



List of Revised Courses

Department : *Biotechnology*

Program Name : *M.Sc.*

Academic Year : *2017-18*

List of Revised Courses

Sr. No.	Course Code	Name of the Course
1.	LBTC 701	Cell Biology
2.	LBTC 702	Microbiology
3.	LBTC 705	Laboratory - 1
4.	LBTC 801	Molecular Biology
5.	LBTC 802	Immunology
6.	LBTC 803	Bio techniques
7.	LBTC 804	Enzymology and Enzyme Technology
8.	LBTC 805	Laboratory- 1
9.	LBTC 806	Laboratory -2
10.	LBTC 902	Microbial Biotechnology (Core)
11.	LBTC 903	Animal Biotechnology (Core)
12.	LBTC 904	a) Bioprocess Technology (Elective)
13.	LBTC 905	b) Genomics & Proteomics (Elective)
14.	LBTC 906	c) Molecular Diagnostics (Elective)
15.	LBTC 907	d) Food Technology (Elective)
16.	LBTC 908	Laboratory -1
17.	LBTC 909	Laboratory -2
18.	LBTC 1001	Bioinformatics & Statistics (Core)
19.	LBTC 1002	a) Plant metabolic Engineering (Elective)
20.	LBTC 1003	b) Gene Therapy & Nanomedicine (Elective)



21.	LBTC 1004	c) Industrial & Fermentation Technology (Elective)
22.	LBTC 1005	d) Immunotechniques (Elective)
23.	LBTC 1006	e) Entrepreneurship Management in Biotechnology (Elective)



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

Academic Year : 2017-18

School : School of Studies of Interdisciplinary Education and Research

Department : Biotechnology

Date and Time : 13-04-2017 - 12:00 Noon

Venue : Room of Head, Department of Biotechnology

MINUTES OF THE MEETING OF BOARD OF STUDIES IN BIOTECHNOLOGY
HELD ON 13/04/2017

A Meeting of the BOS was held on 13/04/2017 at 12:00 Noon to discuss the following:

- To discuss and approve the course structure and scheme of examination of Int. UG/PG, M.Sc. and Ph. D courses in Biotechnology and following members were present:
- Any other matter by permission of the Chair.
 - Dr. Renu Bhatt, Head
 - Prof. B.N. Tiwary, Professor
 - Prof. Ragini Gothwal,
 - Ms. Alka Ekka, Assistant Professor

Chairman
Member
Expert
Member

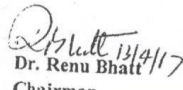
At the very outset the HOD and Chairman of BOS welcomed all the esteemed members and placed the draft prepared to revise course structure and scheme of examination in the light of UGC directives as per CBCS scheme to be implemented from 2017-18. The Syllabus of M.Sc Biotechnology and Pre Ph.D course work was also updated and placed before the committee.

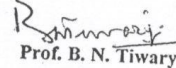
The course structure and scheme of examination was discussed and approved by all the members.

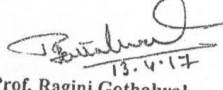
The chairman categorically pointed out that in the UG courses only 03 core subjects have to be defined and the student shall have to opt for honors subject in Ist semester only.

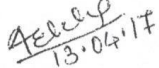
Group A: Biotechnology-Chemistry-Zoology
Group B: Biotechnology-Chemistry-Botany

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 13-40-2017, the following courses were revised in the of Syllabus of B. Sc. and M.Sc. Ph.D. Course work:

Sr. No.	Course Code	Name of the Course
1.	LBTC 402	Paper-2 Biophysical Techniques
2.	LBTC 502	Animal & Plant biotechnology (core)
3.	LBTC 503	Bioinformatics (Core)
4.	LBTC 504	a) Medical Diagnostics (Elective)
5.	LBTC 505	b) Biotechnology in Crop improvement (Elective)
6.	LBTC 506	Laboratory – 1
7.	LBTC 507	Laboratory - 2
8.	LBTC 601	Industrial Biotechnology (core)
9.	LBTC 602	Biosafety, Bioethics & IPR (core)
10.	LBTC 603	a) Fermentation Technology (Elective)
11.	LBTC 604	b) Gene therapy (Elective)
12.	LBTC 605	Laboratory - 1
13.	LBTC 606	Dissertation on electives
14.	LBTC 701	Cell Biology
15.	LBTC 702	Microbiology
16.	LBTC 705	Laboratory - 1
17.	LBTC 801	Molecular Biology
18.	LBTC 802	Immunology
19.	LBTC 803	Bio techniques
20.	LBTC 804	Enzymology and Enzyme Technology
21.	LBTC 805	Laboratory– 1
22.	LBTC 806	Laboratory -2
23.	LBTC 902	Microbial Biotechnology (Core)
24.	LBTC 903	Animal Biotechnology (Core)



