT/GE-202/B&HW-P	Laboratory-4 based on core-4	2	4
	Ability Enhancement Compulsory Course (AECC)	LS/BT/AE-201/EVS	Environmental Science	4*	4
	ECA		ECA-Extracurricular activity/ Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others	2	(2)



			Total	24	28
SUMMER Internship: 15 days			SwayamSwachhta / NSS / Industrial/ others	2	100
III	Core-5	LS/BT/C-305L	Molecular Biology	4	4
	Core -5 Practical	LS/BT/C-305P	Laboratory-5 based on core-5	2	4
	Core -6	LS/BT/C-306L	Bio-analytical Tools	4	4
	Core -6 Practical	LS/BT/C-306P	Laboratory-6 based on core-6	2	4
	Core - 7	LS/BT/C-307L	Chemistry-1	4	4
	Core - 7 Practical	LS/BT/C-307P	Laboratory-7 based on core-7	2	4
	Generic Elective - 3 (GE-3)	LS/BT/GE-303/IPRE-L	Intellectual Property Right and Entrepreneurship	4	4
	Generic Elective - Practical	LS/BT/GE-303/IPRE-P	Laboratory-GE3 based on GE-3	2	4
	Skill Enhancement Course (SEC - 1)	LS/BT/SEC-301/MT -L	Molecular techniques in disease diagnosis	4*	2 (4)
				Total	28
IV	Core-8	LS/BT/C-408L	Mammalian Physiology	4	4
	Core -8 Practical	LS/BT/C-408P	Laboratory-8 based on core-8	2	4
	Core -9	LS/BT/C-409L	Immunology	4	4
	Core -9 Practical	LS/BT/C-409P	Laboratory-9 based on core-9	2	4
	Core - 10	LS/BT/C-410L	Chemistry-2	4	4
	Core -10 Practical	LS/BT/C-410P	Laboratory-10 based on core-10	2	4
	Generic Elective - 4 (GE-4)	LS/BT/GE-404/BME-L	Bio-management of Environment	4	4
	Generic Elective - Practical	LS/BT/GE-404/BME-P	Laboratory-GE4 based on GE-4	4	4
	Skill Enhancement Course (SEC-2)	LS/BT/SEC-402/ACC -L	Animal Cell Culture	4*	2 (4)
				TOTAL	28
SUMMER Internship: 15 days			Swayam Swachhta / NSS / Industrial/ others	2	100
V	Core-11	LS/BT/C-511L	Plant Physiology and	4	4



Core -11 Practical	LS/BT/C-511P	Anatomy Laboratory-11 based on core-11	2	4
Core -12	LS/BT/C-512L	Recombinant DNA Technology	4	4
Core -12 Practical	LS/BT/C-512P	Laboratory-12 based on core-12	2	4
Discipline Specific Elective (DSE-1)	LS/BT/DSE-501L	Bioinformatics / Biostatistics	4	4
DSE-1 - Practical	LS/BT/DSE-501P	Laboratory-DSE1 based on DSE-1	2	4
Discipline Specific Elective (DSE-2)	LS/BT/DSE-502L	Industrial Fermentations	4	4
DSE-2 - Practical	LS/BT/DSE-502P	Laboratory-DSE2 based on DSE-2	2	4
TOTAL			24	32

Core-13	LS/BT/C-613L	Bioprocess Technology	4	4
Core -13 Practical	LS/BT/C-613P	Laboratory-13 based on core-13	2	4
Core -14	LS/BT/C-614L	Genomics and Proteomics	4	4
Core -14 Practical	LS/BT/C-614P	Laboratory-14 based on core-14	2	4
Discipline Specific Elective (DSE-3)	LS/BT/DSE-603L	Microbial Technology / Biodiversity and Bioprospecting	4	4
DSE-3 - Practical	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3	2	4
Discipline Specific Elective (DSE-4)	LS/BT/DSE-604/PD	Dissertation	6	8
TOTAL			24	32
TOTAL CREDITS			152 + 4 (SI)	

As per UGC CBCS guidelines, University / departments have liberty to offer GE and SEC courses offered by any department to students of other departments. The No. of GE course is four. One GE course is compulsory in first 4 semesters each. In present scheme it is proposed to have minimum two GE courses (from one subject) in first two semester after which student shall change two GE for another subject in IIIrd and IVth semester, so that the entire student can have exposure of one additional subject. (Subject to approval by the competent authority)

NOTE:

- c ECA (I and II Semester): The 2 credit allotted for these courses will be addition credit.
- e Continuous Internal assessment should be evaluated by two component test and assignment.
- e Marks distribution as proposed End semester: continuous internal assessment (70:30) according to final ordinance.



B.Sc. (Hons.) Biotechnology, Semester-I, Core-1
Course: Cell Biology
Course Code: C1
Course Credit: (4-0-0) 4

UNIT I

Cell: Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation types: Differential and Density Gradient Centrifugation. Cell Membrane and Permeability: Chemical components of biological membranes, their organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport

UNIT II

Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, microfilaments, intermediate filaments. Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, regulation of receptor expression and function

UNIT III

Structure, biogenesis and functions of endoplasmic reticulum, Golgi complex, Lysosomes, Vacuoles and micro bodies, Ribosomes, Mitochondria, Chloroplasts and Nucleus

UNIT IV

Cell Cycle, mitosis & meiosis, Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics and biological basis of cancer

Dr. S. K. Singh
Pravinkumar Singh
4/11/19



B.Sc. (Hons.) Biotechnology, Semester-I, Lab-1
Course: Laboratory-1 based on Core-1
Course Code: Lab1
Course Credit: (0-0-4) 2

1. To study the effect of temperature and organic solvents on semi permeable membrane.
2. To study the plasmolysis
3. To study the de-plasmolysis
4. To study the structure of Prokaryotic cell (Bacteria).
5. To study the structure of Eukaryotic cell (Plant, Animal).

SUGGESTED READING

1. Karp, G. Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. The Cell: A Molecular Approach ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. The World of the Cell. Pearson Benjamin Cummings Publishing, San Francisco.

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B.Sc. (Hons.) Biotechnology, Semester-I., Core-2
Course: Biochemistry and Metabolism
Course Code: C2
Course Credit: (4-0-0) 4

UNIT I

Introduction to Biochemistry: Amino acids & Proteins: Structure and properties of Amino acids, Synthesis of aromatic and aliphatic amino acids, amino acid oxidation and production of urea. Types of protein and their classification structure and shape. Different levels of structural organization of proteins (primary, secondary, tertiary and quaternary).

UNIT II

Structure, classification, functions and properties of carbohydrates Glycolysis, fate of pyruvate under aerobic and anaerobic conditions, Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis, TCA cycle, Electron Transport Chain, Oxidative phosphorylation.

UNIT III

Structure, classification, functions and properties of fatty acid, Biosynthesis of saturated and unsaturated fatty acids. β -oxidation of fatty acids. Structure, functions, and properties of DNA, double helical model of DNA structure and forces responsible for A, B & Z - DNA. Structure, functions, and properties of RNA

UNIT IV

Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity.

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B.Sc. (Hons.) Biotechnology, Semester-I, Lab-2
Course: Laboratory-2 based on Core-2
Course Code: Lab-2
Course Credit: (0-0-4) 2

1. To calculate the molarity, molality, normality and their relationship of given sample.
2. To prepare the buffers (acetate and phosphate buffers).
3. To maintain the pH of different types of buffer using pH meter.
4. To study the Qualitative tests for carbohydrates (for reducing and nonreducing sugars), lipids (Zak's test for cholesterol) and proteins (ninhydrin test, biuret test).
5. To estimate the content of protein by using Lowery method/Bradford method.

SUGGESTED READING

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. W.H Freeman and Co.
2. Buchanan, B., Gruissem, W. and Jones, R. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M. Lehninger Principles of Biochemistry, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A. Introduction to Plant Physiology. John Wiley and Sons.
5. Salisbury, F.B. and Ross, C.W. Plant Physiology, Wadsworth Publishing Co. Ltd.

Abhatt
Rony
Akhil
Ranjana



B.Sc. (Hons.) Biotechnology, Semester-II, Core-3
Course: General Microbiology
Course Code: C3
Course Credit: (4-0-0) 4

UNIT I

History and scope of microbiology, Microbial taxonomy, Classification of microorganisms: criteria used including molecular and polyphasic approaches, microbial phylogeny and current classification of bacteria. Microbial Diversity: Distribution and characterization of Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi, Protozoa and Viruses

UNIT II

Cultivation and maintenance of microorganisms: methods of isolation, purification and preservation. Nutritional categories of micro-organisms, Control of microorganisms by physical, chemical and chemotherapeutic agents

UNIT III

Microbial growth: Growth curve, Generation time, synchronous, batch and continuous culture, methods of measurement of growth and factors affecting growth of bacteria. Microbial Metabolism: Metabolic pathways, amphi-catabolic and biosynthetic pathways Bacterial Reproduction: Asexual reproduction (binary fission, endospores and sporulation in bacteria), Genetic recombination (Transformation, Transduction and Conjugation).

