DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)

SCHEME OF STUDIES & EXAMINATIONS

B.Tech. 1ST YEAR (SEMESTER–II) (Common for all branches)

Credit Based Scheme w.e.f. 2012-13

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1.	MATH102B	MATHEMATICS-II	3	1		25	75	-	100	4	3
2	PHY102B	ENGINEERING PHYSICS-II	3	1		25	75	-	100	4	3
3	ME101 B **OR** CH101 B	MANUFACTURING PROCESSES (**Gr-B**) ENGINEERING CHEMISTRY **(Gr-A)**	3 3	1 1		25 25	75 75	-	100	4	3
4	EE101B **OR** CSE101B	PRINCIPLES OF ELECTRICAL ENGINEERING (**Gr-B)** INTRODUCTION TO COMPUTERS & PROGRAMMING **(Gr-A)**	3 3	1 1		25 25	75 75	- -	100	4	3
5	ECE102B **OR** BT102B **OR** HUM102 B **OR** CE102 B	BASICS OF ELECTRONICS ENGINEERING BASICS OF BIO TECHNOLOGY ORAL COMMUNICATION SKILLS BASICS OF CIVIL ENGINEERING	3	1		25	75	-	100	4	3
6	ME103B **OR** ME105B	ENGINEERING GRAPHICS & DRAWING (**Gr-B)** ELEMENTS OF MECHANICAL ENGINEERING **(Gr-A)**	1 3	- 1	4 -	40 25	- 75	60 -	100 100	3 4	3
7	PHY104B	PHYSICS LAB-II	-	-	2	20		30	50	1	3
8	ME 107B **OR** CH103B	WORKSHOP PRACTICE (**Gr-B)** CHEMISTRY LAB **(Gr-A)**	- -	- -	4 2	40 20		60 30	100 50	2 1	3
9	EE103B **OR** CSE103B	PRINCIPLES OF ELECTRICAL ENGINEERING LAB (**Gr-B)** COMPUTER PROGRAMMING LAB **(Gr-A)**	- -	- -	2 2	20 20		30 30	50 50	1	3
10	ME109B	ELEMENTS OF MECHANICAL ENGINEERING LAB **(Gr-A)**	-	-	2	20		30	50	1	3
11	GP 102B	GENERAL PROFICIENCY & ETHICS	1	-	-	-	-	50	50	2	3
		Total Gr-B	**17**	**5**	**12**	**245**	**375**	**230**	**850**	**29**	
		Gr-A	**19**	**6**	**8**	**230**	**450**	**170**	**850**	**30**	

Note:

1. Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency Syllabus.
2. Each student has to undergo a workshop of at least 4 weeks (80-100 hours) at the end of II semester during summer vacations. **Out of four weeks, two weeks would be dedicated to general skills and two weeks training for specialized discipline/ department.** The evaluation of this training shall be carried out in the III semester.

3. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
4. Electronic gadgets including cellular phones are not allowed in the examination.
5. Elective course HUM102B (oral Communication Skills) is deleted w.e.f. the session 2013-14.

BT102B - BASICS OF BIOTECHNOLOGY

L	T	P	Credits
3	1	--	4

Sessional marks: 25 Marks
Theory marks: 75Marks
Total: 100 Marks
Duration of Exams: 3 Hours

OBJECTIVES:

- To review the basic concept, nature and scope of biotechnology.
- To develop an intuitive understanding of cell structure and function.
- To study biomolecules; a brief account of structure and functions of carbohydrates, lipids and proteins.
- To study and analyze the concept of gene expression.
- To develop an intuitive understanding of Genetic Engineering including cloning vectors, enzymes, transgenics, DNA fingerprinting and genomics.
- To study the nature of genetic material, Mendel's laws and chromosomes, DNA replication and cell division.
- To visualize the development and also to understand the applications of biotechnology in different areas.

OUTCOME:

- Able to know the nature and the scope of biotechnology.
- Able to know about different biomolecules, their structure and role.
- Able to understand the classical Mendal's laws of inheritance, concept of organization of genetic material into chromosomes and DNA replication mechanisms.
- Able to understand central dogma, genetic code, gene expression, mutations and their molecular basis.
- Able to understand the wide role, involvement and applications of biotechnology in the different fields or areas such as cell culture, enzyme technology, environmental biotechnology, biotechnology in medicine, agriculture, forestry, industry and production of biological inventions.
- Able to imbue the motivation in students for continuous learning and improvement of understanding and
- advancement of knowledge & skills.

BOOKS:

1. Biotechnology, Smith, Cambridge Press.
2. Modern Concepts of Biotechnology, H. D. Kumar, Vikas Publishing House (P) Ltd.
3. Elements of Biotechnology, P. K. Gupta, Rastogi Publications.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

Introduction of the subject **(08.01.18)** 1

UNIT – I
Introduction (9.01.18)

Nature and scope of Biotechnology 1

Cell Structure and Function (15.01.18, 16.01.18, 23.01.2018 & 29.01.2018)

Prokaryotes and Eukaryotes- cell wall, cell membrane, nucleus, mitochondria 2

chloroplast, ribosome, vacuoles, bacteria and viruses: brief descriptions 2

Biomolecules (30.01.18, 5.02.2018 & 6.02.18)

A brief account of structure and functions of carbohydrates, lipids, proteins 3

UNIT– II
Cell Division (12.02.18 & 13.02.18)

Mitosis and meiosis 2

Genes and chromosomes (19.02. 2018 & 20.02.2018)

Classical- Mendel's laws and chromosomes, nature of genetic material 1

DNA and RNA as genetic material, concept of organization of genetic material into chromosomes 1

DNA replication (26.02.2018)

DNA polymerases, replication mechanism 1

UNIT-III

Gene Expression (27.02.2018, 5.03.2018 & 6.03.2018)

Central dogma, genetic code, gene expression-a brief account of transcription and translation 2

House keeping genes, mutations and their molecular basis 1

Genetic Engineering (12.03.2018, 13.03.2018 & 19.03.2018)

An introduction to genetic engineering: cloning (vectors, enzymes) 1

DNA and genomic libraries, transgenics 1

DNA fingerprinting, genomics. 1

UNIT – IV

Applications of Biotechnology (20.03.2018, 26.03.2018, 27.03.2018, 2.04.2018, 3.04.2018, 9.04.2018, 10.04.2018, 16.04.2018, 17.04.2018, 23.04.2018, 24.04.2018, 27.04.2018)

Bioprocess and fermentation technology, cell culture 2

Enzyme technology, biological fuel generation 1

Single cell protein, sewage treatment 1

Environmental biotechnology 2

Biotechnology and medicine 1

Biotechnology in agriculture & forestry industry 2

Food and beverage technology 1

Production of biological inventions 1

Safety in biotechnology 1

Home Assignments: 4-5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%), B (62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record- Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 2nd YEAR (SEMESTER – IV) BIOTECHNOLOGY

Credit Based Scheme w.e.f. 2012-13

Course No.	Course Title	Teaching Schedule				Marks of Class Work	Exam. Schedule		Total Marks	Credits	Duration of Exam. In hours
		L	T	P	Total		Theory	Practical			
GES201B	ENVIRONMENTAL STUDIES **(Common for all branches) (Gr-A)**	3	-	-	3	-	75	-	75	-	3
BT202B	MOLECULAR BIOLOGY	3	1	-	4	25	75	-	100	4	3
BT204B	IMMUNOLOGY	3	1	-	4	25	75	-	100	4	3
BT206B	BIO-ANALYTICAL TECHNIQUES	3	1	-	4	25	75	-	100	4	3
BT208B	INDUSTRIAL MICROBIOLOGY	3	1	-	4	25	75	-	100	4	3
BT210B	BIOCHEMISTRY-II	3	1	-	4	25	75	-	100	4	3
BT212B	MOLECULAR BIOLOGY LAB	-	-	4	4	20	-	30	50	2	4
BT214B	IMMUNOLOGY LAB	-	-	4	4	20	-	30	50	2	3
BT216B	BIO-ANALYTICAL TECHNIQUES LAB	-	-	4	4	20	-	30	50	2	3
BT218B	INDUSTRIAL MICROBIOLOGY LAB	-	-	4	4	20	-	30	50	2	4
GES203B	ENVIRONMENTAL STUDIES FIELD WORK **(Common for all branches) (Gr-A)**	-	-	-	-	-	-	25	25	-	-
GPBT202B	GENERAL PROFICIENCY & ETHICS	1	-	-	-	-	-	75	75	2	3
TOTAL		**19**	**5**	**16**	**40**	**205**	**450**	**220**	**875**	**30**	

NOTE:

- **Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency syllabus.**
- **The Environmental studies (GES201B) and Environment Studies Field work (GES203B) are compulsory & qualifying courses only.**
- **Each student has to undergo Professional Training of at least 4 weeks from the industry, institute, research lab, training center etc. during summer vacation and its evaluation shall be carried out in the V Semester.**
- **The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.**
- **Electronic gadgets including cellular phones are not allowed in the examination.**

BT202B: Molecular Biology

L	T	P	Credits		
3	1	-	04	Sessional Marks:	25
				Theory Marks:	75
				Duration of Exams:	3 Hours