25.	LBTC 904	a) Bioprocess Technology (Elective)
26.	LBTC 905	b) Genomics & Proteomics (Elective)
27.	LBTC 906	c) Molecular Diagnostics (Elective)
28.	LBTC 907	d) Food Technology (Elective)
29.	LBTC 908	Laboratory -1
30.	LBTC 909	Laboratory -2
31.	LBTC 1001	Bioinformatics & Statistics (Core)
32.	LBTC 1002	a) Plant metabolic Engineering (Elective)
33.	LBTC 1003	b) Gene Therapy & Nanomedicine (Elective)
34.	LBTC 1004	c) Industrial & Fermentation Technology (Elective)
35.	LBTC 1005	d) Immunotechniques (Elective)
36.	LBTC 1006	e) Entrepreneurship Management in Biotechnology (Elective)
37.	Paper2	Analytical and Separation Techniques

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

Course Code	Course Name
LBTC 502	Animal & Plant biotechnology (core)
LBTC 601	Industrial Biotechnology (core)
LBTC 602	Biosafety, Bioethics & IPR (core)
LBTC 603	a) Fermentation Technology (Elective)
LBTC 604	b) Gene therapy (Elective)
LBTC 605	Laboratory - 1
LBTC 606	Dissertation on electives
LBTC 701	Cell Biology
LBTC 702	Microbiology
LBTC 705	Laboratory - 1
LBTC 801	Molecular Biology

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.)

LBTC 803	Bio techniques
LBTC 902	Microbial Biotechnology (Core)
LBTC 904	a) Bioprocess Technology (Elective)
LBTC 905	b) Genomics & Proteomics (Elective)
LBTC 907	d) Food Technology (Elective)
LBTC 1001	Bioinformatics & Statistics (Core)
LBTC 1002	a) Plant metabolic Engineering (Elective)
LBTC 1004	c) Industrial & Fermentation Technology (Elective)
LBTC 1005	d) Immunotechniques (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

PG I Semester/ Integ. UG/PG VII Semester					
code	Course opted	Subjects	Hours/ semester	Hours/ week	Credits
LBTC 701	Core -1	Cell Biology	48	03	03
LBTC 702	Core -2	Microbiology	48	03	03
LBTC 703	Core -3	Biochemistry (Regulation & Metabolism)	48	03	03
LBTC 704	Core -4	Recombinant DNA Technology	48	03	03
		Laboratory			
LBTC 705	Lab 01	Laboratory - 1 (based on Core -1 & Core -2)	96	06	03
LBTC 706	Lab 02	Laboratory - 2 (based on Core -3 & Core-4)	96	06	03
		Total	384	24	18

Dehutt 13/04/17 *Potlun 13.4.17* *Akshay 13.04.17*

PG II Semester/ Integ. UG/PG VIII Semester					
Code	Course opted	Subjects	Hours/ semester	Hours/ week	Credits
LBTC 801	Core -1	Molecular Biology	48	03	03
LBTC 802	Core -2	Immunology	48	03	03
LBTC 803	Core -3	Biotechniques	48	03	03
LBTC 804	Core-4	Enzymology and Enzyme Technology	48	03	03
		Laboratory			
LBTC 805	Lab 01	Laboratory- 1 (based on Core -1 & Core -2)	96	06	03
LBTC 806	Lab 02	Laboratory -2 (based on Core -3 & Core-4)	96	06	03
		Total	384	24	18

PG III Semester/ Integ. UG/PG IX Semester					
Code	Course opted	Subjects	Hours/ semester	Hours/ week	Credits
LBTC 901	Core -1	Plant Biotechnology	48	03	03
LBTC 902	Core -2	Microbial Biotechnology	48	03	03
LBTC 903	Core -3	Animal Biotechnology	48	03	03
LBTC 904	Elective	a) Bioprocess Technology	48	03	03
LBTC 905		b) Genomics & Proteomics			
LBTC 906		c) Molecular Diagnostics			
LBTC 907		d) Food Technology			
		Laboratory			
LBTC 908	Lab 01	Laboratory -1 (based on Core -1 & Core -2)	96	06	03
LBTC 909	Lab 02	Laboratory -2 (based on Core -3 Elective)	96	06	03
		Total	384	24	18

PG IV Semester/ Integ. UG/PG X Semester					
Code	Course opted	Subjects	Hours/ semester	Hours/ week	Credits
LBTC 1001	Core -1	Bioinformatics & Statistics	48	03	03
		Skill Development Courses			
LBTC 1002	Elective	a) Plant metabolic Engineering	48×2	03×2	03×2
LBTC 1003		b) Gene Therapy & Nanomedicine			
LBTC 1004		c) Industrial & Fermentation Technology			
LBTC 1005		d) Immunotechniques			
LBTC 1006		e) Entrepreneurship Management in Biotechnology			
LBTC 1007		f) Environmental Biotechnology			
LBTC 1008		Dissertation	288	18	06+03
		Total	432	27	18

Baskets of Electives: Students in PG IV semester has to select any two subjects from the elective baskets.
The dissertation work for PG IV semester shall be based on the area of electives selected by the students.