UNIT IV

Bacteria, fungi, algae and cyanobacteria pollutants of water, sewage composition and its disposal Important microorganisms in food: moulds, yeasts, bacteria, major food born infections and intoxications in humans, food spoilage and preservation of various types of foods.

Abhatt Roy Aulakh Prakash



B.Sc. (Hons.) Biotechnology, Semester-II, Lab-3
Course: Laboratory-3 based on Core-3
Course Code: Lab3
Course Credit: (0-0-4) 2

1. To study the methods of sterilization (autoclave and hot air oven)
2. To study the methods of isolation of bacteria from different sources
3. To prepare the media for cultivation of bacteria/fungi.
4. To perform the biochemical characterization of isolated bacteria.
5. To perform the staining of isolated bacteria using different methods (Gram staining, Spore staining, Negative staining).
6. To determine the bacterial cell size by micrometry.
7. To enumerate the total & viable cell count of microorganism by using haemocytometer.

SUGGESTED READING

1. Alexopoulos CJ, Mims CW, and Blackwell M. (Introductory Mycology. John and Sons, Inc.
2. Jay JM, Loessner MJ and Golden DA. Modern Food Microbiology. CBS Publishers and Distributors, Delhi, India.
3. Kumar HD. Introductory Phycology. Affiliated East Western Press.
4. Madigan MT, Martinko JM and Parker J. Brock Biology of Microorganisms. Pearson Benjamin Cummings.
5. Pelczar MJ, Chan ECS and Krieg NR. Microbiology. McGraw Hill Book Company.
6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. General Microbiology. McMillan.
7. Tortora GJ, Funke BR, and Case CL. Microbiology: An Introduction. Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. Prescott, Harley and Klein's microbiology McGraw Hill Higher Education.

Shukla *Boiy* *Arora* *Prasad*



B.Sc. (Hons.) Biotechnology, Semester-II, Core-4
Course: Genetics
Course Code: C4
Course Credit: (4-0-0) 4

UNIT I

Mendelian genetics: Mendel's law, test and back crosses, Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, pleiotropy, polygenic inheritance, multiple allele, pseudo-allele, essential and lethal genes. Non allelic interactions: Interaction producing new phenotype complementary genes, epistasis (dominant & recessive). Genetic linkage, crossing over and chromosome mapping: Linkage and Recombination of genes in a chromosome crossing over

UNIT II

Chromosome and genomic organization: Eukaryotic nuclear genome nucleotide sequence composition -unique & repetitive DNA, satellite DNA. Centromere and telomere DNA sequences, middle repetitive sequences- VNTRs & dinucleotide repeats, repetitive transposed sequences- SINES & LINES, middle repetitive multiple copy genes, noncoding DNA. Eukaryotic chromosome: chromosome morphology, concept of euchromatin and heterochromatin, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, genetic code.

UNIT III

Chromosome and gene mutations: Definition and types of mutations, causes of mutations, Ames tests for mutagenic agents, variations in chromosomes structure, point mutation. Chromosomal aberrations in human beings, abnormalities: Aneuploidy (Down, Turner, Klinefelter syndrome) and Euploidy, non-disjunction.

UNIT-IV

Sex determination and sex linkage: Mechanisms of sex determination, Barr bodies, genetic balance theory, Fragile-X- syndrome and chromosome, sex linked diseases and inheritance, Pedgree analysis, Evolution and population genetics: Hardy Weinberg law, allelic and genotype frequencies,

Shakti Ravi Akshay Prasad



B.Sc. (Hons.) Biotechnology, Semester-I Lab-4
Course: Laboratory-4 based on Core-4
Course Code: Lab 4
Course Credit: (0-0-4) 2

1. To study the Mendelian Genetics in monohybrid and dihybrid crosses using checker board
2. To study the human traits
3. To identification of Barr body in human sample.
4. To study the Karyotyping with the help of photographs
5. To analyse the autosomal and sex linked disease using Pedigree charts.
6. To study the polyploidy in onion root tip by colchicine treatment.

SUGGESTED READING

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. Principles of Genetics. John Wiley & Sons.
2. Snustad, D.P., Simmons, M.J. Principles of Genetics. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. Concepts of Genetics. Benjamin Cummings.
4. Russell, P. J. Genetics- A Molecular Approach. Benjamin Cummings.
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis, W. H. Freeman & Co.

Q. Bhutt
Rong
A. Singh
Ranawat



B.Sc. (Hons.) Biotechnology, Semester-III, Core-5
Course: Molecular Biology
Course Code: C5
Course Credit: (4-0-0) 4

UNIT I

DNA as genetic material, Structure of DNA, Types of DNA, Replication of DNA in prokaryotes and eukaryotes: Semi-conservative nature of DNA replication, Bi-directional replication, DNA polymerases, The replication complex: Pre-priming proteins, primosome, replisome, Rolling circle replication, Unique aspects of eukaryotic chromosome replication, Fidelity of replication.

UNIT II

DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair: Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, recombination repair. Homologous recombination: models and mechanism, nonhomologous end joining.

UNIT III

Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains. Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing

UNIT IV

Genetic code and its characteristics, Prokaryotic and eukaryotic translation: ribosome structure and assembly, Charging of tRNA, aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Fidelity of translation, Inhibitors of translation. Regulation of gene expression in prokaryotes: Lac Operon and eukaryotes: tryptophan eukaryote.

Abhatt Romy Arshad Farhat



B.Sc. (Hons.) Biotechnology, Semester-III, Lab-5
Course: Laboratory-5 based on Core-5
Course Code: Lab5
Course Credit: (0-0-4) 2

PRACTICALS

1. To isolate the chromosomal DNA from bacterial cells/plant cells/ animal cells
2. To isolate the Plasmid DNA by alkaline lysis method
3. To quantify the genomic DNA & plasmid DNA with the help of Spectrophotometer
4. To check the quality of isolated genomic DNA & plasmid DNA with the help of Agarose Gel Electrophoresis.
5. To isolate the RNA from plant cells/ animal cells
6. To quantify the RNA with the help of Spectrophotometer
7. To check the quality of isolated RNA with the help of Agarose gel Electrophoresis.

SUGGESTED READING

1. Karp, G Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. PThe World of the Cell. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., Molecular Biology of the Gene Cold Spring Harbour Lab. Press, Pearson Pub.

Shakti *Rohit* *Ashish* *Pranav*



B.Sc. (Hons.) Biotechnology, Semester-III, Core-6
Course: Bio-analytical tools
Course Code: C6
Course Credit: (4-0-0) 4

UNIT I

History and Background of microscope, various types of microscope, principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infrared), absorption and emission spectroscopy

UNIT II

Centrifugation: principle and mechanism, types of rotors, types and techniques of centrifugation (differential and density gradient). Micro-techniques, Types cell fractionation techniques, isolation of sub-cellular organelles and particles

UNIT III

Principle of chromatography, Paper chromatography, thin layer, chromatography, column chromatography: silica and gel filtration, affinity and ion exchange, chromatography, gas chromatography, HPLC.

UNIT IV

Introduction to electrophoresis: Starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, Southern, Northern, Western blotting and South-Western blotting

Abhatt
Ranjit
Arun
Rajendra



B.Sc. (Hons.) Biotechnology, Semester-III, Lab-6
Course: Laboratory-6 based on Core-6
Course Code: Lab 6
Course Credit: (0-0-4) 2

1. To study relation between absorbance and % transmission using spectrophotometer
2. To separate different types of amino acids by paper chromatography (ascending method).
3. To separate the proteins by SDS-polyacrylamide gel electrophoresis.
4. To identify the lipids in a given sample by TLC.
5. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH.
6. To separate the plant pigments by adsorption column chromatography

SUGGESTED READING

1. Karp, G. Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons, Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. The Cell: A Molecular Approach. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G. P. The World of the Cell, Pearson Benjamin Cummings Publishing, San Francisco.

Shutt . *Rong* *Arup* *Pratishtha*



B.Sc. (Hons.) Biotechnology, Semester-IV, Core-8
Course: Mammalian Physiology
Course Code: C8
Course Credit: (4-0-0) 4

UNIT I

Respiration: Exchange of gases, Transport of O₂ and CO₂, Oxygen dissociation curve, Chloride shift. Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice

UNIT II

Circulation: Composition of blood, Plasma proteins & their role, blood cells and their functions, Haematopoiesis, Mechanism of coagulation of blood. Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat.

UNIT III

Muscle physiology and osmoregulation: Structure of cardiac, smooth & skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Physical, chemical & electrical events of mechanism of muscle contraction. Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.