OBJECTIVES:

- To review the basic concept of Genetic Material: Chemical nature, structure & properties of genetic material.
- To develop an intuitive understanding of structure of DNA, alternative forms of DNA, RNA as genetic material
- To study From genes to genomes: Genome size, content and evolutionary complexity
- To study DNA replication and repair: Origin of DNA replication
- To analyze DNA polymerases, mechanism of DNA replication and its regulation
- To study about Gene Expression I- Transcription: Transcription in prokaryotes and eukaryotes
- To develop an intuitive understanding of RNA Processing: Processing of rRNA, tRNA and mRNA, poly-A tailing, 5' capping, nuclear splicing, RNA editing
- To analyze Post- translational modifications
- To analyze Apiculture: Types and caste, Honey comb , Bee keeping, Economic importance;
- To study the Protein Translocation and Localization: Translocation of proteins across ER membrane,,
- To study the importance of Regulation of Gene Expression: Regulation in prokaryotes, operon concept

OUTCOME:

- Able to know the DNA replication and repair: Origin of DNA replication
- Able to know Gene Expression I- Transcription: Transcription in prokaryotes and eukaryotes
- Able to find about Signal Transduction: Signaling molecules and cell-surface receptors,

Books :

- Genes, ed. Benjamin Lewin, Oxford University Press, U.K.
- Genomes, ed. T.A. Brown, John Wiley & Sons Pvt. Ltd.
- Molecular biology of Cell, ed. Bruce Alberts, James D.Watson, Garland Publising.
- Molecular Cell Biology, ed. H. Lodish and Baltimore, W.H., 2000, Freeman &Co.
- Cell & Molecular Biology, ed. E.D.P. Robertis.
- Essential of Molecular Biology, ed. Malacinski, Freifelder Jones, Bartlet Publisher.
- Cell & Molecular Biology, Concepts & Experiments, ed. Gerald Karp, John Wiley & Sons.
- The cell – a molecular approach, ed. Cooper, A.S.M. Press.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)	1
UNIT- I	
(09.01.18 to 31.01.18)	
Genetic Material: Chemical nature, structure & properties of genetic material,	3
DNA as the genetic material- experimental evidences, structure of DNA,	2
Alternative forms of DNA, RNA as genetic material,	2
Genomic organization/ packaging of genetic material,	2
Nucleosome model.	1
From genes to genomes: Genome size, content and evolutionary complexity,	2
C-value paradox, split genes, exons & introns,	

Repetitive & nonrepetitive DNA, overlapping genes. 3

UNIT – II
(01.02.18 to 28.02.18)

DNA replication and repair: Origin of DNA replication, replication of bacterial & 3
eukaryotic chromosomes, rolling circle replication, DNA polymerases, mechanism of DNA 2
replication and its regulation,
Telomere replication, DNA repair mechanisms: photoreactivation, excision, mismatch, post 3
replication recombination repair, SOS repair.
Gene Expression I- Transcription: Transcription in prokaryotes and eukaryotes- 3
transcriptional unit, bacterial and eukaryotic RNA polymerases,
Role of sigma factor, promoter recognition, initiation, elongation & termination of 3
transcription, role of transcription factors, promoters and enhancers.
RNA Processing: Processing of rRNA, tRNA and mRNA, poly-A tailing, 5' capping, nuclear 2
splicing, RNA editing

UNIT- III
(01.03.18 to 31.03.18)

Gene Expression II- Translation: Genetic code, wobble hypothesis, ribosomal RNA and 2
ribosome organization, transfer
RNA, translation process- initiation, elongation, termination, comparison of eukaryotic and 3
prokaryotic protein synthesis systems.
Post- translational modifications: A brief account. 3
Protein Translocation and Localization: Translocation of proteins across ER membrane, 2
protein modifications and folding in ER, transport into mitochondria, chloroplast, nucleus and 3
peroxisomes, molecular chaperones. 2

UNIT- IV
(02.04.18 to 27.04.18)

Regulation of Gene Expression: Regulation in prokaryotes, operon concept, *lac*, *trp* and *ara* 2
operon, catabolite repression, attenuation, 3
Gene regulation in eukaryotes- methylation & acetylation, 2
Hormonal control of gene expression, RNA silencing. 3
Signal Transduction: Signaling molecules and cell-surface receptors, intracellular signal 2
transduction, second messengers, 3
Concept of G- proteins cytokine receptors, tyrosine kinases and MAP kinase pathways. 3

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

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For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject
Chamber consultation hour: Any vacant period.

Note:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
3. The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

BT204B: IMMUNOLOGY

L	T	P	Credits	Sessional Marks: 25
3	1	-	04	Theory Marks: 75
				Duration of Exams: 3 Hours

OBJECTIVES:

- To review the basic concept of Immunology.
- To develop an intuitive understanding of Types of immunity
- To identify Cells and organs play role in immune system of an organism.
- To study various immune responses like humoral and cell mediated.
- To analyze structure and function of antigens , haptens, immunoglobulins and various antigenic determinants allotype, isotype and idiotype
- To study about monoclonal antibodies, hybridoma technology and how the antibody diversity generated.
- To develop an intuitive understanding of Major histocompatibility complex, Antigen processing and B-cell and T-cell activation differentiation.
- To analyze various immunological techniques like Immunodiffusion and immunoprecipitation reactions, Immunoelectrophoresis, ELISA, Radio immunoassay, immunofluorescence.
- To analyze immune effector responses, cytokines, Role of T- helper cells in cytokine production
- To study the cell mediated effector responses and complement system
- To study the importance of immune system in health and diseases, auto immunity, immune response to infectious diseases and hypersensitive reactions.
- To develop an intuitive understanding of Tumor immunity, Tissue and organ transplant.
- To study immunodeficiency and vaccines.

OUTCOME:

- Able to know the types of immunity & Cells and organs play role in immune system, various humoral and cell mediated immune response.
- Able to know structure and function of antigens , haptens, immunoglobulins and various antigenic determinants allotype, isotype and idiotype .
- Able to find about monoclonal antibodies, hybridoma technology and how the antibody diversity generated, Major histocompatibility complex, Antigen processing and B-cell and T-cell activation differentiation.
- Able to find various immunological techniques and importance of immune system in health and diseases.

Books :

1. Immunology, ed. R.A. Goldsby, T. J. Kindt, B.A. Osborne, W.H. Freeman & Company, New York.
2. Essential of Immunology, ed. Ivon Roitt, Peter Delves, Blackswell, Scientific Publications. Oxford.
3. Fundanental of immunology, ed. Paul W.E. Raven press, New York.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)	1
UNIT- I	
BASIC IMMUNOLOGY (09.01.18 to 31.01.18)	
Types of immunity, innate and acquired immunities	2
Cells and organs of immune system BLymphocytes and T- Lymphocytes	3

Primary and secondary lymphoid organs	2
Humoral and cell mediated immune response, hematopoiesis and inflammation.	3

UNIT- II

IMMUNE SYSTEM (01.02.18 to 16.02.18)

Structure and function - Antigens, haptens, superantigens, immunoglobulins	2
Antigenic determinants, isotype, allotype & idiotype,	1
Monoclonal Ab, hybridoma techonology	1
Organization and expression of immunoglobulingenes,	2
Generation of Ab diversity,Class switching.	2

GENERATION OF B-CELL AND T-CELL RESPONSES (19.02.18 to 28.02.18)

Introduction and classification-Major histocompatibility complex	2
Peptide binding by class I and class II molecules, T-Cell receptor	2
Antigen processing and presentation	1
B- and T-cell activation and differentiation,	2
Signaling pathways.	1

UNIT – III

IMMUNOLOGICAL TECHNIQUES (01.03.18 to 16.03.18)

Introduction Immunodiffusion and immunoprecipitation reactions	2
Immunoelectrophoresis,	2
ELISA	2
Radio immunoassay, immunofluorescence.	2

IMMUNE EFFECTOR RESPONSES (19.03.18 to 30.03.18)

Cytokines: properties	2
Role of T- helper cells in cytokine production	3
Cell mediated effector responses, complement system.	3

UNIT – IV

IMMUNE SYSTEM IN HEALTH & DISEASE: **(02.04.18 to 27.04.18)**

Introduction and Classification - Hypersensitive reactions	2
Auto immunity, immune response to infectious diseases	3
Tumor immunity	2
Tissue and organ transplant	2
Immunodeficiency, vaccines.	3

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

4. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
5. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

6. The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

BT206B: BIO-ANALYTICAL TECHNIQUES

L				
T	P	Credits	Class Work Marks	: 25
3	1 -	4	Exam Marks	: 75
			Total Marks	: 100
			Duration of Exam	: 3 Hrs.