Dehutt 13/04/17 *Potlun 13.4.17* *Akshay 13.04.17*



PG I Semester/ Integ. UG/PG VII Semester, Core- 1

Course: Cell Biology

Course Code: LBTC 701

Course Credit: (3-0-0) 3

Unit - 1

Structural organization of Biomembrane, Overview of Membrane Transport, Active and passive transport. Facilitated transport of glucose and water, ATP powered pumps, Ion channels, Resting membrane potential, Symporters and antiporters.

UNIT-2

Intracellular protein transport, Protein targeting to and across the ER Membrane, Insertion of membrane proteins into the ER, Protein Modifications and folding in the ER. Protein targeting to cell organelles, Molecular Mechanisms of Vesicle mediated protein.

Unit - 3

Signalling molecules and cell surface receptor, second messenger, intracellular signal transduction pathway (DAG, Ca^{2+} , c-AMP, G-Proteins), MAKK, Notch, TGF-beta, Jak-STAT signalling pathway.

UNIT-4

Eukarvotic cell cycle. model organism to study cell cycle. Regulation of cell cycle. Cell death and its regulation.

Unit - 5

Tumor Cells and the Onset of Cancer, Oncogenic Mutations in Growth-Promoting Proteins, Mutations Causing Loss of Growth-Inhibiting and Cell-Cycle Controls, Role of Carcinogens and DNA Repair in Cancer.



PG I Semester/ Integ. UG/PG VII Semester, Core- 2

Course: Microbiology
Course Code: LBTC 702
Course Credit: (3-0-0) 3

Unit -1

History and Scope of Microbiology, Major characteristics used in microbial taxonomy (numerical and molecular), Current methods of microbial identification (16s rRNA, Gene sequencing, House keeping genes).

Unit -2

Cultivation and enumeration of microbes from environment, Ultrastructure of bacteria, algae, protozoa and viruses, Ecology of micro-organisms

Unit -3

Nutritional requirements of micro-organisms, mode of nutrition, phototrophy, mixotrophy, saparophytic, symbiotic and parasitic organisms

Unit -4

Microbial growth and population kinetics, methodology for measuring growth and growth regulation. Physical and chemical control of microbes

Unit -5

Mechanism of gene transfer and genetic recombination in bacteria: transformation, transduction, conjugation

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessment will be taken into consideration.
PG I Semester/ Integ. UG/PG VII Semester, Core- 3

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13/4/17

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13.4.17

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13.04.17



SEMESTER -VIII

PG II Semester/ Integ. UG/PG VIII Semester, Core- 1

Course: Molecular Biology

Course Code: LBTC 801

Course Credit: (3-0-0) 3

Unit - 1

DNA replication, Unit of replication, Enzymes involved in DNA replication, replication origin and replication fork, fidelity of replication, Mechanism of DNA replication. Inhibitors of DNA replication.

Unit-2

Transcription, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation.

Unit - 3

Ribosome, Translation, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, Mechanism of translation, translational inhibitors, Post- translational modification of proteins.

Unit-4

Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, Epigenetic regulation, Genomic Imprinting.

Unit-5

DNA damage, DNA repair, DNA damage and repair mechanisms, homologous and site-specific recombination,

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration.
Suggested Readings

Roy
13/4/17

Shett
13.4.17

Fotind
13.6.17

Akshay
13.04.17



PG II Semester/ Integ. UG/PG VIII Semester, Core- 2

Course: Immunology
Course Code: LBTC 802
Course Credit: (3-0-0) 3

Unit - 1

Introduction and History of Immunology; Organization and structure of lymphoid organs; Cells and molecules of Immune system; Hematopoiesis; innate and acquired immunity, Clonal nature of immune response, Phylogeny of Immune system,

Unit - 2

Nature and Biology of antigens and super antigens, Antigenicity and immunogenicity; Kinetics and antigen and antibody interaction; Antibody structure and function, Immunoglobulin gene and Generation of antibody diversity, antigen and antibody interactions-based assays, Hybridoma Technology and monoclonal antibody, Antibody engineering and SCFVs.

Unit - 3

Complement System-Activation and regulation; Structure and function of various cytokines and their receptor; Antigen presenting cells; Structure and functions of MHC and HL-A system; Antigen processing and presentation.

Unit - 4

T - cell receptor-CD3 complex; Development and differentiation of T cells; Positive and negative regulation; Development and differentiation of B cells; B Cell receptors; Cell mediated cytotoxicity: T cytotoxic cells, Natural Killer (NK) Cells, Antibody dependent cell Cytotoxicity (ADCC), Macrophage-mediated cytotoxicity. Immunological tolerance, Immunosenescence. Immunodeficiency.

Unit - 5

Autoimmunity, Hypersensitivity; Transplantation, Immunity to infectious agents, Tumor Immunology, Vaccination

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration.