UNIT IV

Nervous and endocrine coordination: Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, salutatory conduction, Neurotransmitters Mechanism of action of hormones (insulin and steroids), Different endocrine glands-Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions

Q. Bhatt
R. Singh
A. Singh
B. Singh



B.Sc. (Hons.) Biotechnology, Semester-IV, Lab-8
Course: Laboratory-8 based on Core-8
Course Code: Lab8
Course Credit: (0-0-4) 2

1. To find the coagulation time of blood sample
2. To determine the blood groups
3. To Count the mammalian RBCs using haemocytometer
4. To prepare the peripheral blood smear
5. To determine the TLC and DLC in prepared blood smear using giemsa/ Leishman stain
5. To determine the haemoglobin in blood sample
6. To demonstrate the action of an enzyme

SUGGESTED READING

1. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology. Herculourt Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. Principles of Anatomy & Physiology. John wiley & sons, Inc.
3. Chatterjee A. G. Human Physiology
4. Berry. T. B. of Animal Physiology
5. H. R. Singh Introduction to Animal Physiology and Related Biotechnology
6. Arora M.P. Animal Physiology
7. Hurkat and Mathur T. B. of Animal Physiology
8. Nahbhushan and kodarkar Animal Physiology
9. Thakur & Puranik T. B. of Animal Physiology & General Biology

Q. Shutt *Rang* *Arora* *Puranik*



B.Sc. (Hons.) Biotechnology, Semester-IV, Core-9

Course: Immunology

Course Code: C9

Course Credit: (4-0-0) 4

UNIT I

Immune Response - An overview, Cells and organs of immune system, molecular structure of immunoglobulins, antigens, antigenicity and immunogenicity, humoral & cellular immune responses, T-lymphocytes (cytotoxic T-cell, helper T-cell, suppressor T-cells), B-lymphocyte and immune response, T-cell receptors B-cell receptors, genome rearrangements during differentiation of B cells.

UNIT II

Regulation of immunoglobulin gene expression-clonal selection theory, allotypes & idiotypes, allelic exclusion, immunologic memory, heavy chain gene transcription, genetic basis of antibody diversity, Antibody affinity maturation class switching, assembly of T-cell avidity receptor genes by somatic recombination.

UNIT III

Major Histocompatibility complexes - class I & class II MHC antigens, antigen processing. Complement activation, autoimmune diseases, hypersensitivity, immunodeficiency-AIDS.

UNIT IV

Immunity to infection: immunity to different organisms, pathogen defense strategies. Vaccines & Vaccination: adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization, Introduction to immunodiagnostics - RIA, ELISA.

Abhatt *Rong* *Ashu* *Bansal*



B.Sc. (Hons.) Biotechnology, Semester-IV, Lab-9
Course: Laboratory-9 based on Core-9
Course Code: Lab9
Course Credit: (0-0-4) 2

1. Total RBC count of blood sample using haemo-cytometer
2. To analyse the haemagglutination assay
3. To analyse the haemagglutination inhibition assay
4. To separation the serum and plasma from blood sample
5. To study the double immunodiffusion test using specific antibody and antigen.
6. To study the different types of ELISA

SUGGESTED READING

1. Abbas AK, Lichtman AH, Pillai S. Cellular and Molecular Immunology. Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. Roitt's Essential Immunology. Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. Kuby's Immunology. W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. Janeway's Immunobiology. Garland Science Publishers, New York.
5. Peakman M, and Vergani D. Basic and Clinical Immunology. Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S Immunology. Wiley Blackwell Publication.

Abhatt *Raj* *Arora* *Hanuman*



B.Sc. (Hons.) Biotechnology, Semester-V, Core-11
Course: Plant Physiology and Anatomy
Course Code: C11
Course Credit: (4-0-0) 4

UNIT I

Plant Anatomy: The shoot and root apical meristem, simple & complex permanent tissues, secondary growth, growth rings, leaf anatomy (dorsi-ventral and isobilateral leaf)

UNIT II

Plant water relations: Importance of water to plant life, diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration, stomata & their mechanism of opening & closing. Micro & macro nutrients: criteria for identification of essentiality of nutrients, roles and deficiency systems of nutrients, mechanism of uptake of nutrients, different types of mechanism of food transport in plants

UNIT III

Photosynthesis: photosynthetic pigments, concept of two photo systems, photophosphorylation, calvin cycle, CAM plants, photorespiration, N₂ cycle, inorganic & molecular nitrogen fixation, nitrate reduction and ammonium assimilation in plants, mechanism.

UNIT IV

Growth and development: phases of growth, growth curve, physiological role and mode of action of growth hormones; auxins, gibberlins, cytokinins, abscisic acid, ethylene, seed dormancy and seed germination, concept of photo-periodism and vernalization

Arshitt *Rony* *Ashu* *Pranish*



B.Sc. (Hons.) Biotechnology, Semester-V, Lab-11
Course: Laboratory-11 based on Core-11
Course Code: Lab 11
Course Credit: (0-0-4) 2

1. To demonstrate the growth rings in plants.
2. To demonstrate the opening & closing of stomata
3. To demonstrate the guttation on leaf tips of grass and garden Nasturtium.
4. To separate the photosynthetic pigments by paper chromatography.
5. To demonstrate the aerobic respiration in plants.
6. To isolate the root nodules from a leguminous plant.
7. To demonstrate the effect of a hormone on plant growth

SUGGESTED READING

1. Dickinson, W.C. Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Esau, K. Anatomy of Seed Plants. Wiley Publishers.
3. Fahn, A. Plant Anatomy. Pergmon Press, USA and UK.
4. Hopkins, W.G. and Huner, P.A. Introduction to Plant Physiology. John Wiley and Sons.
5. Mauseth, J.D. Plant Anatomy. The Benjamin/Cummings Publisher, USA.
6. Nelson, D.L., Cox, M.M. Lehninger Principles of Biochemistry W.H. Freeman and Company, New York, USA.
7. Salisbury, F.B. and Ross, C.W. Plant Physiology, Wadsworth Publishing Co. Ltd.
8. Taiz, L. and Zeiger, E. Plant Physiology, Sinauer Associates Inc. MA, USA

Qshett
Rony
Aashu
Banshi



B.Sc. (Hons.) Biotechnology, Semester-V, Core-12
Course: Recombinant DNA Technology
Course Code: C12
Course Credit: (4-0-0) 4

UNIT - I

History of recombinant DNA technology, Host controlled restriction modification system, restriction endonucleases, cutting and joining of DNA molecules *in vitro*. Phosphatases, ligases and polymerases. Southern and Northern hybridization, Preparation and comparison of Genomic and cDNA library, screening of recombinants, reverse transcription, Genome mapping, Restriction mapping. DNA fingerprinting, Principle applications and types of Polymerase chain reaction (PCR).

UNIT - II

Cloning vectors: plasmid, bacteriophage, cosmids, phagemid, expression vectors, Gene transfer methods: microinjection, electroporation, microprojectile bombardment, shot gun method, ultrasonication, lipofection, micro laser, RNA-interference, selection and screening of recombinants by genetic and immunochemical

UNIT - III

Expression of foreign genes in *E.coli* and Yeast, application of gene cloning for the analysis of gene structure and function, expression of foreign genes using strong promoters, production of protein, artificial insulin gene, recombinant vaccine and other therapeutics from cloned genes

UNIT - IV

Genetic engineering in plants: use of *Agrobacterium tumefaciens* and *Agrobacterium rhizogenes*, Ti plasmids, application of recombinant DNA technology. Genetic engineering in animals: production of transgenic mice, embryonic stem cells for gene targeting in mice, applications of gene targeting.

Abhatt
Rong
Arun
Pratishtha



B.Sc. (Hons.) Biotechnology, Semester-V, Lab-12
Course: Laboratory-12 based on Core-12
Course Code: Lab12
Course Credit: (0-0-4) 2

1. To Isolate the chromosomal DNA from plant cells/human cells /bacterial cells
2. To isolate the plasmid DNA from bacterial cells
3. Qualitative and quantitative analysis of DNA using agarose gel electrophoresis and spectrophotometer
4. To prepare the competent cells
5. To transform the of competent cells
6. To demonstrate the different types of PCR
7. To study the Restriction digestion of DNA using different restriction enzymes

SUGGESTED READING

1. Brown TA. Gene Cloning and DNA Analysis. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. Principles of Gene Manipulation and Genomics, Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. Molecular Cloning-A Laboratory Manual. Cold Spring Harbor Laboratory Press.

Abhatt
Ranjit
A. S. S. S.
S. S. S. S.



B.Sc. (Hons.) Biotechnology, Semester-V, DSE-2
Course: Industrial Fermentations
Course Code: DSE-2
Course Credit: (2-0-0) 2

UNIT I

Production of industrial chemicals, biochemicals and chemotherapeutic products, butyric acid, gluconic acid, microbial insecticides, microbial flavours and fragrances, newer antibiotics, anti cancer agents

UNIT II

Microbial products of pharmacological interest, steroid fermentations and transformations, Secondary metabolism: its significance and products, Metabolic engineering of secondary metabolism for highest productivity, enzyme immobilization in industrial processing

UNIT III

Purification & characterization of proteins, Upstream and downstream processing, centrifugation, filtration of fermentation broth, ultra-centrifugation, liquid extraction, ion-exchange recovery of biological products, Process optimization and recovery of product

UNIT IV

Mathematical derivation of growth kinetics, mathematical derivations of batch and continuous culture operations; single stage CSTR; mass transfer in aerobic fermentation; resistances encountered; overall mass transfer co-efficient (K_a) determination, factors depending on scale up principle and different methods of scaling up.