OBJECTIVES:

- To study different techniques of microscopy and ultracentrifugation
- To identified the applications of electrophoresis and chromatography
- To develop an understanding for spectrophotometry technique
- To study the nature and properties of radioisotopes

OUTCOME:

- Able to know different techniques of microscopy and ultracentrifugation
- Students will understand the applications of electrophoresis and chromatography
- They will learn spectrophotometry technique
- Understanding the nature and properties of radioisotopes

Text Books/References:

- Biological spectroscopy: Campbell and Durek
- Physical Biochemistry, ed. by D. Friefelder, W.H. Freeman and Company, USA.
- Introduction to instrumental analysis, ed. Robert. D. Braun, 1987. McGraw Hill, UK.
- Analytical Chemistry for techniques, ed. John Kenkel, 1994, Lewis Publishers. Boca Raton, USA.
- Principles and Techniques of practical Biochemistry, ed. K. Willson and J. Walker, 1994, Cambridge University Press, Cambridge.
- Biophysical Chemistry: Principles and techniques, ed. A Upadhyay, K. Upadhyay and N. Nath, 1998, Himalya Publication House, Delhi.
- Physical Biochemistry, ed. K.E. Vanholde, 1985, Prentice Hall Inc., New Jersey.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

UNIT – I

Microscopy (08.01.18 to 16.01.18)

Light, electron (scanning & transmission)	2
phase contrast, fluorescence microscopy, freeze–fracture techniques	2
specific staining of organelles or marker enzymes.	2

Ultracentrifugation (17.01.18 to 31.01.18)

Sedimentation of macromolecules	3
Centrifugation techniques and their applications	2
Differential centrifugation, zonal, density gradient and ultracentrifugation techniques.	2

UNIT – II

Electrophoresis (02.02.18 to 23.02.18)

Paper and gel electrophoresis, immunoelectrophoresis	3
Enzyme linked Immunosorbent assay (ELISA), Isoelectric focusing	4
2-D electrophoresis, capillary electrophoresis	3

Chromatography (26.02.18 to 14.03.18)

Paper chromatograp hy and thin layer chromatography, (TLC)	4
Adsorption, partition, ion -exchange, reverse phase, gel filtration, affinity	3
Gas chromatography, High pressure liquid chromatography (HPLC)	3

UNIT – III

Spectrophotometry (16.03.18 to 05.04.18)

Basic concepts and brief description of application of U.V./ Visible, IR, NMR, ESR	3
Fluorescence, Raman, Mass spectroscopy in structure determination of organic and biomolecules	4
X-ray diffraction (diffraction by fibrous proteins, globular proteins and molecular crystals)	2
CD and ORD	2

UNIT – IV

Radioisotope Techniques (06.04.18 to 27.04.18)

Nature of radioactivity, properties of a , ß and γ rays	2
Measurement of radioactivity, use of radioisotopes in research	3
In vivo and in vitro labelling techniques, double labelling, instruments for monitoring radioactivity	2
Quenching, internal standard channel ratio, external standard ratio	2
Emulsion counting radioactive decay, auto radiography, radioimmunoassay.	3

Home Assignments : 4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Assignment / Project / Performance in the Class	10Marks
2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
3.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

7. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
8. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
9. The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

BT208B: INDUSTRIAL MICROBIOLOGY

L	T	P	Credits		
3	1	-	04	Sessional Marks:	25
				Theory Marks:	75
				Duration of Exams:	3 Hours

OBJECTIVES:

- To review the basic concept of Industrial Microbiology.
- To develop an intuitive understanding Fermentation Processes- Principle, range & components of fermentation processes, Types of fermentation, purification of fermentation products.
- To identify sources, isolation, screening, preservation & maintenance of industrially important microbes, Improvement of industrially important microorganisms
- To analyze Uses of r DNA technology.
- To develop an intuitive understanding of Process Technology for Various Products like Primary metabolites (ethanol, acetone, butanol) citric acid, vinegar, dextran.
- To evaluate production of alcoholic beverages (wine & beer), microbial production of industrial enzymes– cellulose, amylase, protease.
- To analyze production of secondary metabolites – antibiotics, (e.g. pencillin, streptomycin and tetracycline and production of vaccines.
- To study Applications of Industrial Microbiology- Bio-pesticides and biofertilizers and Microbes and biofuels.
- To study the importance of Biofilm formation and ecological implication, bioremediation and industrial waste management.
- To quantify the Microbe-plant interactions examples and importance, Microbial genomics and metabolomics.

OUTCOME:

- Able to know the Types of fermentation, purification of fermentation products, range & components of fermentation processes
- Able to know the sources, isolation, screening, preservation & maintenance of industrially important microbes, Improvement of industrially important microorganisms.
- Able to find Process Technology for Various Products like Primary metabolites (ethanol, acetone, butanol) citric acid, vinegar, dextran, production of alcoholic beverages (wine & beer), microbial production of industrial enzymes– cellulose, amylase, protease.
- Able to find Applications of Industrial Microbiology- Bio-pesticides and biofertilizers and Microbes and biofuels.
- Able to quantify the Microbe-plant interactions examples and importance, Microbial genomics and metabolomics

Books :

1. Industrial Microbiology, ed. L.E. Casida, 1989, Wiley Eastern Ltd.
2. Industrial Microbiology, ed. Prescott & Dunn, 1987, CBS. Publishers.
3. Biotechnology: A hand book of Industrial Microbiology, ed. W. Crueger & A. Crueger
4. Enzymes: Biochemistry, Biotechnology & Clinical Chemistry, ed. T. Palmer, R.Wood publishers

5. Process Engineering in Biotechnology. ed. Jackson, Prentice Hall.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)	1
UNIT- I	
Introduction (09.01.18 to 31.01.18)	
Important historical developments, objectives & scope of the topic	1
Fermentation Processes- Principle, range & components of fermentation processes	2
Types of fermentation, purification of fermentation products.	3
SOURCES, ISOLATION, SCREENING, PRESERVATION & MAINTENANCE OF INDUSTRIALLY IMPORTANT MICROBES	3
Improvement of industrially important microorganisms	2
Selection of mutants	1
Uses of r DNA technology	
UNIT- II	
Process Technology for Various Products (01.02.18 to 28.02.18)	
Primary metabolites (ethanol, acetone, butanol)	2
citric acid, vinegar, dextran	2
production of alcoholic beverages (wine & beer),	2
microbial production of industrial enzymes– cellulose, amylase, protease	3
production of secondary metabolites – antibiotics, (e.g. pencillin, streptomycin and tetracycline)	3
production of vaccines	2
UNIT – III	
Applications of Industrial Microbiology- I: (01.03.18 to 30.03.18)	
Introduction Bio-pesticides and biofertilizers	2
Mode of action of B.T. toxin,	2
Classification and isolation of *cry* genes from *Bacillus thuringiensis*, & microbial protein (Quorn),	3
Microbes and biofuels.	2
Microbial diversity assessment tools and techniques	2
UNIT – IV	
Applications of Industrial Microbiology (02.04.18 to 27.04.18)	
Introduction Biofilm formation and ecological implication	1
Microbe-plant interactions examples and importance,	2
Endophytes associated with agricultural crops, tree and medicinal plants	2
Microbial genomics and metabolomics	2
Microbe as biosensor	1
bioremediation and industrial waste management	2

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject
Chamber consultation hour: Any vacant period.

Note:

- In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
- The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
- The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

BT-210 BIOCHEMISTRY-II

L	T	P	Credits		
4	-	-	04	Sessional Marks:	25
				Theory Marks:	75
				Duration of Exams:	3 Hours

OBJECTIVES:

- To study the basic concepts of the metabolism in biochemistry.
- To study the various reactions, energetics and regulation of the various processes involved in carbohydrate metabolism.
- An overview of pentose phosphate pathway and other interdependent processes.
- To study the Citric acid cycle, energetics and regulation along with its linkage with other cycles.
- To study the mechanism of photosynthesis.
- To study the degradation and biosynthesis of fats and lipids.
- To analyze the importance of amino acids and proteins.
- To study the importance and process involved in phosphorylation and mitochondrial electron transport chain.

OUTCOMES:

- Students will be able to understand the basic concept behind the metabolism of various biomolecules.
- Able to understand the importance of biosynthetic and degradative processes involved in metabolism.
- Understand the reality and potential of biochemistry the medical science and role of metabolism in health.
- Know how to link various metabolical processes after studying the mechanism.

TEXT / REFERENCE BOOKS:

Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M. Cox, WH Freeman and
Company.
Principles of Biochemistry (Hardcover) By Geoffrey Zubay. Publisher: McGraw Hill College.
Biochemistry. By Lubert Stryer. WH Freeman and Co.

Biochemistry (Hardcover) 3rd Ed.By Donald J. Voet and Judith G. Voet. John Wiley and Sons.
Biochemistry and Molecular biology. By William H. Elliott and Daphne C. Elliott. Oxford University Press.
Fundamentals of Biochemistry: Life at the Molecular Level [Import] (Hardcover) By Donald Voet, Judith G. Voet
and Charlotte W. Pratt. Publisher: Wiley.
Principles of Biochemistry (Paperback) By Robert Horton, Laurence A Moran, Gray Scrimgeour, Marc Perry and
David Rawn. Pearson Education.
Biochemistry By U. S. Satyanarayana.