Suggested Readings

1. Essentials of Immunology: Roitt IM
2. Immunology: Kuby
3. Advanced Immunology: Male D, Champion B. Cooke A. and Owen M.
4. Principle and practice of Immunoassay: Christopher P. Price and David J
5. Culture of Animal cell- Ian: Freshney

Q.Bhatt
13-4-17

F. Prasad
13-4-17

A. Singh
13-04-17

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PG II Semester/ Integ. UG/PG VIII Semester, Core- 3
Course: Biotechniques
Course Code: LBTC 803
Course Credit: (3-0-0) 3

Unit- 1

Microscopy: Principles and applications, simple, compound, phase-contrast and fluorescence microscopes. Electron microscopy: SEM and TEM. X-Ray Crystallography, X-ray diffraction Bragg equation. Application in structural analysis of biomolecules, Centrifugation Technique Principles, types of centrifuges, density gradient centrifugation in isolation of cells, organelles and biomolecules.

Unit- 2

Electromagnetic spectrum, Beer Lambert's Law, Photometry, UV/VIS Spectrophotometry, Infrared spectroscopy, Atomic absorption spectroscopy, ESR and NMR spectroscopy, Mass spectroscopy (LC-MS, GC-MS, MALDI - TOF), Fluorescent spectroscopy, Applications of different Spectroscopic techniques in Biology.

Unit- 3

Introduction and types of chromatography, paper, thin layer, gas, Gel permeation, ion exchange, HPLC, FPLC and affinity chromatography and instrumental details of each. Applications of Chromatographic techniques in Biology.

Unit- 4

Paper and gel electrophoresis, Polyacrylamide gel electrophoresis (native and SDS), Agarose gel electrophoresis, Immunoelectrophoresis, Principle and application of blotting (Southern Western and Northern and South Western blotting), ELISA.

Unit- 5

Nature and types of radiations, preparation of labeled biological samples, Detection and measurement of radioactivity, GM counter, Scintillation counter, Autoradiography, Safety measures in handling radiolabelled samples, RIA, Non radiolabelled, Role of ionizing and non ionizing radiation in Structural and functional analysis of biological sample.

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	15
2	Internal Assessment II	1 hour	15
3	End Semester	3 hour	30
4	Attendance/Assignment/Class performance	Entire semester	5

Note: The best one out of two Internal Assessments will be taken into consideration.

Suggested Readings:

1. Nuclear Magnetic Resonance: (2007) Williams
2. Biochemical Techniques theory and practice: (2008) White R.
3. Analytical Chemistry: (2000) Christon G. D.
4. A Biologist Guide to Principle and Techniques: (2009) Wilson K, and Gounding K.H.
5. An Introduction to Practical Biochemistry: (2008) Plummer D. T.

PG II Semester/ Integ. UG/PG VIII Semester, Core- 4

Abhatt
13.4.17

Prashant
13.4.17

Akshay
13.04.17



Course: Enzymology and Enzyme Technology
Course Code: LBTC 804
Course Credit: (3-0-0) 3

Unit - 1

Introduction to enzymes, enzyme nomenclature, classification of enzymes and enzyme commission numbers. Concept of active centre, binding sites, stereospecificity and ES complex formation. Isolation and purification of enzymes, preparation of purification chart, Enzyme activity, Specific activity and turn over number, Marker enzymes.

Unit - 2

Enzyme Kinetics: Steady state, pre-steady state, equilibrium kinetics, Michaelis and Menten, Lineweaver-burk, Eadie-Hofstee equation and its derivation, Different methods to calculate the K_m and V_{max} and their significance.

Unit - 3

Factor affecting enzyme activity and catalysis: pH, substrate and enzyme concentration, temperature, coenzyme and cofactor etc, Mechanism of action of enzymes involving two/more substrates. Role of metal ions in enzyme catalysis. Enzyme inhibition, different types of inhibitors and activators.

Unit - 4

Structure and function of enzymes: Lysozyme, chymotrypsin, proteases. Enzyme regulation and control of their activity. Introduction to allosteric enzymes and isozymes.

Unit - 5

Enzyme Technology: Immobilization of enzymes, whole cell immobilization and their application, commercial production of enzymes, RNA-catalysis, abzymes, Protein and Enzyme engineering: Design and construction of novel enzymes. Enzymes used in drug synthesis, biosensors. Application of enzymes in medicine (therapeutic enzymes, enzymes as analytical reagents)



Integrated UG/PG VIII Sem, Lab -1

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Course: Laboratory -2(Based on Core -1 & Core -2)
Course Code: LBTC 805
Course Credit: (3-0-6) 3

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	3 hour	15
2	Internal Assessment II	3 hour	15
3	End Semester	6 hours	30
4	Attendance/Assignment/Class performance	1 hour	5

Note: The best one out of two Internal Assessments will be taken

Integrated UG/PG V Sem, Lab - 2
Course: Laboratory -2(Based on Core -3 & Core-4)
Course Code: LBTC 806
Course Credit: (3-0-6) 3

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	3 hour	15
2	Internal Assessment II	3 hour	15
3	End Semester	6 hours	30
4	Attendance/Assignment/Class performance	Each semester	5

Note: The best one out of two Internal Assessments will be taken



PG III Semester/ Integ. UG/PG IX Semester, Core-2

Course: **Microbial Biotechnology**
Course Code: **LBTC- 902**
Course Credit: **(3-0-0) 3**

Unit-1

Microbial biotechnology, scope and techniques, Bioprospecting of microbial diversity, Isolation and preservation of industrially important microorganisms.

unit -2

Genomics, Transcriptomics, Proteomics, Metabolomics, metagenomics and Systems Biology. Definition, methodology and application in Microbial technology. Functional enzymes.

