



### List of New Course(s) Introduced

**Department : *Biotechnology***

**Program Name : *B.Sc.***

**Academic Year : *2019-2020***

### List of New Course(s) Introduced

Sr. No.	Course Code	Name of the Course
1.	LS/BT/C-306L	Bio-analytical Tools(core-6)
2.	LS/BT/C-307L	Chemistry-1(core-7)
3.	LS/BT/C-307P	Laboratory-7 based on core-7
4.	LS/BT/GE-303/IPRE-L	Intellectual Property Right and Entrepreneurship(GE-3)
5.	LS/BT/GE-303/IPRE-P	Laboratory-GE3 based on GE-3
6.	LS/BT/SEC-301/MT-L	Molecular techniques in disease diagnosis(SEC-1)
7.	LS/BT/SEC-301/MT-P	Laboratory-SEC1 based on SEC-1
8.	LS/BT/C-408L	Mammalian Physiology(core-8)
9.	LS/BT/C-408P	Laboratory-8 based on core-8
10.	LS/BT/C-410L	Chemistry-2
11.	LS/BT/C-410P	Laboratory-10 based on core-10
12.	LS/BT/GE-404/BME-L	Bio-management of Environment (GE-4)
13.	LS/BT/GE-404/BME-P	Laboratory-GE4 based on GE-4
14.	LS/BT/SEC-402/ACC -L	Animal Cell Culture (SEC-2)
15.	LS/BT/SEC-402/ACC -P	Laboratory-SEC2 based on SEC-2
16.	SwayamSwachhta / NSS / Industrial/ others	Summer Internship: 15 days
17.	LS/BT/C-511L	Plant Physiology and Anatomy(core-11)
18.	LS/BT/C-511P	Laboratory-11 based on core-11
19.	LS/BT/DSE-502L	Industrial Fermentations(DSE-2)
20.	LS/BT/DSE-502P	Laboratory-DSE2 based on DSE-2



21.	LS/BT/C-613L	Bioprocess Technology(core-13)
22.	LS/BT/C-613P	Laboratory-13 based on core-13
23.	LS/BT/C-614L	Genomics and Proteomics(core-14)
24.	LS/BT/C-614P	Laboratory-14 based on core-14
25.	LS/BT/DSE-603L	Microbial Technology (DSE-3)
26.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Microbial Technology)
27.	LS/BT/DSE-603L	Biodiversity and Bioprospecting(DSE-3)
28.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Biodiversity and Bioprospecting)



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

**Academic Year : 2019-2020**

**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 Science was held on 13/04/2018 at 12:00 Noon under the chairmanship of Dr. Renu Bhatt, Head of 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 |
| (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 pappers 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 following new courses were introduced in the Syllabus of B. Sc.

Sr. No.	Course Code	Name of the Course
1.	LS/BT/C-306L	Bio-analytical Tools(core-6)
2.	LS/BT/C-307L	Chemistry-1(core-7)
3.	LS/BT/C-307P	Laboratory-7 based on core-7



4.	LS/BT/GE-303/IPRE-L	Intellectual Property Right and Entrepreneurship(GE-3)
5.	LS/BT/GE-303/IPRE-P	Laboratory-GE3 based on GE-3
6.	LS/BT/SEC-301/MT-L	Molecular techniques in disease diagnosis(SEC-1)
7.	LS/BT/SEC-301/MT-P	Laboratory-SEC1 based on SEC-1
8.	LS/BT/C-408L	Mammalian Physiology(core-8)
9.	LS/BT/C-408P	Laboratory-8 based on core-8
10.	LS/BT/C-410L	Chemistry-2
11.	LS/BT/C-410P	Laboratory-10 based on core-10
12.	LS/BT/GE-404/BME-L	Bio-management of Environment (GE-4)
13.	LS/BT/GE-404/BME-P	Laboratory-GE4 based on GE-4
14.	LS/BT/SEC-402/ACC -L	Animal Cell Culture (SEC-2)
15.	LS/BT/SEC-402/ACC -P	Laboratory-SEC2 based on SEC-2
16.	SwayamSwachh ta / NSS / Industrial/ others	Summer Internship: 15 days
17.	LS/BT/C-511L	Plant Physiology and Anatomy(core-11)
18.	LS/BT/C-511P	Laboratory-11 based on core-11
19.	LS/BT/DSE-502L	Industrial Fermentations(DSE-2)
20.	LS/BT/DSE-502P	Laboratory-DSE2 based on DSE-2
21.	LS/BT/C-613L	Bioprocess Technology(core-13)
22.	LS/BT/C-613P	Laboratory-13 based on core-13