LECTUREWISE PLAN OF THE SUBJECT (08.01.18 to 27.04.18)

Introduction to the subject (08.01.18)	1
UNIT- I Carbohydrate Metabolism	
(09.01.18 to 20.01.18)	
Glycolysis reactions, energetics and regulation, fate of pyruvate under aerobic and anaerobic conditions	2
pentose phosphate pathway and its significance; gluconeogenesis pathway and its regulation	1
control of glycogen metabolism, maintenance of blood glucose levels,	2
biosynthesis of lactose, sucrose and starch, glycogenolysis and glycogenesis	2
(23.01.18 to 31.01.18)	
pyruvate dehydrogenase and its regulation	3
TCA cycle: reactions, regulation and amphibolic nature	1+2
glyoxalate cycle, photosynthesis	2
UNIT- II LIPID Metabolism	
(05.02.18 to 23.02.18)	
Degradation of triacylglycerols by lipases, fatty acid activation, transport of fatty acyl CoA into mitochondria	2
beta-oxidation of saturated fatty acids, oxidation of unsaturated and odd carbon fatty acids, regulation of fatty acids oxidation,	2
alpha & omega oxidation of fatty acids, peroxisomal beta-oxidation & formation & utilization of ketone bodies	2
Acetyl CoA carboxylase, transport of acetyl CoA from: mitochondrial matrix to cytosol.	2
Biosynthesis of tri acylglycerols, regulation of fatty acid metabolism.	2
Biosynthesis of saturated fatty acids, elongation and desaturation of fatty acids,	2
UNIT – III Protein and Amino Acid Metabolism	
(26.02.18 to 24.03.18)	

Essential & non essential amino acids	1
Degradation & biosynthesis of amino acid.	5
Urea cycle: reactions, regulation and its linkage with the citric acid cycle.	2
Nitrogen cycle.	2
Regulation of amino acid bio synthesis.	2

UNIT – IV Nucleic Acid Metabolism
(25.03.18 to 17.04.18)

De novo-biosynthesis of purine and pyrimidine nucleotides.	2
Regulation of purine and pyrimidine nucleotide biosynthesis.	1
Salvage pathways of purines and pyrimidines.	2
Formation of deoxyribonucleotides.	2
Catabolism of purines.	1
Catabolism of pyrimidines.	2

Integration of Metabolism (18.04.18 to 27.04.18)

Mitochondrial electron transport chain, mechanism of mitochondrial oxidative	2
Phosphorylation, hypotheses of oxidative phosphorylation, inhibitors and uncouplers of oxidative phosphorylation.	1+2

Home Assignments :4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weight age) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

- In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
- The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
- The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

BT212B: MOLECULAR BIOLOGY LAB

L	T	P	Credits		
-	-	4	02	class work Marks:	20
				Exam Marks:	30
				Duration of Exams:	3 Hours

OBJECTIVES:

- To review the basic concept Isolation of plasmid DNA from prokaryotic cell.
- To develop an intuitive understanding of Isolation of genomic DNA from prokaryotic cells.
- To study Isolation of DNA from eukaryotic cells.
- To study Qualitative and quantitative estimation of DNA: spectrophotometric/electrophoretic
- To analyze Gel electrophoretic separation of RNA.
- To study about PCR amplification of DNA: visualization by gel electrophoresis.

OUTCOME:

- Able to know the Isolation of plasmid DNA from prokaryotic cell
- Able to know Isolation of DNA from eukaryotic cells.
- Able to find about PCR amplification of DNA: visualization by gel electrophoresis.

Books :

- Genes, ed. Benjamin Lewin, Oxford University Press, U.K.
- Genomes, ed. T.A. Brown, John Wiley & Sons Pvt. Ltd.
- Molecular biology of Cell, ed. Bruce Alberts, James D.Watson, Garland Publising.
- Molecular Cell Biology, ed. H. Lodish and Baltimore, W.H., 2000, Freeman &Co.
- Cell & Molecular Biology, ed. E.D.P. Robertis.
- Essential of Molecular Biology, ed. Malacinski, Freifelder Jones, Bartlet Publisher.
- Cell & Molecular Biology, Concepts & Experiments, ed. Gerald Karp, John Wiley & Sons.
- The cell – a molecular approach, ed. Cooper, A.S.M. Press.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

List of Experiments/ Exercises:

1. Isolation of plasmid DNA from prokaryotic cell.	4
2. Isolation of genomic DNA from prokaryotic cells.	4
3. Isolation of DNA from eukaryotic cells.	4
4. Qualitative and quantitative estimation of DNA: spectrophotometric/electrophoretic.	4
5. Gel electrophoretic separation of DNA & molecular weight determination.	4
6. Gel electrophoretic separation of RNA.	4
7. Isolation of proteins from eukaryotic cells.	4
8. Gel electrophoretic separation of proteins.	4
9. PCR amplification of DNA: visualization by gel electrophoresis.	4
10. Restriction mapping of plasmid DNA, involving single & double digestion of the plasmid with restriction enzyme.	4

Evaluation Procedure

1.	Internal practical	20 Marks
2.	External practical	30 Marks
4.	Final (University Examination)	50 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject
Chamber consultation hour: Any vacant period.

Note:

- In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
- The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
- The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

BT 214 B IMMUNOLOGY LAB

L	T	P	Credits	Class Work Marks: 20
0	0	4	2	Exam Marks: 30
				Total Marks: 50

OBJECTIVES:

- To review the basic concept of Immunology.
- To understand, study and learn the basic/ routine techniques in handling the laboratory animals.
- To study preparation and administration of antigens.
- To study isolation and purification of immunoglobulins.
- To perform the different immunology test such as single radial immunodiffusion test, double immunodiffusion test, Indirect/Dot ELISA, immunoelctrophoresis and differential and total leukocyte count including the detection of blood group of the given blood sample.

OUTCOME:

- Able to know and understand the basic techniques used and performed routinely in immunology.
- Able to detect the blood group of the given blood sample.
- Able to perform the immunoelectrophoresis, single radial and double immunodiffusion test.
- Able to perform the total and differential leukocyte count of the given blood sample.
- Able to perform the ELISA technique.
- Able to imbue the motivation in students for continuous learning and improvement of practical advancement, knowledge & skills.

EXPERIMENT WISE PROGRAMME: (from 08.01.18 to 27.04.18)

List of Experiments/ Exercises:

1. Routine techniques in handling laboratory animals: Feeding, cleaning & bleeding procedures for mice/ rabbit. **(8.01.2018 & 9.01.2018)** 4+4
2. Preparation and administration of antigens. **(15.01.2018 & 16.01.2018)** 4+4
3. Isolation and purification of immunoglobulins. **(29.01.2018 & 30.01.2018)** 4+4
4. To perform single radial immunodiffusion test. **(5.02.2018 & 6.02.2018) and (12.02.2018 & 13.02.2018)** 4+4
5. To perform differential leukocyte count of the given blood sample. **(19.02.2018 & 20.02.2018)** 4+4
6. To perform double immunodiffusion test. **(26.02.18 & 27.02.18) and (5.03.2018 & 6.03.2018)** 4+4
7. To perform Indirect/Dot ELISA. **(12.03.2018 & 13.03.2018) and (19.03.2018 & 20.03.2018)** 4+4
8. To detect the blood group of the given blood sample. **(26.03.18 & 27.03.18)** 4+4
9. To perform total leukocyte count of the given blood sample. **(2.04. 2018 & 3.04. 2018) and (9.04.18 & 10.04.18)** 4+4
10. To perform immunoelectrophoresis. **(16.04.18 & 17.04.18) and (23.04.18 & 24.04.18)** 4+4

Attendance Record – Candidate should attend at least75% attendance of the total practical classes held of the subject.

Chamber consultation hour: Any vacant period.

Note:

- The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course.

BT216B: BIO-ANALYTICAL TECHNIQUES LAB

L	T	P	Credits	
-	-	4	02	Class work Marks:20 ExamMarks:30 Duration of Exams: 3 Hours

Course objectives:

- To discuss basic knowledge about the biosafety and laboratory ethics in detail.
- The primary objectives of this course are to develop the skills to understand the theory and practice of bio analytical techniques.
- To provide scientific understanding of analytical techniques and detail interpretation of results.

OUTCOMES:

- Hands on experience to strengthen the concepts.
- Able to use selected analytical techniques.
- Familiarity with working principals, tools and techniques of analytical techniques.
- To understand the strengths, limitations and creative use of techniques for problem-solving.

TEXT /REFERENCE BOOKS:

- Principles & Techniques of Practical Biochemistry, ed. K. Wilson & J. Walker, 1994, Cambridge University Press, Cambridge.
- Introductory Practical Biochemistry, ed., S.K. Sawhney & Randhir Singh, 2000, Narosa Publishing House, New Delhi.
- An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw Hill, Book Company. U.K.