Unit-3

Production of proteins and enzymes in bacteria, yeast and fungus, recombinant and synthetic vaccines. Microbial polysaccharides and polymers. Microbial resources for biopolymer production.

Unit- 4

Microbes as biocontrolagents microbial insecticides (Baculoviruses, entomopathogenic fungi, *Bacillus thuringiensis*, *Bacillus sphaericus*, *Bacillus popillae*, Microbe derived inhibitors. Entamopathogenic viruses (Baculovirus, Nuclear Polyhedrosis Virus)

Unit-5

Microbial biomass production, utilization of plant biomass by microorganisms (lignocellulose biodegradation). Application of lignolytic microorganisms and enzymes in biodegradation of recalcitrant xenobiotics

Q. Shetty 13-4-17
J. Jaisankar 13-4-17
A. Kulkarni 13-04-17

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PG III Semester/ Integ. UG/PG IX Semester, Core-3

Course: **Animal Biotechnology**
Course Code: **LBTC 903**
Course Credit: **(3-0-0) 3**

Unit - 1

Introduction to the balanced salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, Serum & protein free defined media and their applications.

unit - 2

Primary and secondary cell culture, Development of cell lines, Biology and characterization of the cultured cells. Basic techniques of mammalian cell cultures in vitro.

Unit - 3 .

Maintenance of cell culture, Cell Passaging, Measuring parameters of growth, Measurement of viability and cytotoxicity.

Unit - 4

Cell synchronization, Cell transformation, Apoptosis, Cryopreservation, Common cell culture contaminants.

Unit - 5

Applications of animal cell culture: cell culture based products, vaccines, Hybridoma technology and monoclonal antibodies, stem cells and their applications, Animal cloning, IVF technology, Organ, organotypic and histotypic cultures.

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration.

Q. Shetty 13-4-17
J. Jaisankar 13-4-17
A. Kulkarni 13-04-17

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PG III Semester/ Integ. UG/PG IX Semester, Elective

Course: a) Bioprocess Technology

Course Code: LBTC-904

Course Credit: (3-0-0) 3

Unit 1

Introduction to bioprocess engineering, bioreactors, isolation, preservation and maintenance of industrial microorganisms, kinetics of microbial growth and death, media formulation for industrial fermentation. Designing of a fermenter/Bioreactor, Air and media sterilization.

Unit 2

Types of fermentation process, analysis of batch fed batch and continuous bioreactions, stability of microbial reactors, specialized bioreactors (pulsed, fluidized, photo bioreactors etc.), Measurement and control of bioprocess parameters

Unit - 3

Downstream processing, removal of microbial cells and solid matters, foam separation, precipitation, filtration, centrifugation, cell disruption, liquid-liquid extraction, chromatography, membrane process, drying and crystallization

Unit - 4

Industrial production of chemicals: solvents (acetone, butanol). Microbial production of Bioflavourant and Biocolourant antibiotics (penicillin, streptomycin, tetracycline) amino acids (lysine, glutamic acid)

Unit - 5

Food Biotechnology: Food spoilage and preservation process. Causative organisms and process. Physical and chemical preservation process. Dairy products, wine, beer and other alcoholic Beverages. Mushroom-types, isolation and culture

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration.

Suggested Readings

1. General Microbiology: Sullia SB and Shantharam S
 2. Microbial Biotechnology: Glaser AN and Nilaido
 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. The Handbook of Microbial Bioresources by V.K. Gupta, G.D. Sharma
- PG III Semester/ Integ. UG/PG IX Semester, Elective

Abhitt

J. J. J.
13-4-17

Ashish
13-04-17



Course: Genomics and Proteomics
Course Code: LBTC 905
Course Credit: (3-0-0) 3

Unit-1

Genomics: Omics and importance, Genome sequencing, Shotgun sequencing, Whole Genome sequencing, Human Genome project.

Unit-2

Transcriptomics: DNA Microarray for analysis of gene expression patterns. cDNA based and oligonucleotide based DNA microarray, Application in system biology and disease diagnosis. Single nucleotide polymorphisms, Predictive genomic medicine.

Unit-3

Proteomics: Proteome- General Account, Isoelectric focusing, Protein profiling by one Dimensional and 2 Dimensional gel electrophoresis, Detection and quantitation of proteins in gels, Pros and cons of various staining methods, Image analysis of 2D gels, Application of 2D PAGE.

