



### List of New Course(s) Introduced

**Department : *Biotechnology***

**Program Name : *M.Sc.***

**Academic Year : *2017-18***

### ***List of New Course(s) Introduced***

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 803	Bio techniques
6.	LBTC 902	Microbial Biotechnology (Core)
7.	LBTC 904	a) Bioprocess Technology (Elective)
8.	LBTC 905	b) Genomics & Proteomics (Elective)
9.	LBTC 907	d) Food Technology (Elective)
10.	LBTC 1001	Bioinformatics & Statistics (Core)
11.	LBTC 1002	a) Plant metabolic Engineering (Elective)
12.	LBTC 1004	c) Industrial & Fermentation Technology (Elective)
13.	LBTC 1005	d) Immunotechniques (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 Chairman
  - Prof.B.N.Tiwary, Professor Member
  - Prof. Ragini Gothwal, Expert
  - 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 to revise course structure and scheme of examination in the light of UGC directive 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 course 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 A: Biotechnology- Chemistry-Botany

**The following new courses were introduced in the Syllabus of M.Sc.:**

Course Code	Course Name
LBTC 701	Cell Biology
LBTC 702	Microbiology
LBTC 705	Laboratory - 1
LBTC 801	Molecular Biology
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)

The meeting ended with a vote of thanks by the chair

*Ashatt*

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



## Scheme and Syllabus

Proposed Syllabus for  
Integrated UG/PG (Hons.) based on CBCS system  
(Five years/Ten semesters)

(Biotechnology)

(To be implemented from the academic session 2017-2018)

Department of Biotechnology  
School of Life Sciences  
Guru Ghasidas Vishwavidyalaya  
Bilaspur (C. G.) 495 009

*Fairbairn*  
13-6-17

*Devi*  
13-04-17

*Shruti*  
13/04/17

*Romy*  
13/04/17



Integrated UG/PG V Semester					
Code	Course opted	Subjects	Hours/ semester	Hours/ week	Credits
LBTC 501	Core -1	Genetic Engineering	48	03	03
LBTC 502	Core -2	Animal & Plant biotechnology	48	03	03
LBTC 503	Core -3	Bioinformatics	48	03	03
LBTC 504 LBTC 505	Elective	a) Medical Diagnostics b) Biotechnology in Crop improvement	48	03	03
		<b>Laboratory</b>			
LBTC 506	Lab 01	Laboratory - 1 (based on Core -1 & Core -2)	96	06	03
LBTC 507	Lab 02	Laboratory - 2 (based on Core -3 & Elective)	96	06	03
LBTC 508	Seminar	Seminar based on elective	32	02	02
		<b>Total</b>	<b>806</b>	<b>26</b>	<b>20</b>

Integrated UG/PG VI Semester					
Code	Course opted	Subjects	Hours/ semester	Hours/ week	Credits
LBTC 601	Core -1	Industrial Biotechnology	48	03	03
LBTC 602	Core -2	Biosafety, Bioethics & IPR	48	03	03
LBTC 603 LBTC 604	Elective	a) Fermentation Technology b) Gene therapy	48	03	03
		<b>Laboratory</b>			
LBTC 605	Lab 01	Laboratory - 1 (based on Core -1 & Core -2)	96	06	03
LBTC 606	Lab 02	Dissertation on electives	192	12	06
		<b>Total</b>	<b>384</b>	<b>27</b>	<b>18</b>

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
		<b>Laboratory</b>			
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
		<b>Total</b>	<b>384</b>	<b>24</b>	<b>18</b>

*Dehutt*  
13/04/17

*Buradua*  
13.4.17

*AE/ky*  
13.04.17



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

Integrated UG/PG VISEm, Dissertation on electives

Course: Dissertation  
Course Code: LBTC 606  
Course Credit: (3-0-6) 3

Evaluation Scheme:

S.No.	Examination	Duration	% of Marks
1	Internal Assessment	2 hour	60
2	End Semester	3 hours	90

### SEMESTER - VII

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<sup>2+</sup>, c-AMP, G-Proteins), MAKK, Notch, TGF-beta, Jak-STAT signaling pathway.