LECTUREWISE PROGRAMME :(from 08.01.2018 to 27.04.2018)

Introduction of subject and Biosafety and ethics in the laboratory	01
Basic instruments	01
Verification of Beer Lambert Law.	01
Separation of amino acids by paper chromatography.	01
Separation of sugars by paper chromatography.	01
Extraction of lipids from tissues and their separations by using TLC.	02
Partial purification of an enzyme by ammonium sulphate fractionation, Ion exchange & gel filtration chromatography of proteins.	02+03
Determination of molecular weight of an enzyme by gel filtration.	01
Isolation of proteins	02
Separation of proteins by SDS-PAGE.	01
Disc gel electrophoretic separation of isoenzymes.	01
Study the enzyme linked immunosorbent assays (ELISA) and conduct suitable practical.	01

Evaluation Procedure

1.	Viva-Voce/ Test	6 Marks
2.	Laboratory Record	8 Marks

3.	Objective Tests	6 Marks
4.	Major External Practical (University Examination)	30 Marks

Home Assignments :4 –5 assignments are given during the semester.

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT206B (Bio-Analytical Techniques)

BT-218 B INDUSTRIAL MICROBIOLOGY LAB

B.Tech Semester - IV (Biotechnology)

L	T	P	Credits	Class work Marks:	20
-	-	2	08	Exam Marks:	30
				Duration of Exams:	3 Hours

OBJECTIVES:

- To review the basic techniques involved in industrial microbiology laboratory.
- To study the various types and functions of fermenters used in the laboratory.
- .To identify the industrially important microorganisms and their role in industries.
- To isolate important microorganisms from different sources and their use in production of antibiotics and alcohols.
- To study the growth kinetics of various important microorganisms.
- To estimate the enzyme production from laboratory isolated microorganisms qualitatively.

OUTCOMES:

- Able to understand the basic terminology and techniques involved in industrial microbiology laboratory.
- Understand the reality and potential of microbiology in the commercially important industries.
- Know how to apply practical and theoretical knowledge with relation to industrially important organisms.
- Identify the applicability and use of the laboratory techniques used in industrial microbiology.

TEXT / REFERENCE BOOKS:

- Fermentations & Biochemical Hand Book, Principles, Process Design and Equipments. H.C. Vogel, Noyes, 1983.
- Exp. in Microbiology, Plant Pathology, Biotechnology, ed. Aneja K.R., 2003, New Age International Publishers, New Delhi.
- Microbiology lab. Manual, ed. Cappuccino J. & Sheeman N., 2004, Wesley, California.
- Manual of Industrial Microbiology & Biotechnology, Denain Daeivs J.E., 1999, ASM Press.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT208B (Industrial Microbiology). B. TECH. SEMESTER – I

EXPERIMENTWISE PLAN OF THE SUBJECT **(08.01.18 to 27.04.18)**

List of experiments	**Time period**	**No. of Experiments**
Introduction to the laboratory techniques.	08.01.18 -09.01.18	1
Sterilization techniques (media, air, water	15.01.18 -16.01.18	1
Identification of industrially important microorganism e.g. molds, yeasts & bacteria.	22.01.18 -23.01.18 29.01.18 -30.01.18	1
Study of various fermenters (Bioreacters	05.02.18 -06.02.18	1
Production of various products in the lab.- alcohol, wine , celluloses, proteases & bread	12.02.18 -13.02.18 19.02.18 -20.02.18 26.02.18 -27.02.18	1+1+1
Isolation of antibiotic producing microorganisms from the soil	05.03.18 -06.03.18 12.03.18 -13.03.18	1+1
Penicillin production & testing of antimicrobial activity	19.03.18 -20.03.18	1
Determination of cell growth: bacteria, fungi.	26.03.18 -27.03.18 2.04.18 -3.04.18	1+1
Qualitative estimation of various industrially important enzymes produced by various microbes.	09.04.18 -10.04.18	1
Quantitative estimation of various industrially important enzymes produced by various microbes.	16.04.18 -17.04.18	1
Revision	23.04.18 -24.04.18	1

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)

SCHEME OF STUDIES & EXAMINATIONS

B.TECH. 3rd YEAR (SEMESTER – VI) BIOTECHNOLOGY

Credit Based Scheme w.e.f. 2012-13

Course No.	Course Title	Teaching Schedule				Marks of Class Work	Exam. Schedule		Total Marks	Credits	Duration of Exam. In hours
		L	T	P	Total		Theory	Practical			
BT302B	PLANT BIOTECHNOLOGY	3	1	-	4	25	75	-	100	4	3
BT304B	ANIMAL BIOTECHNOLOGY	3	1	-	4	25	75	-	100	4	3
BT306B	ENZYME BIOTECHNOLOGY	3	1	-	4	25	75	-	100	4	3
BT308B	ENVIRONMENTAL BIOTECHNOLOGY	3	1	-	4	25	75	-	100	4	3
BT310B	FOOD BIOTECHNOLOGY	3	1	-	4	25	75	-	100	4	3
BT312B	CELL & TISSUE CULTURE LAB	-	-	4	4	20	-	30	50	2	3
BT314B	ENZYME & FOOD BIOTECHNOLOGY LAB	-	-	4	4	20	-	30	50	2	3
BT316B	ENVIRONMENTAL BIOTECHNOLOGY LAB	-	-	4	4	20	-	30	50	2	3
HUM302B	REPORT WRITING SKILLS **(Common for all branches)**	1	-	-	1	25	50	-	75	1	2
HUM304B	ORAL PRESENTATION SKILLS **(Common for all branches)**	-	-	2	2	20	-	30	50	1	2
GPBT302B	GENERAL PROFICIENCY & ETHICS	1	-	-	-	-	-	75	75	2	3
TOTAL		**17**	**5**	**14**	**36**	**230**	**425**	**195**	**850**	**30**	

NOTE:

1. **Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency syllabus.**
2. **Each student has to undergo Professional Training of at least 4 weeks from the industry, institute, research lab, training center etc. during summer vacation and its evaluation shall be carried out in the VII Semester.**
3. **The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.**

BT302B: PLANT BIOTECHNOLOGY

L	T	P	Credits
3	1	-	4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

OBJECTIVES:

- To review the basic concept of biotechnology methods in plants and scope of plant biotechnology.
- The objective of the course is to impart students widening of the knowledge with modern plant biotechnology processes, including breeding of healthy plants and production of plants with improved characteristics.
- To learn grow, maintain, and propagate specific plant cell types in a sterile environment.
- To allow skills and make students understand the interaction of all elements of the technological process and able to apply the knowledge in the development and implementation in plant biotechnology projects.
- To identify applications of micropropagation and cell-suspension cultures.
- To study the techniques of plant, organ, tissue and cell culture and combined with recent advances in genetic engineering, plant biotechnology is having a significant impact on agriculture, horticulture and forestry.
- To analyze the current applications of plant biotechnology in agriculture are micropropagation, somatic embryogenesis.
- To gain knowledge about germplasm storage and plant modifications by somaclonal variations.
- To develop an intuitive understanding of protoplast isolation, protoplast fusion and somatic hybridization.
- *To analyze in vitro* production of fine chemicals using plant cell cultures for production of secondary metabolites production.
- To study plant molecular biology and become aware of plant gene structure.
- To study and acquire advance knowledge about gene transfer in plants.
- To gain knowledge about various direct and indirect methods of gene transfer in plants.
- To describe the genetic manipulations carried out in plants for the production of transgenic plants and the ultimate goal of transgenic plants (involving introduction, integration, and expression of foreign genes) is to improve the crops, with the desired traits.

OUTCOME:

After successful completion of this course students are expected to be able to:

- To know the scope of plant biotechnology, plant propagation methods for global food security and commercial gains in agricultural *biotechnology.*
- Able to know the types of plant cultures -cell suspension and secondary metabolites, in-vitro production , somaclonal variation, protoplast isolation and fusion:
- To understand the principles behind the isolation of genes and gene transfer methods in

plants.

- To gain theoretical knowledge on the plant biotechnology and acquired practical skills in basic plant tissue culture techniques.
- To evaluate the possibilities of plant biotechnology applications from a technical and a societal point of view.

Books:

1. Introduction to Plant Biotechnology, ed. H.S Chawla, Oxford and IBH Publishers, New Delhi.
2. Handbook of Plant Biotechnology, Vol. I and II. By Paul Christou and Harry Clee. John Wiley and Sons, Ltd.
3. Molecular Biotechnology: Principles and Applications of recombinat DNA, ed. Bernard R Glick, Jack.J. Pasternak, ASM press Washington DC.
4. Plant Biotechnology: The genetic Manipulation of plants by Adrian Slater, Nigel W. Scott, Mark R.Fowler, Oxford University Press.
5. Plant tissue culture: Theory and practice Bhojwani, S.S., Razdan, M.K., (Elsevier Science, Netherlands

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

Introduction to the subject : **S**cope of Plant Biotechnology (08.01.18) 1

UNIT – I

Plant tissue culture: (09.01.18 to 20.01.18)

Cryo and organogenic differentiation of plant cells, 2
Types of culture: seed, embryo, callus, organ, cell and protoplast culture. 1
Axillary bud proliferation, meristem and shoot tip culture, bud culture 1
Organogenesis and embryogenesis 1

Micropropagation: (23.01.18 to 31.01.18)

Micropropagation- Stages, advantages and disadvantages of micropropagation 2
Types of Suspension cultures and applications. 1
Production of secondary metabolites-Applications and problems associated with their production**.** **2**
Practice and questions 1

UNIT - II

In-vitro production of haploids: (02.02.18 to 23.02.18)