Dishant
Raj *Arun* *Pankaj*



B.Sc. (Hons.) Biotechnology, Semester-V, Lab- DSE-2
Course: Laboratory- DSE-2 based on Industrial Fermentations
Course Code: DSE-2
Course Credit: (2-0-0) 2

1. Comparative analysis of design of a batch and continuous fermenter.
2. Calculation of Mathematical derivation of growth kinetics.
3. Ethanol production using fruit juice as the carbon source.
4. Solvent extraction & analysis of a metabolite from a bacterial culture.
5. Perform an enzyme assay demonstrating its hydrolytic activity.
protease/peptidase/glucosidase etc.)

SUGGESTED READING

1. Casida L.E. Industrial Microbiology. Wiley Eastern Limited.
2. Crueger W and Crueger A Biotechnology: A textbook of Industrial Microbiology. Panima Publishing Co. New Delhi.
3. Patel AH. Industrial Microbiology. Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. Principles of Fermentation Technology. Elsevier Science Ltd.
5. Salisbury, Whitaker and Hall. Principles of fermentation Technology

Shett *Ranj* *Asakp* *Ranbir*



B.Sc. (Hons.) Biotechnology, Semester-VI, Core-13
Course: Bioprocess Technology
Course Code: C13
Course Credit: (4-0-0) 4

UNIT I

Introduction to bioprocess technology, Range of bioprocess technology and its chronological Development, Basic principle components of fermentation technology, Types of microbial culture and its growth kinetics- Batch, Fedbatch and Continuous culture.

UNIT II

Design and types of bioprocess vessels: Significance of Impeller, Baffles, Sparger; Types of culture/production vessels: Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing: Media preparation, Inocula development and sterilization from straw dust.

UNIT III

Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control.

UNIT IV

Introduction to downstream processing, product recovery and purification, effluent treatment, Microbial production of ethanol, amylase, lactic acid and single cell proteins

Q. Shrivastava
Rajiv. Arora *Ranvijay*



B.Sc. (Hons.) Biotechnology, Semester-VI, Lab-13
Course: Laboratory-13 based on Core-13
Course Code: Lab13
Course Credit: (0-0-4) 2

1. To study the bacterial growth curve.
2. To calculate the thermal death point of a microbial sample.
3. Production and analysis of ethanol.
4. Isolation of industrially important (amylase producing) microorganism from natural resource.
5. Production and analysis of amylase.
6. Production and analysis of lactic acid.

SUGGESTED READING

1. Casida LE. (Industrial Microbiology. Wiley Eastern Limited.
2. Crueger W and Crueger A. Biotechnology: A textbook of Industrial Microbiology. Panima Publishing Co. New Delhi.
3. Patel AH. Industrial Microbiology. Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. Principles of Fermentation Technology. Elsevier Science Ltd.

Arshant *Raj* *Ashish* *Pranav*



B.Sc. (Hons.) Biotechnology, Semester-VI, Core-14

Course: Genomics and Proteomics

Course Code: C14

Course Credit: (4-0-0) 4

UNIT I

Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam & Gilbert and Sangers method. Pyrosequencing, Genome Sequencing: Shotgun & Hierarchical (clonecontig) methods, Human genome project

UNIT II

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

UNIT III

Introduction to protein structure: Chemical properties of proteins. Physical interactions that determine the property of proteins, Short-range interactions, electrostatic forces, van der waal interactions, hydrogen bonds, Hydrophobic interactions. Sedimentation analysis, gel filtration, SDS-PAGE, Native PAGE, Determination of covalent structures, Edman degradation

UNIT IV

Introduction to Proteomics: Analysis of proteomes, 2D-PAGE, Sample preparation, solubilization, reduction, resolution. Mass spectrometry based methods for protein identification. *De novo* sequencing using mass spectrometric data

Q. Chhatt
R. Singh
A. Singh
P. Singh



B.Sc. (Hons.) Biotechnology, Semester-VI, Lab-14
Course: Laboratory-14 based on Core-14
Course Code: Lab14
Course Credit: (0-0-4) 2

1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. Detection of Open Reading Frames using ORF Finder
4. Proteomics 2D PAGE database
5. To analyse the Protein localization by using different Softwares.
6. Hydropathy plots

SUGGESTED READING

1. Benjamin Lewin, Johns, Genes Bartlett Publisher
2. S.B. Primrose, Modern Biotechnology Blackwell Publishing.
3. B.R. Glick, J.J. Pasternak and C.L. Patten Molecular Biotechnology: Principles and Applications of Recombinant DNA ASM Press, Washington.
4. Sambrook and Russell Molecular Cloning: A Laboratory Manual.
5. S.B.Primrose, R.M.Twyman and R.W. Old Principles of Gene Manipulation Blackwell Science.
6. Snustad, D.P., Simmonns, M.J Principles of Genetics. John Wiley and Sons Inc.
7. Klug, W.S., Cummings, M.R., Spencer, C.A. Concepts of Genetics. Benjamin Cummings.
8. Russell, P. J, Genetics- A Molecular Approach. Benjamin Cummings.
9. Pevsner, J. Bioinformatics and Functional Genomics. John Wiley & Sons.

Discipline Specific Elective (DSE-4) LS/BT/DSE-604/PD Dissertation: The Dissertation will be prepared by the students under the supervision of faculty member. The dissertation will include a collection of literature, review writing, hypothesis or a survey or Industrial tour. The write-up/report has to be submitted for evaluation.

Rohatt *Romy* *Abhis* *J. P. S. S. S.*



GENERIC ELECTIVE SUBJECTS

B.Sc. (Hons.) Biotechnology, Semester-I, GE-I

Course: Bioethics and Biosafety

Course Code: GE1

Course Credit: (4-0-0) 4

UNIT I

Bioethics: Necessity of Bioethics, different paradigms of Bioethics: National & International, Universal Declaration on Bioethics and Human Rights, Ethical issues against the molecular technologies.

UNIT II

Biosafety: Introduction, different levels, applications, protocol (UN Cartagena Biosafety Protocol) and health hazards related to Biotechnology, guidelines of Biosafety in India.

UNIT III

Introduction to the concept of containment level and Good Manufacturing Practices (GMP), OECD guidelines of Good Laboratory Practices (GLP), Quality assurance programme, apparatus material and reagents used for GLP.

UNIT IV

Ethical, Legal and Social Implication program of Human Genome project, Bioethics in Biodiversity and resources management, genetically modified foods: steps for genetically modified food technology regulations, ethical issues and present scenario in consumption of Genetically Modified Organisms

Obhetti . *Rony* *Tejve* *Konitrad*



B.Sc. (Hons.) Biotechnology, Semester-I, Lab-GE1
Course: Laboratory-GE1 based on GE-1
Course Code: Lab-GE1
Course Credit: (0-0-4) 2

1. To study the guidelines for good laboratory Practice
2. To identify the different hazardous symbols for different chemicals/reagents used in laboratory
3. A case study on clinical trials of drugs in India with emphasis on ethical issues
4. Case study on women health ethics
5. Case study on handling and disposal of radioactive waste
6. Case study on medical errors and negligence

SUGGESTED READING

1. Sateesh MK Bioethics and Biosafety, I. K. International Pvt Ltd.
2. Sree Krishna V Bioethics and Biosafety in Biotechnology, New age international Publishers
3. Fleming, D.A., Hunt, D.L., Biotechnology and Safety Assessment, Academic press.
4. Thomas, J.A., Fuch, R.L. Biotechnology and safety assessment CRC press, Washington. patents by Sibley. Butterworth publication
5. Biotechnology - A comprehensive treatise. Legal economic and ethical dimensions VCH.

Q. Bhatt *Ranjit* *Arjun* *Pranav*



B.Sc. (Hons.) Biotechnology, Semester-II, GE-2

Course: Biotechnology and Human Welfare

Course Code: GE2

Course Credit: (4-0-0) 4

UNIT I

Industry: protein engineering; enzyme and polysaccharide synthesis, activity and secretion,

Enzyme immobilization: methods and application.

UNIT II

Agriculture and Environments: Plant Tissue culture, N₂ fixation, transgenic plants: insect resistance, bacterial/ fungal stress tolerance, drought/salt tolerance, bioremediation, biofertilizers, biopesticides, biofuels and bioleaching.

UNIT III

Forensic science: solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing, Polymerase chain reaction, Restriction fragment length polymorphism.

UNIT IV

Health: development of non-toxic therapeutic agents, recombinant live and DNA vaccines, gene therapy, Molecular diagnosis: (monoclonal antibodies, DNA probes, Microarrays), transgenic animals.