23.	LS/BT/C-614L	Genomics and Proteomics(core-14)
24.	LS/BT/C-614P	Laboratory-14 based on core-14
25.	LS/BT/DSE-603L	Microbial Technology (DSE-3)
26.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Microbial Technology)
27.	LS/BT/DSE-603L	Biodiversity and Bioprospecting(DSE-3)
28.	LS/BT/DSE-603P	Laboratory-DSE3 based on DSE-3 (Biodiversity and Bioprospecting)

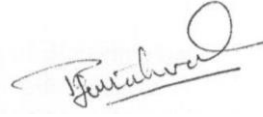
The meeting ended with a vote of thanks by the Chair.



Dr. Renu Bhatt  
Chairman



Prof. B.N. Tiwary  
Professor



Prof. Ragini Gothwal  
Expert



Ms. Alka Ekka  
Member



Signature & Seal of HoD

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

**गुरु घासीदास विश्वविद्यालय**  
(केन्द्रीय विश्वविद्यालय अधिनियम 2009 क्र. 25 के अंतर्गत स्थापित केन्द्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



**Guru Ghasidas Vishwavidyalaya**  
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

## **Scheme and Syllabus**



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	34
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	34
SUMMER Internship: 15 days			Swayam Swachhta / NSS / Industrial/ others	2	100
V	Core-11	LS/BT/C-511L	Plant Physiology and	4	4



			Anatomy		
Core -11 Practical	LS/BT/C-511P		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

VI	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) Dissertation	LS/BT/DSE-604/PD	Dissertation	6	8
				TOTAL	24
			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 III<sup>rd</sup> and IV<sup>th</sup> semester, so that the entire student can have exposure of one additional subject. (Subject to approval by the competent authority)

NOTE:

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





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 Roy. Kelly Babbar



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.

*Shruti*      *Romy*      *Ashu*      *Hemant*



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 O<sub>2</sub> and CO<sub>2</sub>, 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

DBhatt  
Romy  
Arun  
Bansal



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. Herculart 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

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Arora

Pranishal



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, N<sub>2</sub> 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

*Arbhatt* *Romy* *Aewp* *T. J. J. J.*



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. Fahh, 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* *Romy* *Ashy* *Pranjal*



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 processingcentrifugation, 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.

*Dishett*  
*R. Singh* *A. Singh* *P. Singh*



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* *Ranj* *Ashu* *Pratish*





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 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.
5. Salisbury, Whitaker and Hall. Principles of fermentation Technology

*Qshatt* *Romy* *Arculp* *Fermentation*



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.

*Qshatt* *Raj* *Ashu* *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

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Romy  
Arun  
Pranav



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., Simmons, 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.

*Abhatt*

*Romy*

*Tejap*

*J. Patil*



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.

*Shruti  
Rong*

*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

*Abhatt* *Romy* *Ashu* *Harshul*



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

**UNIT I**

Biomanagement 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**

Biomanagement of Petroleum Contaminants: benzene-contaminated underground aquifers. Biomining, Bioleaching, 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

*Qshett* *Romy* *Ashlyp* *Pravara*



**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

*Obhett* *Romy* *Aelly* *Pradipta*





**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

*Dr. Shetty* *R. Singh* *A. K. Singh* *P. K. Singh*



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, CO<sub>2</sub> 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. Subh  
Ranj  
Arun 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. Bhatt*      *R. Singh*      *A. Singh*      *P. Prasad*



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

*Dbhatt*  
*Rony* *Akshay* *Pranav*



**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, J.J. Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
3. Glazer Hiroshi Nikaido W.H. Freeman and Company Microbial Biotechnology Alexandern.
4. Bernaral R Molecular Biotechnology: Principles and Applications of Recombinant DNA.
5. Fungal Ecology and Biotechnogy, Rastogi Publicaions, Meerut.

*Obhatt* *Romy* *Ashu* *T. Prasad*



**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* *Ashy* *Tanishk*



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.,

*Q. Shett*  
*Romy*  
*Atul*  
*P. Prasad*



**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 florescence, 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

*Abhatt* *Romy* *Telega* *Tharshul*