Androgenic methods, anther culture, microspore culture 2
Factors effecting regeneration, significance and use of haploids 1
Ploidy level and chromosome doubling, diplodization 2
Gynogenic haploids, factors affecting gynogenesis. **1**

Somaclonal variation:

Nomenclature, methods 1
Applications, basis and disadvantages 2
Gametoclonal variation. 1
Practice and questions 1

UNIT - III

Protoplast Isolation and fusion: (26.02.18 to 14.03.18)

Methods of protoplast isolation	2
Protoplast development and Protoplast fusion	2
Somatic hybridization, identification and selection of hybrid cells	2
Cybrids, potential of somatic hybridization, limitations	2

Germplasm storage and Cryopreservation: (16.03.18 to 27.03.18)

Nomenclature, method, cryoprotectants, pretreatment, freezing, storage, thawing	2
Determination of survival, applications of cryopreservation.	2
Practice and questions	2

UNIT - IV

Plant Molecular Biology: (28.03.18 to 11.04.18)

Plant gene structure as a discontinuous gene, control sequences.	2
Gene transfer in plants:	
Transient and stable gene expression, marker genes, selectable and scorable markers.	2
Gene transfer methods: Direct and indirect methods of gene transfer. (12.04.18 to 27.04.18)	
Agrobacterium mediated gene transfer.	2
Vector-less or direct DNA transfer.	2
Physical and chemical methods of gene transfer.	1
Transgenics in crop improvement:	
Resistance to biotic stresses- insect, virus and disease (fungus and bacterium) resistance	2
Resistance to abiotic stresses, herbicide resistance	2
Transgenic plants as bioreactors and edible vaccines, commercial transgenic crops.	1
Practice and questions	2

Home Assignments: 2–3 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%),
B+ (70% - 79%) , B(62% - 69%),
C+ (55% - 61%), C (46% - 54%),
D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.

BT304B: ANIMAL BIOTECHNOLOGY

L	T	P	Credits
3	1	-	4

Class Work Marks : 25
Exam Marks : 75
Total Marks : 100
Duration of Exam : 3 Hrs.

Objectives:

- To provide students with a scientific and technical understanding of animal biotechnology.
- To develop knowledge on commercial and ethical aspects of the biotechnology industry, and to challenge students with animal cell culture techniques
- To present concepts of the recent technique of ABT and to encourage students to derive informed opinions on the potential benefit or danger of biotechnology and its impact on animal agriculture

Outcomes

- Describe the various biotechnologies available to the animal related fields
- Explain how developments in biotechnology may have applications in those fields
- Locate and critically evaluate scientific literature and experimental studies relating to animal biotechnology and be able to effectively communicate the findings in oral and written form.

Books

- Molecular Biotechnology, ed. Old and Primrose.
- Molecular Biotechnology: Principles and Applications of recombinant DNA, ed. Bernard R. Glick, Jack. J. Pasternak, ASM press Washington DC.
- Animal Cell biotechnology, ed. R.E. Spier and J.D Griffiths, 1988, Academic press, U.S.A.
- Animal Biotechnology, ed. Murray Moo-Young, 1989, Pergamon Press, Oxford.

Section	Lectures **(08.01.18 - 27.04.2018)**	Approx # Lectures
UNIT-I **(08.01.18-29.01.2018)**	History and scope of animal biotechnology. Basic techniques of animal cell culture & their applications Balanced salt solutions and simple growth media, serum quality and cell culture, animal cell lines, organ cell culture and its applications.	1 2 1 2
	Total number of lectures/classes	6
UNIT-II **(30.01.18 – 9.03.18)**	Preservation and maintenance of animal cell lines Cryopreservation and transport of animal germplasm (i.e. semen, ovum and embryos) Protocol for transgenic techniques Retroviral vector method, DNA microinjection method and engineered embryonic stem cell method Yeast artificial chromosome transgenesis, *in vitro* fertilization and embryo transfer	2 3 2 1 3 3
	Total number of lectures	14
UNIT-III **(12.03.18-04.04.18)**	diagnosis of genetic diseases and gene therapy, Molecular maps of animal genomes, chemical carcinogenesis and transfection Oncogenes and antioncogenes.	2 1 2 2
	Total number of lectures	7

UNIT-IV **(07.04.18-26.04.18)**	Techniques for mammalian cells, establishment of immortal cell lines, cloning in mammalian cells, expression of mammalian genes in Vectors, Extinction of gene function by antisense RNA and DNA.	2 1 2 2 2
	Total number of lectures in section 4	09

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Consultation period: Any vacant period.

BT306B: Enzyme Biotechnology

L	T	P	Credits	Sessional Marks: 25
4	-	-	04	Theory Marks: 75
				Duration of Exams: 3 Hours

OBJECTIVES: The objective of the course is to familiarize the student with enzymes, their kinetics, purification and applications in different fields.

The objectives of the course are to:

- Introduce students with enzymes, their nomenclature and classification.
- Elucidate the theories for various enzyme models.
- Understand the different methods of isolation, purification and immobilization of enzyme.
- Study Kinetics of soluble and immobilized enzymes.
- Study chemical and enzyme process.
- Help the student to appreciate the principles of industrial application of biocatalyst.
- Understand various upstream and downstream processes involved in enzyme catalysis
- Appreciate the principles of industrial application of biocatalyst.
- provide students with current trends in the use of soluble enzyme and immobilized enzyme in various biotechnological processes and future potential of enzymes.

OUTCOME:

- Upon successful completion of this course, the student will have sufficient scientific understanding of the enzyme biotechnology.
- Students expected to know Enzyme Commission nomenclature and important representatives of each class of enzymes.
- Students are expected to understand the different methods of isolation and purification enzyme.
- The student will be able to perform immobilization of enzymes.
- Able to utilize the concepts of immobilization to improve the stability, specificity of the core enzymes.
- Students are expected to understand the significant of kinetic constant and able to apply biochemical calculation for enzyme kinetics and Plot graph based on kinetic data.
- Able to Differentiate chemical and enzyme process.
- Able to know the importance of biocatalyst in our daily life and in various commercial industries.
- Able to understand the concepts in enzyme technology and methods for the production of sustainable and high value added products utilizing enzymes as biocatalysts and microbes as efficient producers, in order to meet various human needs.

BOOKS:

- Nature of Enzymology By RL Foster (1979)
- A textbook of enzyme biotechnology By Alan Wiseman (1995)
- Enzymes: Biochemistry, Biotechnology and Clinical Chemistry By Trevor Palmer (2008)
- Enzymes: By M Dixon and EC Webb. EC Longmans, London (1979)
- Lehninger Principles of Biochemistry 6th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company (2012)
- Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 3rd Ed By D Voet. John Wiley and Sons (2004)
- Advances in Enzymology: V. 75 By Alton Meister. John Wiley and Sons Inc (2010)

LECTUREWISE PROGRAMME: (from 08.01.2018 to 27.04.2018)

Introduction of subject (**09.01.18 to 25.01.18)**	01
Enzymes: Introduction, nomenclature and classification of enzymes	02
Mechanism of action	01
Isolation and purification of enzymes	02
Mol. wt. determination and characterization	01
Enzyme specificity	01
Types & theories (lock & key, induced fit & three point attachment),	01
Applications of enzymes in industrial, medical, analytical, chemical, pharmaceutical and food sector.	02
Unit-II (**26.01.18 to 13.02.18) 03.18 to 26.03.18**)	02
Immobilized Enzymes:	
Methods of immobilization,	
kinetics of immobilized enzymes	02
Free vs immobilized enzymes	01
Economic argument for immobilization	01
Effect of solute partition and diffusion on enzyme	02
Applications of immobilized enzymes.	01
Unit-III (**14.02.18 to 21.03.18)**)	05
Enzymes and Bioreactors:	
Bioreactors using immobilised enzymes (enzyme reactor, membrane reactor, continuous flow reactors, packed bed reactor, continuous flow stirred tank reactor, fluidised bed reactor)	
Immobilized enzyme processes	01
Biocatalysts	02
Advantages of enzyme vs chemical catalysts, enzyme vs fermentation	02
Applications of biocatalysts: industry, medicine & analysis, enzyme business in India and abroad	02
Unit-IV (**22.03.18 to 27.04.18**)	02
Large scale/ Industrial uses of enzymes: Enzyme used in detergents, use of proteases in food, leather and wool industries,	
production of glucose syrup from starch using starch hydrolyzing enzymes,	01 02+01
production of syrup containing maltose, enzyme in sucrose industry, glucose from cellulose,	
lactose in dairy industry, glucose oxidase and catalase in food industry and medical application of enzymes	
Enzyme reactions in organic media	01
Design and construction of novel enzymes	01
Artificial enzymes	01
Basic principles of biosensors and their applications.	01

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks

3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Home Assignments :4 –5 assignments are given during the semester.

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%), B (62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

- In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
- The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

BT308B ENVIRONMENTAL BIOTECHNOLOGY

L	T	P	Credits
3	1	-	04

Sessional Marks: 25
Theory Marks: 75
Total Marks: 100
Duration of Exams: 3 Hrs.