Unit-4

Basics of mass spectrometry, Tandem MS/MS spectrometry, MALDI TOF and ESI, and their application in proteomics, Peptide sequencing by tandem mass spectrometry, Protein microarrays, Yeast two hybrid system, Clinical and biomedical application of proteomics

Unit-5

Metabolomics: Metabolomics: Definition, History, Tools, Databases and the Applications.

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

Suggested Readings

1. Genome 3: TA Brown,
2. Principles and Techniques of Biochemistry and Molecular Biology: Wilson and Walker
3. Proteomics: R Twyman
4. Metabolomics: M Tomita and T Nishioka

Q.Bhatt
13.4.17

J. J. J.
13.4.17

A. K. K.
13.04.17



Course: c) Molecular Diagnostics
Course Code: LBTC 906
Course Credit: (3-0-0) 3

Unit - 1

Southern, northern, dot/slot blot; electrophoresis, nucleic acid probe preparation, DNA sequencing, interpretation, troubleshooting
DNA amplification techniques and applications including reverse transcriptase (RT)-PCR, in situ PCR, mutational analysis: PCR, sample preparation, experimental design, primers, controls, product detection

Unit - 2

Ligase chain reaction, nucleic acid sequence-based amplification, branched DNA detection
Introduction to common approved kits and their applications, RT-PCR, relative RT-PCR, competitive RT-PCR; experimental design, controls, kits, and specialized applications, RACE, RNA fingerprinting

Unit- 3

Immunological Diagnostics: agglutination, RIA, ELISA's, immunofluorescence, Western blots -- Bioluminescence

Unit- 4

PCR-based mutation detection: single-stranded conformational polymorphism analysis, heteroduplex analysis, denaturing gradient gel electrophoresis, chemical cleavage, ribonuclease cleavage; allele-specific and multiplex PCR; competitive oligonucleotide priming, protein truncation

Unit- 5

In situ nucleic acid hybridization and amplification: ISH, FISH, ISA. Applications and limitations; DNA chips, automation, gene therapy; applications in diagnosis of genetic disorders, human genome project, ethical considerations

Evaluation Scheme:

S.No	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

Suggested Reading:

1. Immunology: Kuby
2. Molecular Diagnostics: For the Clinical Laboratorian Hardcover: William B. Coleman, Gregory J. Tsongalis
3. Fundamentals of Molecular/Diagnostics: David E. Bruns, Edward R. Ashwood
4. Molecular Biotechnology: Pasternak
5. Textbook of Clinical Chemistry and Molecular Diagnostics: Carl A. Burtis, Edward R. Ashwood, David E. Bruns
6. Introduction to Molecular Diagnostics (DX-INSIGHTS)
7. Biophysical chemistry: Upadhyas&Nath
8. A Biologist Guide to Principle and Techniques: Wilson K and Gounding KE

Q. Mittal
13-9-12

Prashant
13-9-12

A. K. Singh
13-9-12



PG III Semester/ Integ. UG/PG IX Semester, Elective
Course: d) Food Technology
Course Code: LBTC 907
Course Credit: (3-0-0) 3

Unit - 1

Introduction to Food Biotechnology, Application Biotechnology to food stuffs, Food Processing Biotechnology, Unit Operation in Food Processing Unit Operation, Quality factors of Food, food Deterioration and its control.

Unit - 2

Application of Molecular methods in food Production, Methods of molecular cloning in food, Techniques for development of new plant varieties, GMO as food.

Unit - 3

Microbial Biotechnology in Food Products, Role of microbes in food products, Microbial Food Spoilage; Use of microbes for production of food (Yeast, Bacteria and other microorganism-based process).

Unit - 4

Raw material for food and its modification, Bio conversion of food raw material, Conversion of food waste in value added products, (conversion of Whey, molasses, starch and etc.)

Unit - 5

Alternative food products- Mushrooms, Single cell protein, Aqua culture, Microbes as food product, etc.
Social and Regulatory aspects of Food Biotechnology, Regulations for food industries

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

PG III Semester/ Integ. UG/PG IX Semester, Lab - 1
Course: Laboratory -1(Based on Core -1 & Core -2)
Course Code: LBTC 908
Course Credit: (3-0-6) 3

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	3 hour	30
2	Internal Assessment II	3 hour	30
3	End Semester	6 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

PG III Semester/ Integ. UG/PG IXSem, Lab -2

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13.04.17



PG III Semester/ Integ. UG/PG IX Semester, Lab - 1
Course: Laboratory -1(Based on Core -1 & Core -2)
Course Code: LBTC 908
Course Credit: (3-0-6) 3

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	3 hour	30
2	Internal Assessment II	3 hour	30
3	End Semester	6 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

PG III Semester/ Integ. UG/PG IXSem, Lab -2

Pooja Mishra
13.04.17

Pooja Mishra
13.04.17

Akshay
13.04.17

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Course: Laboratory -2(Based on Core -3 & Electives)
Course Code: LBTC 909
Course Credit: (3-0-6) 3

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	3 hour	30
2	Internal Assessment II	3 hour	30
3	End Semester	6 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration



SEMESTER - X

PG IV Semester/ Integ. UG/PG X Semester, Core-1

Course: Bioinformatics & Statistics

Course Code: LBTC 1001

Course Credit: (3-0-0) 3

Unit-1

Introduction to Bioinformatics, Searching database and locating genes, Alignment of gene sequences, Local and Global. Analysis of DNA sequence, Finding and calculating core nucleotide sequence, Predicting ORFs, location of transcription start point and end point, getting polypeptide sequence of the extracted core nucleotide sequence, application of bioinformatics.