Abhuti

Romy

Ashu

Pravesh



B.Sc. (Hons.) Biotechnology, Semester-II, Lab-GE2

Course: Laboratory-GE2 based on GE-2

Course Code: Lab-GE2

Course Credit: (0-0-4) 2

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. To perform ethanolic fermentation using Baker's yeast
2. To study the plant parts (leaves and stems) infected with a microbes.
3. To perform quantitative estimation of residual chlorine in water samples
4. To isolate and analyse the DNA from different biological samples
5. To demonstrate the PCR in biological samples

SUGGESTED READING

1. Sateesh MK Bioethics and Biosafety, I. K. International Pvt Ltd.
2. Sree Krishna V Bioethics and Biosafety in Biotechnology, New age international publishers
3. Gupta, Elements of Biotechnology
4. Dubey, T. B. of Biotechnology
5. Kumar H. Modern Concept of Biotechnology
6. Jogdand, Advances in Biotechnology
7. Chatwal, T. B. of Biotechnology
8. Primrose, Molecular Biotechnology

Abhatt *Romy* *Ashu* *Ranvir*



B.Sc. (Hons.) Biotechnology, Semester-III, GE-3
Course: Intellectual Property Right and Entrepreneurship
Course Code: GE3
Course Credit: (4-0-0) 4

UNIT-I

Introduction to Indian Patent Law, World Trade Organization and its related intellectual property provisions, Intellectual/Industrial property and its legal protection in research, design, development in Biotechnology

UNIT II

Essential requirements for patenting, types of patent, things that are patentable and non-patentable, Drug patents in India, various types of patent application in India, patenting of living organism, traditional knowledge, commercial exploitation and protection.

UNIT III

Concept of entrepreneur, nature of entrepreneur, entrepreneurial characteristics, functions of an entrepreneur, role of entrepreneurship in developing economy.

UNIT - IV

Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc. The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.

Abhatt
Romy *Arjun* *Parvati*



B.Sc. (Hons.) Biotechnology, Semester-III, Lab-GE3
Course: Laboratory-GE3 based on GE-3
Course Code: Lab-GE3
Course Credit: (0-0-4) 2

1. Proxy filing of Indian Product patent
2. Proxy filing of Indian Process patent
3. Planning of establishing a hypothetical biotechnology industry in India
4. Patent search on internet
5. To draw the outline for project proposal related to biotechnology

SUGGESTED READING

1. Holt DH. Entrepreneurship: New Venture Creation.
2. Kaplan JM, Patterns of Entrepreneurship.
3. Gupta CB, Khanka SS. Entrepreneurship and Small Business Management, Sultan Chand & Sons.
4. P. C. Tripathi, P.N. Reddy, Principles of Management
5. Vasant Desai, Dynamics of Entrepreneurial Development & Management
6. Poornima. M. Charantimath, Entrepreneurship Development
7. Robers Lusier, Thomson Management Fundamentals
8. SS Khanka, Entrepreneurship Development
9. Stephen Robbins, Management

Abhutt *Romy* *4ellu* *Ranatal*



B.Sc. (Hons.) Biotechnology, Semester-IV, GE4
Course: Biomangement of environment
Course Code: GE4
Course Credit: (4-0-0) 4

UNIT I

Biomangement of soil: An overview of global market and available technologies local gain, global loss: The Environmental cost of action, bioavailability of contaminants in soil, microbial remediation of metals in soils

UNIT II

Biomangement of Petroleum Contaminants: benzene-contaminated underground aquifers. Biomining, Biobleaching, Enrichment of ores by microorganisms (Gold, Copper and Uranium). Environmental significance of genetically modified microbes, plants and animals, Molecular aspects and applications in biotechnology

UNIT III

Biosurfactants, strategies based on the use of fungal enzymes, anaerobic Metabolism and bioremediation of BTEX Hydrocarbons (Benzene, Toluene, Ethylbenzene, and Xylene), Treatment of municipal waste and Industrial effluents, Bio-fertilizers, Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil, Algal and fungal biofertilizers (VAM)

UNIT IV

Heavy metal phytoremediation: Microbial indicators of soil health for the assessment of remediation efficiency. Environment and the tools in rhizo- and bioremediation of contaminated soil molecular tools for monitoring and validating bioremediation, genetic engineering of bacteria and their potential for bioremediation

Abhatt *Romy* *Asulp* *Bhatnagar*



B.Sc. (Hons.) Biotechnology, Semester-IV, Lab-GE4
Course: Laboratory-GE4 based on GE-4
Course Code: Lab-GE4
Course Credit: (0-0-4) 2

1. To study the biodegradation of a dye/ xenobiotic
2. Assay for biosurfactant production and bioemulsification index of selected microorganisms
3. Assessment of bioleaching of metals from ore
4. Calculation of Total Dissolved Solids (TDS) of water sample
5. Calculation of BOD of water sample
6. Calculation of COD of water sample
7. Bacterial Examination of Water by MPN Method

SUGGESTED READING

1. S.C. Santra, Environmental Science
2. Pradipta Kumar Mohapatra, Environmental Biotechnology
3. Hans-Joachim Jordening and Josef Winter, Environmental Biotechnology – Concepts and Applications
4. Metcalf and Eddy, Tata McGraw hill, Waste Water Engineering
5. S.S. Purohit, Agricultural Biotechnology
6. Alicia L. Ragout De Spencer, John F.T. Spencer, Environmental Microbiology : Methods and Protocols
7. Milton Wainwright, Introduction to Environmental Biotechnology
8. Gilbert Masters, Principles of Environmental Engineering
9. Metcalf & Eddy, Wastewater Engineering
10. Sibley, Law and Strategy of biotechnological patents. Butterworth publication
11. Ganguli-Tat McGrawhill, Intellectual property rights.
12. Wattal, Intellectual Property Right. Oxford Publication

Qabhatt *Rony* *Arjun* *Pranav*



SKILL ENHANCEMENT COURSE

B.Sc. (Hons.) Biotechnology, Semester-III, SEC-1

Course: Molecular Techniques in Disease Diagnostic

Course Code: SEC-1

Course Credit: (2-0-0) 2

Unit - I

Transportation of different clinical materials to distant Laboratories, Proper storage of samples, Chemicals, antibodies and enzymes, common anticoagulants used-composition, amount, mechanism of action and methods of preparation of different types of vials, Biosafety measures and disposal of laboratory waste. Basics of quality control methods and Laboratory accreditation

Unit - II

Composition of blood and its function, drawing of peripheral blood smear, staining & stain preparation, Methods of estimation of Haemoglobin, Methods of total counts of WBC, RBC, Platelets & fluids used, Blood Group (ABO & Rh), Cytochemical stain for diagnosis/differential diagnosis of leukemia/other diseases

Unit- III

Susceptibility tests: Diffusion test procedures, Tests for bactericidal activity, Immunodiagnostic tests, Immuno fluorescence, Enzyme Immunoassays: Enzyme linked immunosorbent assay, Radioimmunoassay, Immunophenotyping, Fluorescence activated cell sorter, Magnetic cell sorter, FTR, Spectrophotometry

Unit - IV

Molecular techniques to detect genetic disorders: Polymerase chain reaction, Restriction fragment length polymorphism, Nuclear hybridization methods, Single nucleotide polymorphism and DNA finger printing

Shruti Romy Akshay J. S. S. S.



B.Sc. (Hons.) Biotechnology, Semester-III, Lab-SEC1

Course: Laboratory-SEC1 based on Molecular Techniques in Disease Diagnostic

Course Code: SEC-1

Course Credit: (2-0-0) 2

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Perform/demonstrate RFLP and its analysis on biological sample
2. To identify the microorganisms for different diseases
3. A kit-based detection of a microbial infection (Widal test)
4. To study the electron micrographs of biological sample
5. Perform any one immuno diagnostic test (Typhoid, Malaria, Dengue)
6. To study the genetic disorders using molecular diagnostic tools

SUGGESTED READING

1. Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
2. J.F. Van Impe, Kluwer Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes,
3. Ananthanarayan R and Paniker CKJ. Textbook of Microbiology. University Press Publication.
4. Brooks GF, Carroll KC, Butel JS and Morse SA. Jawetz, Melnick and Adelberg's Medical Microbiology. McGraw Hill Publication.
5. Goering R, Dockrell H, Zuckerman M and Wakelin D. Mims' Medical Microbiology.
6. Joklik WK, Willett HP and Amos DB. Zinsser Microbiology. Appleton Century-Crofts publication.
7. Willey JM, Sherwood LM, and Woolverton CJ. Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
8. Michael Hoppert, Microscopic Techniques in Biotechnology

Signature: Ashutt, Ravi, Anup, Praveen



B.Sc. (Hons.) Biotechnology, Semester-IV, SEC2

Course: Animal Cell Culture

Course Code: SEC-2

Course Credit: (2-0-0) 2

UNIT I

History and scope of animal cell culture technology. Basic requirements of animal cell culture laboratory (Laminar air flow, CO₂ incubator, centrifuge, microscope) biological containment and biosafety levels, good laboratory practices to prevent contamination, common cell culture contaminants

UNIT II

Culture media and buffers, natural and defined media, basal media, serum supplemented media, serum free media, growth supplements, balanced salt solution, sterilization and filtration of media.