OBJECTIVES:

- To review the basic concept of Environment and current status of biotechnology in environment protection.
- To develop an intuitive understanding of microbiology of waste water management and degradation of xenobiotics.
- To understand the concept of biodegradation, biological detoxification and biotechnological management.
- To analyze the concept of bioremediation and the role of biopesticides in integrated pest management and solid waste management.
- To visualize the global environmental problems including ozone depletion, green house effect, acid rain and their impact and management.
- To develop an intuitive understanding of novel methods for pollution control.
- To analyze the Vermi technology as a novel method for pollution control.
- To study the waste water treatment using aquatic plants.
- To study the importance of root zone treatment.
- To evaluate the concept of aiming for biodegradable and ecofriendly products for pollution control.

OUTCOME:

- Able to know about the environment, the problems and the factors responsible for the environmental pollution.
- Able to know the biotechnology and its role and application in management of environment pollution.
- Able to find waste water collection treatments-physical, chemical and biological process, treatment schemes for waste waters of diary, distillery, tannery, sugar, antibiotic industries.
- Able to find applications of bioremediation and restoration of degraded soil and waste land.
- Able to imbue the motivation in students for continuous learning and identify the novel methods and techniques for the pollution control.

Books:

1. Waste water Engineering Treatment and Disposal and Reuse, ed. Metcalf & Eddy.
2. Water Pollution Management hand Book, ed. Lepathak.
3. Waste Water Management, ed. Arceivala.
4. Environment Biotechnology, ed. C.F. Forster and D.A. J. Wase.
5. New Processes of Waste water treatment and recovery, ed. G. Mattock, Ellis Horwood.
6. Biochemical Engineering fundamentals, ed. J.E. Bailey and D F Ollis, 1986, McGraw-Hill. Chapters 12 & 14
7. Environment Biotechnology, ed. Jogdand.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18) 1

UNIT- I

Environment (10.01.18, 12.01.18, 17.01.18)

Introduction, basic concept and issues 1

Current status of biotechnology in environment protection 1

Approaches for management methodology and limitations 1

Environment Pollution (19.01.18, 24.01.18 & 2.02.18)

Types of pollution in air, water and soil 1

Water as a scarce natural resource, sources of pollution, measurement, collection and treatment 2

UNIT- II

Microbiology of Waste Water Treatment (7.02.18, 9.02.18, 16.02.18, 21.02.18 & 23.02.18)

Waste water collection, treatments – physical, chemical and biological process 1

Aerobic and anaerobic process 1

Activated sludge, oxidation ditches 1

Filters, rotating discs and drums, and bioreactors 1

Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotics industries 1

UNIT- III

Microbiology of degradation of xenobiotics (28.02.18, 7.03.18 & 9.03.18)

Xenobiotic compounds, hazardous wastes 1

Biodegradation, ecological consideration, biological detoxification, biotechnological management 2

Bioremediation (14.03.18, 16.03.18, 21.03.18 & 28.03.18)

Introduction, types, advantages 1

Systems, applications and current market 1

Restoration of degraded soil and waste land 1

Biopesticides in integrated pest management and solid waste management 1

UNIT – IV

Global Environmental Problems (30.03.18, 4.04.18 & 6.04.18)

Ozone depletion, UV-B 1

Green house effect 1

Acid rain, their impact and management 1

Novel Methods for Pollution Control (11.04.18, 13.04.18, 20.04.18, 25.04.18, 27.04.18)

Vermitechnology 2

Waste water treatment using aquatic plants 1

Root zone treatment 1

Aiming for biodegradable and ecofriendly products 1

Home Assignments:4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage)	15 Marks

	Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%), B (62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject
Chamber consultation hour: Any vacant period.

Note:

10. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 & 6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.

BT310B: FOOD BIOTECHNOLOGY

L	T	P	Credits		
4	-	-	04	Sessional Marks: 25	
				Theory Marks:	75
				Duration of Exams:	3 Hours

OBJECTIVES:

- To study the basic concept of Food Biotechnology.
- To develop understanding of food borne illness this is very significant in day to day life.
- To understand the applications of various techniques in food industry.
- To analyze the role of microorganisms in food industry.
- To learn how food spoilage can be prevented.
- To develop concept of food storage.

OUTCOME:

- Able to know the importance of temperature and environmental factors about food storage and preservation.
- Able to know the importance of microorganisms in food industry.
- Able to understand the economic importance of food spoilage and post-harvest loss.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

UNIT-I (8.01.18 to 30.01.18)	**No. of Hours**
Historical Background:	
History of microorganisms in food	1
historical developments.	2
Sources, Types, Incidence, and Behavior of Microorganisms in Foods:	
Role and significance of microorganisms,	1
primary sources of microorganisms found in foods,	2
synopsis of common food-borne bacteria,	3
synopsis of genera of molds common to foods,	2
synopsis of genera of yeasts common to foods.	3
UNIT-II (1.02.18 to 28.02.18)	
Intrinsic and extrinsic parameters of foods	1
food additives like colouring, flavours and vitamins.	2
Determining Microorganisms and their Products in Foods:	
Culture, microscopic and sampling methods, conventional, SPC	3
membrane filters, microscopic colony counts, agar droplets,	2
dry films, MPN, DMC, dye reduction, roll tubes,	3
enumeration and detection of food borne organisms,	2
physical, chemical and immunological methods.	3
UNIT-III (1.03.18 to 20.03.18))	
Bioassay, alcoholic beverages and fermented foods.	3
Microbiological examination of surfaces and sampling	2
metabolically injured organism	1
New Protein Foods: Single cell protein (SCP),	1
mushroom, food yeast's, algal proteins.	2
Food Borne Diseases: Bacterial and viral.	3

UNIT-IV (21.03.18 to 27.04.18)

Food Spoilage: Spoilage of fruits and vegetables,	1
microbial spoilage of vegetables, spoilage of fruits,	3
spoilage of fresh and processed meats, poultry,	2
sea foods, spoilage of miscellaneous foods, food preservation,	2
characteristics of radiations of interest in food preservation,	3
destruction of microorgansims and applications, radappertization,	2
radieidation and radurization of food, legal status of food irradiation.	3
Storage and Stability of Food Preservation: High and low temperature,	1
drying, pathogens, psychrotrophs,	1
thermophiles and radiation resistance microorganisms,	2
brief account of food borne diseases.	2

TEXT / REFERENCE BOOKS:

- Modern Food Micro-Biology, ed. J.M. Jay, 1986, Van Nostrand Reinhold Company, New York.
- Food Microbiology, ed. Adams & Moss 1996, CBS Publishers, New Delhi

Home Assignments:4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%), B (62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

11. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 & 6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.

BT312B: CELL & TISSUE CULTURE LAB

L	T	P	Credits
0	0	4	2

Class Work Marks	: 20
Exam Marks	: 30
Total Marks	: 50
Duration of Exam	: 3 Hrs.

OBJECTIVES:

- To review the basic concept of cell and tissue culture.
- To understand, study and learn the basic/ routine techniques in preparation of liquid and solid plant tissue culture media.
- To study transplantation of rooted shoots to soil, induction of callus.
- To study protoplast isolation and culture, anther culture and production of haploid.
- To study induction of interferon in cell culture, induction of somatic embroys using carrot.
- To perform the different cell and tissue culture techniques such as isolation of genomic DNA from plants, primary cell culture of human lymphocytes, culture of fibroblast and epithelial cells, transformation of a plant species using Agrobacterium tumefaciens.

OUTCOME:

- Able to know and understand the basic techniques of cell and tissue culture.
- Able to know transplantation of rooted shoots to soil.
- Able to isolate genomic DNA from plants.
- Able to perform culture of fibroblast and epithelial cells, primary cell culture of human lymphocytes.
- Able to imbue the motivation in students for continuous learning and improvement of practical advancement, knowledge & skills.

EXPERIMENT WISE PROGRAMME: (from 08.01.18 to 27.04.18)

List of Experiments/ Exercises:

1. Preparation of liquid and solid plant tissue culture media. **(8.01.2018 & 9.01.2018)** 4
2. To induce roots at the base of shoots to get plantlet. **(15.01.2018 & 16.01.2018)** 4
3. Transplantation of rooted shoots to soil. **(29.01.2018 & 30.01.2018)** 4
4. Induction of callus. **(5.02.2018 & 6.02.2018) and (12.02.2018 & 13.02.2018)** 4
5. Protoplast isolation and culture. **(19.02.2018 & 20.02.2018)** 4
6. Anther culture and production of haploid. **(26.02.18 & 27.02.18) and (5.03.2018 & 6.03.2018)** 4
7. Induction of somatic embryos using carrot. **(12.03.2018 & 13.03.2018) and (19.03.2018 & 20.03.2018)** 4
8. Transformation of a plant species using *Agrobacterium tumefaciens.* **(26.03.18 & 27.03.18)** 4
9. Isolation of genomic DNA from plants. **(2.04. 2018 & 3.04. 2018)** 4
10. Primary cell culture of human lymphocytes. **(9.04.18 & 10.04.18)** 4
11. Induction of interferon in cell culture. **(16.04.18 & 17.04.18)** 4
12. Culture of fibroblast and epithelial cells. **(23.04.18 & 24.04.18)** 4

TEXT / REFERENCE BOOKS:

- Culture of Animal Cells – A manual of basic techniques, ed. R.I Freshney, John Wiley & Sons, New York.
- Experiments in Plant Tissue Culture, ed. J.H. Dodde and I.W. Robert, 1998.
- Practicals in Plant Biotechnology, ed. H.S. Chawla, Oxford & IBH Publications, New Delhi.
- Plant Tissue Culture: Theory and Practice, ed. S.S. Bhojwani and M.K. Razdan, 1996, Elsevier Science, Netherlands.