Unit-2

Designing primers of specific gene, generation of restriction maps, Generating phylogenetic trees based on DNA sequence and evolutionary relationship Analysis of proteins: Protein classification, homology modeling, trading, prediction of protein structure (secondary and .3 dimensional), tools for structure prediction, validation and visualization.

Unit-3

Computer assisted drug design- concept, methods and practical approaches, various computational methods applied to design the drugs: QSAR and 3DQSAR methods, CADD software demonstration

Unit-4

Diagrammatic, graphical and tabular representations of data; measures of central tendency, dispersion, skewness and kurtosis. Linear regression, Pearson correlation coefficient and Rank correlation

Unit-5

Basic concepts of hypothesis testing, two kinds of error, level significance, p value, t- Test for mean and difference between two means, partial t-test., and Chi square test for goodness of fit. Analysis of variance for one way and two way classified data

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class	Each	10

Obhatt
13.4.17

Potential
13.4.17

Akshay
13.04.17

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PG IV Semester/ Integ. UG/PG X Semester, Elective
Course: Skill Development

PG IV Semester/ Integ. UG/PG X Semester, Elective
Course: a) Plant metabolic Engineering
Course Code: LBTC 1002
Course Credit: (3-0-0) 3

Unit-1

The concept of secondary metabolites, Historical and current views, Importance of secondary metabolites in medicine and agriculture, Introduction to various pathways

Unit-2

Flavanoid pathway: The basic structure, Stereochemistry, Chemical synthesis of different intermediates, The biochemical pathway, Different regulatory points, Intermediate pools and their significance in horticulture, agriculture and medicine, Regulatory genes, Regulation of gene expression

Unit-3

Terpenoid pathway: The basic structure, Stereochemistry, Chemical synthesis of different intermediates, The biochemical pathway, Different regulatory points, Intermediate pools and their significance in horticulture, agriculture and medicine, Regulatory genes, Regulation of gene expression

Unit-4

Polyketoid pathway: The basic structure, Stereochemistry, Chemical synthesis of different intermediates, The biochemical pathway, Different regulatory points, Intermediate pools and their significance in horticulture, agriculture and medicine, Regulatory genes, Regulation of gene expression

Unit-5

Production of secondary metabolites from plant cell cultures; Processes for enhancing the production of secondary metabolites. Technology of plant cell culture for production of chemicals; Bioreactors systems and models for mass cultivation of plant cells, Plant Therapeutic proteins, Edible vaccine, Bioplastic.

Evaluation Scheme:

D. Bhatt
13.4.17

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13.4.17

A. K. Singh
13.04.17

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PG IV Semester/ Integ. UG/PG X Semester, Elective
Course: b) Gene Therapy & Nanomedicine
Course Code: LBTC 1003
Course Credit: (3-0-0) 3

Unit -1

Clinical management and Metabolic manipulation – Diabetes, Phenylketouria, Familial Hypercholesterolemia, Rickets, ADA, Congenital hypo-thyroidism

Unit - 2

Gene therapy – Molecular basis of disease and disease model, Ex-vivo, In-vivo, In-situ gene therapy, Strategies of gene therapy; gene augmentation, Vectors used in gene therapy - retrovirus, adenoviruses, Herpes Synthetic vectors liposomes, receptor mediated gene transfer, Gene therapy trials, HLA typing, Graft rejection.

Unit - 3

Stem cell and tissue engineering: plastic surgery, Embryonic and adult stem cell, Potential use of stem cells - Cell based therapies

Unit - 4

Types of nanoparticles and their development, uses in Nanomedicine and therapeutically applications in medical biotechnology

Unit - 5

Health and Environmental impact of Nanotechnology: Special emphasis to risk assessment and risk management of nanomaterials, ethical and legal aspects of nanotechnology, and nano-industry and nano-entrepreneurship.

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

Suggested Reading:

Q. Bhatt
13-4-17

Pratibha
13-4-17

A. G. Upadhyay
13-04-17

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PG IV Semester/ Integ. UG/PG X Semester, Elective
Course: c) Industrial & Fermentation Technology
Course Code: LBTC 1004
Course Credit: (3-0-0) 3

Unit-1

History and scope of microbial biotechnology, the bioreactor/fermenter-types and parts, scale-up, media design for fermentation processes, Economic aspects of fermentation

Unit-2

Biotechnological application of microorganisms, Production of chemicals and pharmaceuticals (bioconversion), Production of microbial enzymes and their applications, Microbes in mining-Bioleaching, oil recovery, Application of microbes in pharmaceutical industry

UNIT-3

Role of microorganisms in the production and transformation of food and beverages, Food fermentation - Bread leavening by yeast and other micro-organisms, chemical leavening, brewing: Manufacture of Beer- microbiological aspects, Wine - Kinds of wines, manufacture, microbial spoilage, Distilled liquors. Vinegar -methods of manufacture

Unit-4

Fermented vegetables - Pickles - Fermented dairy products — Fermented milk, cheese, butter and other milk products - spoilage of milk - preservation of milk.