UNIT III

Cell culture techniques, primary and secondary culture, cell lines, monolayer culture, suspension culture, organ culture, cryopreservation of cell lines

UNIT IV

Behaviour of cultured cells in terms of growth, differentiation and metabolism, apoptosis, necrosis and senescence, appearance of viable and non-viable cells, application of cell culture, in-vitro fertilization

Dr. P. K. Singh

Ranj

Arjun Prasad



B.Sc. (Hons.) Biotechnology, Semester-IV, Lab-SEC2
Course: Laboratory-SEC2 based on Animal Cell Culture
Course Code: SEC2
Course Credit: (2-0-0) 2

1. To prepare the media for animal cell culture
2. Sterilization and filtration of cell culture medium
3. Trypsinization of cell lines
4. Passaging of cell lines available in department laboratory
5. To count the viable cells using haemocytometer
6. Cryopreservation of cell lines/cells/tissues
7. Thawing of cryopreserved cell lines

SUGGESTED READING

1. Butler, M and Dawson, M. (eds.): Cell Culture Lab Fax, Eds., Bios Scientific Publications Ltd., Oxford. Clynes, M. (ed): Animal Cell Culture Techniques. Springer.
2. Glick, B.R. and Pasternak, J.J. Molecular biotechnology- Principles and applications of recombinant DNA. ASM press, Washington, USA.
3. Sambrook & Russel. Molecular Cloning: A laboratory manual.
4. Freshney, Culture of Animal cell: A manual of Basic Techniques
5. Masters, J. R. W. (ed): Animal Cell Culture – Practical Approach, Oxford Univ. Press.
6. Basega, R. (ed): Cell Growth and Division: A Practical Approach. IRL Press.
7. Mather, J.P and Barnes, D. (eds) : Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Academic Press.

Q. Shutt *R. Singh* *A. Singh* *K. Prasad*



DISCIPLINE CENTRIC SUBJECTS

(Any two per semester in semesters 5-6)

B.Sc. (Hons.) Biotechnology, Semester-V, DSE1

Course: Bioinformatics

Course Code: DSE1

Course Credit: (4-0-0) 4

Unit -I

Introduction to bioinformatics, Applications of Bioinformatics, General Introduction of Biological Databases: Flat files, relational, object oriented databases and controlled vocabularies File Format (Genbank, FASTA). Introduction of Data Generating Techniques for Genomics: shotgun sequencing, clone contig, Nucleic acid databases

Unit-II

Introduction of Data Generating Techniques in proteomics: Mass spectroscopy, Protein databases (PDB, Swiss Prot, TREMBL). File Format (PDB). Searching Databases: SRS, Entrez

Unit-III

Pairwise sequence alignments, Local alignment and Global alignment, Mutation/Substitution Matrices. Introduction to BLAST and interpretation of result, Multiple Sequence Alignment

Unit-IV

Genome Annotation: Gene identification, Detecting Open Reading Frames, Phylogenetic analysis tools

Qshett *Rony* *Arshad* *Touhid*



B.Sc. (Hons.) Biotechnology, Semester-V, DSE1
Course: Laboratory-DSE1 based on Bioinformatics
Course Code: DSE1
Course Credit: (0-0-4) 2

1. To understand and use various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
2. To understand and use PDB, Swissprot, TREMBL
3. To retrieve the gene from Genbank in the output File format
5. To retrieve the protein from PDB in the output File format
6. To align nucleic acid sequence using BLASTN
7. To align protein sequence using BLASTP
8. To align multiple sequence using Clustal W

SUGGESTED READING

1. Ghosh Z. and Bibekanand M. Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. Bioinformatics and Functional Genomics. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (Discovering Genomics, Proteomics and Bioinformatics. Benjamin Cummings.
4. Des Higgins and Willie Taylor, Bioinformatics: Sequence, Structure and Databanks. Oxford University Press.
5. Rashidi H. H. and Buehler. Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
6. Gibas Cynthia and Jambeck P. Developing Bioinformatics Computer Skills: Shroff Publishers and Distributors Pvt. Ltd. (O'Reilly), Mumbai.

Q. Shatt *B. Singh* *A. Singh* *R. Singh*



B.Sc. (Hons.) Biotechnology, Semester-V, DSE1
Course: Biostatistics
Course Code: DSE1
Course Credit: (4-0-0) 4

UNIT I

Scope and applications of Biostatistics, samples and population concept, collection, processing and presentation of data, frequency distribution

UNIT II

Measures of central tendency: Arithmetic, Harmonic and Geometric Mean, Mode and Median, their applications, merits and demerits

UNIT III

Measures of dispersion, Variance, Standard Deviation, Coefficient of Variance, their applications, merits and demerits, Correlation analysis and Regression analysis, Concept of Probability

UNIT IV

Comparison of two data sets: testing of hypothesis, Student's t-test, Chi square test, F-test-introduction and application in biology, comparison of three and more data sets: ANOVA test.

Qbhatt
Rony
Arun
Pranav



B.Sc. (Hons.) Biotechnology, Semester-V, DSE1

Course: Laboratory-DSE1 based on Biostatistics

Course Code: DSE1

Course Credit: (0-0-4) 2

1. To study the data based on graphical representation (Bar, multiple bars, histogram, pie chart etc.)
2. To determine the mean, median, mode and standard deviation of given sample/data
3. To determine the probability of given sample/data
4. To perform the t-test/F-Test of given data
5. To perform the Chi-square test of given data

SUGGESTED READING

1. Le CT Introductory biostatistics. John Wiley, USA
2. Glaser AN High Yield TM Biostatistics. Lippincott Williams and Wilkins, USA
3. Edmondson A and Druce D Advanced Biology Statistics, Oxford University Press.
4. Dania W Biostatistics: A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.
5. Mishra BN and Mishra SN, Principles of Biostatistics.
6. Marcello pagano, Principle of Biostatistics.

Dehatt *Romy* *495009* *Principle*



B.Sc. (Hons.) Biotechnology, Semester-V, DSE3
Course: Microbial Technology
Course Code: DSE3
Course Credit: (4-0-0) 4

UNIT I

Introduction to Microbial biotechnology, Definition, Bioprospecting of microbial diversity, Isolation and preservation of industrially important microorganisms

UNIT II

Production of proteins and enzymes in bacteria, recombinant vaccines, polysaccharides from microbes

UNIT III

Microbes as biocontrol agents: microbial insecticides: their mode of action (Metarhiziumanisopliae, Bacillus thuringiensis, Nuclear Polyhedrosis Virus), requirements of biopesticide registration, insect resistance transgenic plants

UNIT IV

Microbial biomass production, lignocellulose biodegradation, application of ligninolyticmicroorganisms and enzymes in biodegradation

Obhatt
Raj
Akhil
Ishant



B.Sc. (Hons.) Biotechnology, Semester-V, DSE3
Course: Laboratory-DSE3 based on Microbial Technology
Course Code: DSE3
Course Credit: (4-0-0) 4

1. To isolate microbes for bio-prospecting from biological soil
2. To preserve microbes using glycerol
3. To produce protein in *Escherichia coli*
4. To isolate microbes with the ability to secrete microbial polysaccharide
5. To isolate microbes having the bio-control potential

SUGGESTED READING

1. Clark DP and Pazdernik NJ. Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.
2. Glick, B.R., Pasternak, JJ. Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
3. Glazer Hiroshi Nikaido W.H. Freeman and Company Microbial Biotechnology Alexandern.
4. Bernal R Molecular Biotechnology: Principles and Applications of Recombinant DNA.
5. Fungal Ecology and Biotechnology, Rastogi Publications, Meerut.

Obhatt *Rsing* *Ashu* *Thakur*



B.Sc. (Hons.) Biotechnology, Semester-V, DSE3
Course: Biodiversity and Bio-prospecting
Course Code: DSE3
Course Credit: (4-0-0) 4

UNIT I

Components of biodiversity, Biodiversity crisis and biodiversity loss, Importance of biodiversity in daily life, Biodiversity and climate change, Types of Ecosystems, India as mega biodiversity Nation, Hot spots and biodiversity in India, Biodiversity and Ecosystem functioning, Plant and Animal systematic, Species concept in biodiversity studies

UNIT II

Modern Tools in the study of Biodiversity, endemism, endemic plants and animals, assessment of mapping of biodiversity; GIS/Remote sensing; Biotechnology and Conservation, IUCN, Germplasm banks, National Parks, Botanical Gardens, Wild life Sanctuaries, Bioresources, Health and biodiversity

UNIT III

Introduction to bioprospecting, bioprospecting from plants, plant derived drugs, botanicals for biocontrol, bioprospecting from animal sources, scope and examples

UNIT IV

Bio-prospecting from microbes, micro organisms as a source of novel enzymes, antibiotics, antiviral agents, immunosuppressive agents and other therapeutic agents