Attendance Record – Candidate should attend at least75% attendance of the total practical classes held of the subject.

Chamber consultation hour: Any vacant period.

Note: The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course: BT302B (Plant Biotechnology) and BT304B (Animal Biotechnology).

BT314B: ENZYME & FOOD BIOTECHNOLOGY LAB

L	T	P	Credits		
0	0	4	2	Class Work Marks	: 20
				Exam Marks	: 30
				Total Marks	: 50

Duration of Exam : 3 Hrs.

OBJECTIVES:

- To study the basic concept of enzymes and their filtration techniques.
- To develop understanding of various biochemical tests.
- To understand how microorganisms load can affect food storage.

OUTCOME:

- Able to know the importance of various filtration techniques.
- Able to know the importance of biochemical tests for detecting adultration.

List of Experiments/ Exercises: (from 08.01.18 to 27.04.18)		No. of hours
1.	Purification of an enzyme (oxalate oxidase) by gel filtration and ion exchange chromatography.	4
2.	Testing of purity of purified enzyme (oxalate oxidase).	4
3.	Determination of the molecular weight of enzymes by gel filtration method.	4
4.	Immobilization of an enzyme (alkaline phosphatase) on an insoluble and soluble support.	4
5.	To examine the effect of pH, substrate and temperature on enzyme activity.	4
6.	To check the quality of the given milk sample by MBRT.	4
7.	To isolate, enumerate and purify bacteria and fungi in the given food samples.	4
8.	To characterize the food borne bacteria by biochemical tests.	4
9.	To test the potability of water by MPN.	8
10.	To analyze air of food processing facility for microbial load.	8
11.	To assess the sanitary quality of contact surfaces.	12
12.	To detect adulteration in food.	4

TEXT / REFERENCE BOOKS:

- Enzymes in Industry: Production and Applications, ed. W. Gerhartz, 1990, VCH Publishers, New York.
- Biocatalyst for Industry, ed. J.S Dordrick, 1991, Plenum press, New York.
- Modern Food Microbiology, ed. J.M. Jay, 1986, Van Nostrand Reinhold, New York.

Attendance Record – Candidate should attend at least75% attendance of the total practical classes held of the subject.

Chamber consultation hour: Any vacant period.

Note:

The students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory course.

BT316B: ENVIRONMENTAL BIOTECHNOLOGY LAB

L	T	P	Credits	Class work Marks:20
0	0	4	02	Exam Marks: 30
				Total marks: 50
				Duration of Exams: 3 Hours

OBJECTIVES:

- To determine the water TDS, salinity, alkalinity, hardness and BOD.
- To analyze BOD
- To identify heavy metals in water or soil samples.
- To analyze Estimation of nitrate, phosphate and sulphate in drinking water
- To determine chemical oxygen demand (COD) of sewage samples.
- To develop an intuitive understanding of Isolation of xenobiont degrading bacteria by selective enrichment techniques.
- To analyze Degradation of aromatic hydrocarbons by bacteria.
- To Study on biogenic methane production in different habitats.
- To study Isolation and enrichment of the microorganisms for the degradation of harmful environmental pollutants.
- To study Effect of sulphur dioxide on crop plants
- To analyze Survey of degradative plasmids in microbes growing in polluted environment.

OUTCOME:

- Able to know the water TDS, salinity, alkalinity, hardness and BOD.
- Able to determine Estimation methods for nitrate, phosphate, sulphate and heavy metals in drinking water.
- Able to find chemical oxygen demand (COD) of sewage samples.
- Able to find methods for Isolation and enrichment of the microorganisms for the degradation of harmful environmental pollutants.

Books :

1. Water Pollution Management hand Book, ed. Lepathak.
2. Environmental Biotechnology, 2007. BC Bhattacharyya & Ritu Banerjee. Ed. Oxford University Press.
3. Waste Water Management, ed. Arceivala.
4. Environment Biotechnology, ed. C.F. Forster and D.A. J. Wase.
5. New Processes of Waste water treatment and recovery, ed. G. Mattock and Ellis Horwood.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject	1
1. Determination of water TDS, salinity, alkalinity, hardness and BOD.	1
2.Determination of BOD.	1
3. Estimation of heavy metals in water/soil samples.	1
4.Estimation of nitrate, phosphate and sulphate in drinking water.	1
5. Determination of chemical oxygen demand (COD) of sewage samples.	1

6. Isolation of xenobiont degrading bacteria by selective enrichment techniques. 1
7. Degradation of aromatic hydrocarbons by bacteria. 1
8. Study on biogenic methane production in different habitats. 1
9. Isolation and enrichment of the microorganisms for the degradation of harmful environmental pollutants. 1
10. Effect of sulphur dioxide on crop plants 1
11.Survey of degradative plasmids in microbes growing in polluted environment. 1

Evaluation Procedure

1.	Internal practical exam	20 Marks
2.	External exam	30 Marks
3.	Total Marks	50 marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

- In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
- The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
- The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL
SCHEME OF STUDIES & EXAMINATIONS
B.TECH. 4th YEAR (SEMESTER – VIII) BIOTECHNOLOGY
Credit Based Scheme w.e.f. 2011-12

Course No.	Course Title	Teaching Schedule				Marks of Class Work	Exam. Schedule		Total Marks	Credits	Duration of Exam. In hours
		L	T	P	Total		Theory	Practical			
BT402B	DNA MICROARRAY TECHNOLOGY	4	-	-	4	25	75	-	100	4	3
BT404B	STEM CELL TECHNOLOGY	4	-	-	4	25	75	-	100	4	3
	DEPT ELECTIVE –I	4	-	-	4	25	75	-	100	4	3
	DEPT ELECTIVE –II	4	-	-	4	25	75	-	100	4	3
BT414B	SEMINAR	-	-	2	2	50	-	-	50	2	3
BT415B	PROJECT	-	-	8	8	75	-	125	200	8	3
GFBT402B	GENERAL FITNESS FOR THE PROFESSION	1	-	-	-	-	-	100	100	4	3
TOTAL		**17**		**10**	**27**	**225**	**300**	**225**	**750**	**30**	

DEPT. ELECTIVE-I **DEPT. ELECTIVE-II**

BT452B	BIOPHARMACEUTICAL TECHNOLOGY	BT464B	BIOCATALYSTS & TRANSFORMATION
BT454B	HUMAN GENOME	BT466B	PROTEIN ENGINEERING
BT456B	VIROLOGY	BT468B	UNIT OPERATIONS IN BIOTECHNOLOGY
BT458B	BIOETHICS & INTELLECTUAL PROPERTY RIGHTS	BT462B	BIOFERTILIZERS & BIOPESTICIDES

NOTE:

- **Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Fitness for the Profession syllabus.**
- **Project involving design, fabrication, testing, computer simulation, case studies etc., which had been commenced by students in VII semester will be completed in the VIII semester.**
- **For the course BT414B -Semianr, a student will select a topic from emerging areas of Biotechnology and study it independently. Student will give a seminar talk on the topic.**
- **The evaluation of the student for his/her General Fitness for the Profession shall be carried out by a team consisting of Dean of faculty, Chairperson of the department and external examiner appointed by the University.**
- **The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.**
- **Electronic gadgets including cellular phones are not allowed in the examination.**

BT402B -DNA MICROARRAY TECHNOLOGY

L	T	P	Credits	Sessional Marks: 25
4	-	-	4	Theory Marks: 75
				Total Marks: 100
				Duration of Exams: 3 Hrs.

OBJECTIVES:

- To review the basic concept of DNA microarray technology.
- To develop an intuitive understanding of microarray designs, methods of fabrication, SAGE and parallel sequencing.
- To understand the concept of image analysis (basic data analysis, dye bias, mixed cell population, visualization by reduction of dimensionality.
- To analyze the concept of cluster analysis including hierarchical clustering, K-means clustering, distance measures, time series analysis, gene normalization, integrated analysis and system biology.
- To develop an intuitive understanding of reverse engineering of regulatory network including time series approach, steady state approach, limitation of network modeling, molecular classifiers-feature selection, validation selection, genotyping and resequencing chips.
- To analyze the concept of experimental design and interpretation of results by making use of factorial design, two channel array, hypothesis driven experiments, interpretation of results and limitation of expression analysis.
- To visualize the development of softwares for data analysis, software issues, data formats and commercial software packages.

OUTCOME:

- Able to know the technology behind the DNA microarray, designs, methods of fabrication and SAGE.
- Able to know the image analysis.
- Able to know the cluster analysis.
- