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List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Name of the Subjects	Yellow	
Employability Contents	Green	
Entrepreneurship Contents	Light Blue	
Skill Development Contents	Pink	



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : *Biotechnology*

Programme Name : *M.Sc.*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
1.	LBTC 704	RECOMBINANT DNA TECHNOLOGY
2.	LBTC 803	BIOTECHNIQUES
3.	LBTC 901	PLANT BIOTECHNOLOGY
4.	LBTC 902	MICROBIAL BIOTECHNOLOGY
5.	LBTC 903	ANIMAL BIOTECHNOLOGY
6.	LBTC 906	MOLECULAR DIAGNOSTICS
7.	LBTC 1001	BIOINFORMATICS AND BIostatISTICS
8.	LBTC 1002	PLANT METABOLIC ENGINEERING
9.	LBTC 1003	GENE THERAPY AND NANOMEDICINE
10.	LBTC 1005	IMMUNOTECHNIQUES
11.	LBTC 1006	ENTREPRENEURSHIP MANAGEMENT IN BIOTECHNOLOGY
12.	LBTC 1007	ENVIRONMENTAL BIOTECHNOLOGY
13.	LBTC 1008	DISSERTATION



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:

1. 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:
2. Any other matter by permission of the Chair.
 - (i) Dr. Renu Bhatt, Head
 - (ii) Prof. B.N. Tiwary, Professor
 - (iii) Prof. Ragini Gothalwal,
 - (iv) 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.

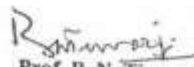
The chairman categorically pointed out that in the UG courses only 03 core subjects have to be defined and the student shall have to opt for honors subject in Ist semester only.

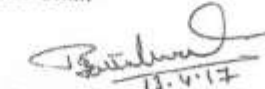
Group A: Biotechnology-Chemistry-Zoology

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 Gothalwal
Expert


Ms. Alka Ekka
Member



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

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 LBTC 905 LBTC 906 LBTC 907	Elective	a) Bioprocess Technology b) Genomics & Proteomics c) Molecular Diagnostics d) Food Technology	48	03	03
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 LBTC 1003 LBTC 1004 LBTC 1005 LBTC 1006	Elective	a) Plant metabolic Engineering b) Gene Therapy & Nanomedicine c) Industrial & Fermentation Technology d) Immunotechniques e) Entrepreneurship Management in Biotechnology f) Environmental Biotechnology	48×2	03×2	03×2
LBTC 1007		Dissertation	288	18	06+03
LBTC 1008			432	27	18
Total					



Course: Recombinant DNA Technology
Course Code: LBTC 704
Course Credit: (3-0-0) 3

Unit - 1

Isolation of DNA and RNA, Quantification of nucleic acids, Polymerase chain reaction, Principle of hybridization, Northern blotting, Southern blotting, Western blotting, South-Western blotting, RFLP, RAPD, AFLP, Radiolabelling of nucleic acids: End labelling, nick translation, labelling by primer extension, DNA sequencing: Maxam-Gilbert (Chemical) and Sanger- Nicolson (dideoxy/ enzymatic) sequencing method, Pyrosequencing.

Unit - 2

Restriction endonucleases: Types of restriction endonucleases, classification and uses, Analysis of restriction fragments, Restriction mapping, DNA modifying enzymes, Nucleases, Polymerases, Phosphatases and Polynucleotide kinase

Unit - 3

Introduction to cloning: Generalized cloning schemes, host genotypes specificities and applications, strategies for selection and screening (Introduction to marker and reporter genes, positive and negative selection, insertion inactivation, α complementation).

Unit - 4

Cloning vectors; Plasmid, Bacteriophage, and other vectors, Cosmid expression vectors, DNA ligases; Joining of DNA Fragments *in vitro*, cohesive and blunt end ligation, linkers, adaptors, Homo polymer tailing, Preparation of the Gene construct, Construction of genomic and c-DNA libraries,

Unit - 5

Strategies of gene delivery, expression in bacteria and yeast, expression in insects cells, expression in mammalian cells, expression in plants, *in vitro* translation, Chromosome engineering, Site directed mutagenesis, Targeted gene replacement, gene editing, gene regulation and gene silencing



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:



PG III Semester/ Integ. UG/PG IX Semester, Core-1

Course: Plant Biotechnology

Course Code: LBTC 901

Course Credit: (3-0-0) 3

Unit - 1

Introduction to the techniques of plant tissue culture, Concept of cellular totipotency, Nutritional requirements, single cell culture, micro-propagation, somaclonal variation, somatic embryogenesis and production of embryoids

Unit - 2

Haploid and double haploid production, Protoplast isolation and culture, Somatic hybridization and cybrid production and their applications in crop improvement, Productions of virus free plants using meristem culture

Unit - 3

Basis of tumor formation, hairy roots, features of Ti and Ri plasmids, mechanisms of transformation, binary vectors, use of 35S and other promoters, genetic markers, use of reporter genes, transformation on monocots, Transgene stability and gene silencing, Herbicide and insect resistance, Plant Genetic Engineering: Transgenic plants, Genetically modified (GM) plants (Bt cotton, BtBrinjal)

Unit - 4

Photoregulation and phytochrome regulation of nuclear and chloroplast genes expression, Molecular biology of light and dark reactions of photosynthesis, Molecular mechanism of nitrogen fixation, Genetics of *nif* genes

Unit - 5

Plant secondary metabolites: Control mechanisms and manipulation metabolic pathways of production of alkaloids and industrial enzymes, biodegradable plastics, therapeutic proteins, Edible vaccines, purification strategies, Green house Technology, Biotic and Abiotic stress

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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 popilliae*, 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

Dr. Anil Kumar AEL/17



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.



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



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



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.



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.



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)



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



PG IV Semester/ Integ. UG/PG X Semester, Elective
Course: f) Environmental Biotechnology
Course Code: LBTC1007
Course Credit: (3-0-0) 3

Unit - 1

Components of Environment - Hydrosphere, lithosphere, atmosphere and biosphere — definitions with examples; Interaction of man and environment; Environmental Studies as a multidisciplinary subject

Unit - 2

Global Environmental Problems - Green House Effect, Acid rain, Ozone depletion, salination, biodiversity loss; chemical and radiation hazards.

Unit - 3

Environmental pollution and degradation- Pollution of air, water and land with reference to their causes, nature of pollutions, impact and control strategies; noise pollution; Habitat Pollution by Chlorinated Hydrocarbons (DDT, PCBs, Dioxin etc)

Unit - 4

Environmental Management - Concept of health and sanitation, environmental diseases — infectious (water and air borne) and pollution related, health hazards due to pesticide and metal pollution, solid waste management

Unit -5

Bioremediation - Oil spills, pesticides, Wastewater treatment, chemical degradation, heavy Metals



PG IV Semester/Integrated UG/PG XSem, Laboratory
Course: Dissertation
Course Code: LBTC 1008
Course Credit: (0-3-12) 9

S.No.	Examination	Duration	% of Marks
1	Internal Assessment	2 hour	90
2	End Semester	3 hour	110

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