Abhatt
Rony
Aswaj
Gourav



Sc. (Hons.) Biotechnology, Semester-V, DSE3

Course: Laboratory-DSE3 based on Biodiversity and Bio-prospecting

Course Code: DSE3

Course Credit: (4-0-0) 4

1. To study the faunal composition (insects and mites) of soil samples (Berley's funnel)
2. To study faunal composition of water samples (Lucky drop method)
3. To study the microbial diversity from soil sample/ water sample
3. Report on visit to National Park/Wild life sanctuary/Botanical garden
4. Study through specimens/photographs/slides of : Source of Immunosuppressive and other therapeutic agents, Botanicals for biocontrol, Sacred flora (havan materials etc.)
5. Study of the characteristic features of any two flowers for each family
 - (a) Malvaceae/ Fabaceae/Cruciferae/Ranunculaceae (any one family)
 - (b) Compositae

SUGGESTED READINGS

1. Aber, J.D. and Melillo J.M., Terrestrial Ecosystems, W.B. Saunders
2. Ingrowille, M Diversity and Evolution of land plants chapman and Hall
3. Arora, R.K. and Nayar, E.R. Wild relatives of crop plants in India, NBPGR Science
4. Baker, H.G. Plants and civilization (A. Wadsworth, Belmont).
5. Bole, P.V. and Vaghani, Y. Field guide to common Indian trees, Oxford University Press, Mumbai.
6. Thakur, R.S., Puri, H.S. and Husain, A. Major medicinal plants of India, Central Institute of medicinal and aromatic plants, Lucknow.
7. Swaminathan, M.S. and Kocchar, S.L. (Es.) Plants and Society, MacMillan Publication Ltd.,

Qishett
Rony *Abhishek* *Pranav*



Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2018-2019

School : School of Studies of Interdisciplinary Education and Research

Department : Biotechnology

Date and Time : 15-04-2019 - 12:00 Noon

Venue : Room of Head, Department of Biotechnology

MINUTES OF THE MEETING OF BOARD OF STUDIES IN BIOTECHNOLOGY GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR HELD ON 15/04/2019

A Meeting of the Board of Studies in Biotechnology under School of Life Sciences was held on 15/04/2019 at 12:00 Noon under the chairmanship of Dr. Renu Bhatt, Head Department of Biotechnology to discuss and approval of the syllabus of Pre PhD course work in Biotechnology 2019.

The following members were present:

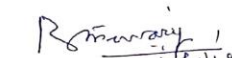
(i) Dr. Renu Bhatt, Head	Chairman
(ii) Prof. B.N. Tiwary, Professor	Member
(iii) Prof. K.K. Sahu	External Expert
(iv) Dr. Dhananjay Shukla, Assistant Professor	Member

At the very onset the Chairperson welcomed all the members and placed the draft prepared for the course structure and the scheme of examination of Pre PhD course work, 2019 in biotechnology as per guidelines of the UGC adopted by university. The committee resolved that two paper 101 (research methodology and scientific communication) and 102 (Analytical and separation techniques) are common to all students and paper III comprises of five optional paper, among which only one is to be opted by the students. The members after thorough deliberation approved the course structure and scheme of examination of Pre PhD course work to be implemented for the academic session 2019.

The meeting ended with a vote of thanks by the Chair.


Dr. Renu Bhatt

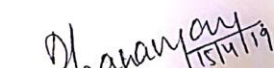
(Chairman)


Prof. B. N. Tiwary

(Member)


Prof. K.K. Sahu

(External Expert)


Dr. Dhananjay Shukla
(Member)



In the meeting of BOS-Biotechnology held on 15-10-2019, the following courses were revised in the of Syllabus of Ph.D. Course work:

Course Code	Course Name
101	Research Methodology and scientific communication (core)
102	Analytical and Separation techniques (core)
103A	Advances in Animal Cell Culture Technology (Elective)
103B	Advances in Cancer Biology (Elective)
103C	Advances in immunology (Elective)
103D	Microbial resources and Products (Elective)
103E	Enzyme and fermentation technology (Elective)

The following new courses were introduced in the Syllabus of **Ph.D.** Course work:

Course Code	Course Name
103A	Advances in Animal Cell Culture Technology (Elective)
103B	Advances in Cancer Biology (Elective)
103C	Advances in immunology (Elective)
103D	Microbial resources and Products (Elective)
103E	Enzyme and fermentation technology (Elective)

Signature & Seal of HoD

विभागाध्यक्ष, जैव प्रौद्योगिकी विभाग
Head, Department of Biotechnology
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)



Scheme and Syllabus

Pre-PhD Syllabus Department of Biotechnology Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)

Research scholars of Department of Biotechnology have to undergo a pre-Ph.D. course work of 3 papers to be completed in one semester (Six month). The Departmental Courses comprise of three theory papers, the paper I is research methodology and scientific communication, paper II comprises analytical and separation techniques. Paper III is optional in nature and comprise of five Elective papers and therefore student can select one paper based on his/her research interest area.

Code	Subject	End Semester Total Marks	Passing Marks (%) (As amended)	Credit
101	Research Methodology and Scientific Communication	100	55	4
102	Analytical and Separation Techniques	100	55	4
103	Elective paper (Student need to select only one as per their research interest)	100	55	4
103A	Advances in Animal cell culture Technology			
103B	Advances in Cancer Biology			
103C	Advances in Immunology			
103D	Microbial Resources and products			
103E	Enzyme and fermentation technology			
Total		300	165	12

The seminar will be mandatory but qualifying on the recommendation of the members of the DRC and approval of the chairman of DRC. The minimum passing marks in each papers will be 55%

Q. Shett
15/4/19

Dhanraj
15/4/19

P. Singh
15/4/19

Keshar
15/04/19



Chapter 1

101: Research Methodology and Scientific Communication

Unit - 1

Literature Review, Defining the research questions, Approaches and Methodology for Scientific research, Documentation and presentation of data, Analysis and interpretation of data, manuscript preparation

Unit - 2

Statistics in Research, Measures of Central Tendency, Dispersion, Asymmetry, Relationship, Regression Analysis, Multiple correlation and Regression, Partial Correlation, Association in case of Attributes, Testing of Hypothesis, Chi-Square test: Applications, Steps, characteristics, limitations, Analysis of Variance and Covariance.

Unit - 3

Basic knowledge of computers, hardware and software, Generation of Computers and information storages devices, MS-OFFICE, MS-WORD, MS-EXCEL, MS-POWER POINT Application of Different computer software in handling the bio-statistical problems and Data-management, R Programme, SPSS, Origin, Prism, .

Unit - 4

Biosafety and Bioethics and IPR, Guidelines for Biosafety, Institutional Biosafety committee, Institutional Animal ethics committee, Institutional ethics committee, Patents and Intellectual property rights, Bioethics (Animal, Human), Human cloning

Unit - 5

Preparing project proposals for funding agencies, Critical analysis of research papers of interest published in refereed Journals with respect to language, content, title, reference style, data, figures, tables, Discussion etc. and preparing a report on the same. Plagiarism.

Suggested Readings

1. Kothari, C.R., Research Methodology (Methods and Techniques), New Age Publisher
2. Fundamentals of modern statistical methods By Rand R. Wilcox
3. Power Analysis for Experimental Research A Practical Guide for the Biological, Medical and Social Sciences by R. Barker Bausell, Yu-Fang Li Cambridge University Press
4. Design of Experiments: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/Cole
3. Study and Communication Skills for the Biosciences by Stuart Johnson and Jon Scott, Oxford University Press
6. Write and Publish a Scientific Paper by Robert A. Day Oryx Press
7. Scientific Easy when you know how by Jennifer Peat BMJ Books
8. Research Projects and Research Proposals A Guide for Scientists Seeking Funding by Paul G. Chapin Cambridge.
9. Critical conversation about Plagiarism: Ed: Michael Donnelly et al, Parler press 2012

Vishwa
15/11/19

Abhatt
15/11/19

Ram
15/11/19

Sharma
15/11/19



PAPER-II:

102: Analytical and Separation Techniques

Unit - 1 :- CHAUHAN JYAM
Chromatographic technique: Types of chromatography used for biomolecular separations. HPLC, FPLC, GAS and instrumentation details of each. Application of chromatography in Biology.

Unit - 2
Electrophoretic techniques, Polyacrylamide gel electrophoresis (native and SDS), Agarose gel electrophoresis, 2-D electrophoresis. Immunoblotting, Southern, Western and Northern blotting, DNA finger printing and ELISA.

Unit - 3
Spectroscopy techniques, UV/VIS Spectrophotometry, Infrared spectroscopy, Atomic absorption spectroscopy, ESR and NMR spectroscopy. Mass spectroscopy (LC-MS, GC-MS). Fluorescent spectroscopy. Fourier Transform Infra-Red Spectrometer (FTIR), Applications of different Spectroscopic techniques in Biology.

Unit - 4
PCR techniques, Real time PCR, DNAMicroarray, ProteinMicroarray, Next generation sequencing, Protein Sequencing, Microscopic techniques including Fluorescence microscopy, Confocal microscopy and live cell imaging FACS analysis, Histology and histochemistry: Fixation and sectioning of tissue, embryos and cells, Immunohistochemistry, immunofluorescence, histochemical staining for characterization of cell type.

Unit - 5
Introduction to bioinformatics, Bioinformatics resources, sequence database, sequence analysis and application of bioinformatics

Suggested Readings

1. Nuclear Magnetic Resonance: (2007) Williams
2. Biochemical Techniques theory and practice: (2009) WhiteR
3. Analytical Chemistry: (2000) Cluiston G.D.
4. A Biologist Guide to Principle and Techniques: (2009) Willson K. and GqundingK.H.
5. An Introduction to Practical Biochemistry: (2008) Plummer D.T.

Debar
15/4/19

Abhatt
15/4/19

Rajy
15/4/19

Sharma
15/4/19



Paper III Elective Paper

103A: Advances in animal Cell Culture Technology

Unit 1

Types of Tissue Culture, Types of Cell Culture-Primary and Secondary Cell Transformation, Cryopreservation Contamination

Unit 2

Culture media, Base ingredients and nomenclature, Antibiotics, Fetal bovine serum, Sterility and storage.

Unit 3

Preparation of single cell suspension, Trypsinization of cells, subculture or passaging of cells, Cryopreservation, freezing and cell thawing.

Unit 4

Cell counting using a hemocytometer, cell viability assay, mt colorimetric proliferation assay, crystal violet assay, Immunofluorescent staining, flow cytometry, Methods of Gene Transfer :Viral and Non-Viral Vectors

Unit 5

Stem Cells, Reprogramming of Somatic Cells to induced pluripotent Stem cells, Application of iPS technology to Regenerative Medicine, Tissue Engineering, 3D printing.

Suggested Readings

1. Basic Biotechnology - Colin Ratlidge and Bjorn Kristiansen, Cambridge University, Press,2006
2. Biotechnology and Biopharmaceuticals -- Rodney J.Y. Ho and Milo Gibaldi, Wiley-Liss2003
3. Culture of Animal Cells -- Ian Freshney Wiley-Liss2006
4. Microbial Biotechnology -- Alexander N Glazer and Hiroshi Nikaido, Cambridge University Press,2006

Kashan
15/4/19

Abhail
15/4/19

Raj
15/4/19

Shrawan
15/4/19



103B: Advances in Cancer Biology

Unit 1

Introduction to Cancer Biology Tumor suppressors and oncogenes. Cancer growth and metastasis. Hallmarks of Cancer, Epithelial to Mesenchymal Transition (EMT), Angiogenesis, Escape Strategies against Apoptosis/Cell death and Autophagy

Unit 2

Tumor Microenvironment, Stroma Interaction, Infiltrating Immune cells. Animal models for cancer growth and metastasis, Cancer stem cells.

Unit 3

Signaling mechanisms: Cancer growth and metastasis, Abnormal cell signaling for cancer growth, Reprogramming metabolism and rewiring signaling.

Unit 4

Therapeutic Intervention Success and failure of present therapies. Micro-RNA mediated cancer treatment and targeted drug delivery, Drug resistance, Molecular diagnosis and stem cell therapy.

Unit 5

In vitro tools of cancer biology: Tissue Culture, Primary and Secondary Cell Culture, Cell Transformation, Cryopreservation, iPSCs, Generation and Reprogramming of Somatic Cells. Applications of iPSC technology to Regenerative Medicine and cancer biology. Microscopic techniques including Fluorescence microscopy, Confocal microscopy and live cell imaging FACS analysis, Histology and histochemistry: Fixation and sectioning of tissue, embryos and cells. Immunohistochemistry, immunofluorescence, histochemical staining for characterization of cell type.

Suggested readings:

1. Basic Biotechnology - Colin Ratlidge and Bjorn Kristiansen, Cambridge University, Press, 2006
2. Biotechnology and Biopharmaceuticals -- Rodney J.Y. Ho and Milo Gibaldi, Wiley-Liss 2003
3. Culture of Animal Cells -- Ian Freshney Wiley-Liss 2006
4. Microbial Biotechnology -- Alexander N Glazer and Hiroshi Nikaido, Cambridge University Press, 2006

Roshan
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103C: Advances in Immunology

Unit - 1

Monoclonal Antibody and Antibody engineering, abzymes, Antigen-antibody interaction-based Assays (RIA, ELISA, Immuno-Microscopy, Immunohistochemistry, Immunoprecipitation and co-immunoprecipitation, Immunoblotting, ELISPOT, Flow-cytometer etc)

Unit - 2

Isolation and enrichment of specific immune cells, FACS for quantitative/qualitative analysis and sorting of different immune cell subsets, Cell functional assays- lymphoproliferation, Cell cytotoxicity, mixed lymphocyte reaction, methods for determination of cell deaths/apoptosis

Unit - 3

Immune response in infections, immunodeficiency; autoimmune diseases, Immunological tolerance Tumor Immunology.

Unit - 4

Manipulation of the immune response: Regulation of unwanted immune responses and immunomodulation against autoimmunity, Correction of immunodeficiency, transplantation rejections, cancer immune-therapy, Vaccination and vaccine design, Stem cell therapy; Immunoinformatics.

Unit - 5

Evaluation of immunomodulation and biological response modification, adoptive transfer of lymphocytes and HSCs; Transgenic mice and gene knockout by targeted disruption, Molecular diagnosis of immunological disorders.

Suggested Readings

1. Immunobiology: Kenneth Murphy
2. Cellular and Molecular Immunology: Abbas AK, Lichtman AH and Pillai S
3. Immunology: Kuby
4. Essential Immunology: Devlin and Roit
5. Zneway's Immunology
6. Fundamental Immunology: William Paul

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AdShakti
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Ranjit
15/4/19

Dhananjay
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103D: Microbial Resources and Products

Unit - 1

Microbial resources. Bacteria, Fungi and Viruses. Source of microorganism (Soil, Water and Air). Isolation, preservation and maintenance of industrial microorganisms.

Unit - 2

Microbial Identification: Morphological methods, Biochemical methods, Chemotaxonomy, Molecular taxonomy, Isoenzymes, ELISA and PCR based identification methods

Unit - 3

Bioprospecting, Major methods of bioprospecting, Screening of microorganisms for value added products and therapeutic molecules. Downstream processing: introduction, removal of microbial cells and solid matters, drying and crystallization

Unit - 4

Industrial production of chemicals: Antibiotics, Organic acids, Solvents, Polymers, Enzymes. Optimization of conditions for production, Scaleup of the process. Quality control parameters in Industry.

Unit - 5

Application of microorganism: Novel products, Biofuel cell, Biodegradation of xenobiotics and pollutants, Biotransformation of drugs and metabolites, biosensors.

Suggested Readings

1. General Microbiology: Sullia SB and Shantharam S
2. Microbial Biotechnology: Glaser AN and Nilaido H
3. Industrial Microbiology : Prescott & Dunn
4. A text of Industrial Microbiology: Crueger W and Crueger A
5. Principles of Fermentation Technology: Stanbury PF, Ehitaker H, Hall SJ
6. Industrial Biotechnology: SN Jogdan

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103E: Enzyme and fermentation technology

Unit - 1

General introduction to Enzymes; nomenclature, EC numbers, and classification. Enzyme activity. Specific activity and turn over number. Marker enzymes. Enzyme Kinetics: Steady state, pre-steady state, equilibrium kinetics, Michaelis-Menten, Lineweaver-Burk Equations and plots. Different methods to calculate the K_m and V_{max} and their significance.

Unit - 2

Factor affecting enzyme activity and catalysis: pH, substrate and enzyme concentration, temperature, coenzyme and cofactors, Mechanism of bisubstrate and multi substrate reaction catalysis. Role of metal ions in enzyme catalysis. Enzyme inhibition and activators.

Unit - 3

Enzyme technology: isolation and purification of enzymes, determination of molecular weight preparation of purification chart, limitations of microbial cells used as catalysts, Immobilization of enzymes, whole cell immobilization and their application, multi-enzyme reactors. Enzyme engineering: Design and construction of novel enzymes.

Unit - 4

Introduction to fermentation: Fermenter design, operation, measurement and control in fermentation. Aeration and agitation in fermentation, oxygen requirement, measurement of adsorption coefficients, Types of Bioreactors: Stirred tank, bubble columns, airlift bioreactors, submerged and solid state fermentation and immobilized cell reactors

Unit - 5

Upstream processing: methods for isolation of pure culture, measurement of microbial growth, nutritional and genetic parameters for over production of metabolites, Strain selection and improvement maintenance and preservation of pure culture. Design of production media, preparation of inoculum, alternative carbon and nitrogen sources, manipulation of environment and Sterilization techniques. Downstream processing - extraction, separation, concentration, recovery & purification operations of fermentation products.

Suggested Readings

1. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry: Trevor Palmer and Philip Bonner.
2. Biochemistry: Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto
3. Lehninger's Principles of Biochemistry by Nelson, Cox
4. Enzyme kinetics: Dixon W. B.
5. Fundamentals of Enzymology : Nicholas C. Price and Lewis Stevens
6. A text of Industrial Microbiology: Crueger W. & Crueger A.
7. Principles of Fermentation Technology: Stanbury P.F, Ehitaker H, Hall S.J

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