UNIT-4

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

Unit-5

*Shakti*  
13.4.17

*J. Parashar*  
13.4.17

*Ashish*  
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
		<b>Laboratory</b>			
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
		<b>Total</b>	<b>384</b>	<b>24</b>	<b>18</b>

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			
		<b>Laboratory</b>			
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
		<b>Total</b>	<b>384</b>	<b>24</b>	<b>18</b>

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
		<b>Skill Development Courses</b>			
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
		<b>Total</b>	<b>432</b>	<b>27</b>	<b>18</b>

**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.

*Debnath*  
13/04/17

*Potlun*  
13.04.17

*Acharya*  
13.04.17

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.

**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.

**Suggested Readings**

1. Cell (A Molecular approach): Cooper GM
2. Cell and Molecular Biology: Karp G, 3. Cell Biology: Sadava DE
4. Cell and Molecular Biology: Kish VM and Kleinsmith LJ
5. Cell and Molecular Biology: deRobertis and deRobertis
6. Molecular cell Biology: Lodish H, Berk A, Zipursky SL, Paul M and Darnell J

**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**

*Signature*  
13/4/17

*Signature*  
13.4.17

*Signature*  
13.04.17





Integrated UG/PG V Sem, Lab -1  
Course: Laboratory -1 (Based on Core -1 & Core -2)  
Course Code: LBTC 705  
Course Credit: (3-0-6) 3

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 hours	30
4	Attendance/Assignment/Class performance	Each semester	5

Note: The best one out of two Internal Assessments will be taken  
Integrated UG/PG V Sem, Lab -2

*Abhatt*  
13-4-17

*Prakash*  
13-4-17

*Arjun*  
13-04-17  
26



Course: **Laboratory -2 (Based on Core -3 & Core-4)**  
Course Code: LBTC 706  
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

### 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

Rohit  
13/04/17

Abhishit  
13.4.17

Fotichwal  
13.4.17

Akshay  
13.04.17



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 fluorescent microscopes. Electron microscopy: SEM and TEM. X-Ray Crystallography, X-ray diffraction, Bragg equation. Application in structural analysis of biomolecules, Centrifugation Techniques: Principles, types of centrifuges, density gradient centrifugation in isolation of cells, cell 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 radioisotopes. RIA, Non radiolabelling. 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	1hour	15
2	Internal Assessment II	1hour	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: (2009) White R
3. Analytical Chemistry: (2000) Christian G. D.
4. A Biologist Guide to Principle and Techniques: (2009) Willson 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

*Q. Bhatt*  
13.4.17

*Prakash*  
13.4.17

*A. K. S. P.*  
13.04.17

29



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. Entomopathogenic viruses (Baculovirus, Nuclear Polyhedrosis Virus)

**Unit-5**

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

*Abhish*  
13-4-17

*Jatinder*  
13.4.17

*Akshay*  
13.04.17

32



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

Debnath  
13.4.17

J. Patra  
13.4.17

A. K. Saha  
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. S. Jaiswal*  
13.4.17

*A. K. Singh*  
13.04.17

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



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**

*Bohri*  
*13/04/17*

*Fatehwar*  
*13.4.17*

*Ashly*  
*13.04.17*



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

Obhutt  
13.4.17

Pratishtha  
13.6.17

Akshay  
13.04.17





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: Bernaral R Glick and Jack J. Pasternak
3. Principles of Fermentation Technology: Whittaker & Stan bury

*Q. S. Mitt*  
13.4.17

*B. Patil*  
13.4.17

*A. K. B. B. B.*  
13.04.17



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 $\gamma$  receptor  $\alpha$  and  $\beta$  chain, MHC Class I)

Evaluation Scheme:

*Q. Shukla*  
13.4.17

*J. Bhatnagar*  
13.4.17

*Aditya*  
13.04.17