Unit-5

Biofertilizers- manufacture, formulation and utilization, Microbes as Biofertilizers -Chemically fixed Nitrogen versus biologically fixed Nitrogen, biopesticides.

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

Suggested Readings

1. Microbial Biotechnology: Alexandern, Glazer Hiroshi Nikaido
2. Molecular Biotechnology: Principles and Applications of Recombinant DNA: Bernal R Glick and Jack J. Pasternak
3. Principles of Fermentation Technology: Whittaker & Stanbury

Q. S. Mittal
13.4.17

P. S. Mittal
13.4.17

A. S. Mittal
13.04.17

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PG IV Semester/ Integ. UG/PG X Semester, Elective
Course: d) Immunotechniques
Course Code: LBTC 1005
Course Credit: (3-0-0) 3

Unit - 1

Introduction to antigen and antibody interaction; Methods for generation of antibody; Monoclonal antibody and Hybridoma technology; Antibody engineering and ScFvs, Abzymes, Immunoprecipitation based methods; Agglutination based techniques; Immunological assays based on molecular binding on solid support (RIA, ELISA, ELISPOT, Western blotting) Methodological options and considerations. Methods for determination of Antigen antibody affinity. Equilibrium dialysis; SPR;

Unit- 2

Microscopic methods based on antigen antibody interactions: Immunocytochemistry, Immunohistochemistry, immunoelectronmicroscopy, Imaging techniques based on immunofluorescence: immunofluorescence microscopy; Confocal microscopy, Intravital imaging methods. Isolation and enrichment of specific immune cells, Flow-cytometer and FACS for quantitative/qualitative analysis and sorting of different immune cell subsets, Magnetic Activated Cell Sorting, Techniques for cell cycle analysis, Assays for apoptosis and cell death, Cell functional assays-lymphoproliferation, Cell-mediated cytotoxicity, mixed lymphocyte reaction, Detection of apoptosis

Unit - 3

Immune response and bacterial, parasitic and viral infections, Immunization, strategies: Vaccination; Recombinant DNA and protein based vaccines, Peptide vaccines, conjugate vaccines; Passive Immunization: Antibody, Transfusion of immuno-competent cells, Stem cell therapy, Cell based vaccines, edible vaccines; Immunoinformatics and vaccine design

Unit - 4

Manipulation of the immune response: Regulation of unwanted immune responses and immunomodulation against autoimmunity, transplantation rejections, cancer therapy, congenital and acquired immunodeficiency; tolerance and autoimmune diseases, Transplantation and Tumor Immunology, diagnosis and therapeutic approaches. Cytokine related diseases: diagnosis and therapeutic application of cytokines

Unit- 5

Adoptive cell transfer therapy; Animal models: Transgenic mice and gene knockout by targeted disruption, in vivo cell tracking techniques, Cell imaging techniques-in vitro and in vivo. Molecular diagnosis of immunological disorders: ex. DiGeorge syndrome, humoral immunodeficiency, cellular immunodeficiency (due to defects in IFN γ receptor α and β chain, MHC Class I)

Evaluation Scheme:

Abhinit
13.4.17

J. Prasad
13.4.17

Abhinit
13.04.17



PG IV Semester/ Integ. UG/PG X Semester, Elective
Course: e) Entrepreneurship Management in Biotechnology
Course Code: LBTC1006
Course Credit: (3-0-0) 3

Unit - 1

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

Unit -2

Nature and characteristics of Management, Scope and Functional areas of management, Management V/s Administration, Roles of Management, Levels of Management, Basic managerial functions, management as profession.

Unit -3

Business opportunity: Business opportunity identification process, project cycle and its management, project identification, project appraisal, project closure report.

Unit - 4

Structure of a Biotechnology Company, Start-up of Biotechnology Company, New Product Development, Market Research, Sales & Marketing Principles, Institutional support system for small scale sector, SIDO, NSIC, SIDBI, SIBRI, BCIL

Unit-5

Intellectual Property Principles in Biotechnology, Health Care Overview and Role of Government in Biotechnology, Ethical and Other Legal Issues in Biotechnology, national and international policies on Biotechnology

Evaluation Scheme:

S. No.	Examination	Duration	% of Marks
1	Internal Assessment I	1 hour	30
2	Internal Assessment II	1 hour	30
3	End Semester	3 hours	60
4	Attendance/Assignment/Class performance	Each semester	10

Note: The best one out of two Internal Assessments will be taken into consideration

Suggested Readings

Q. Shett
13.4.17

Patel
13.4.17

A. K. Singh
13.04.17

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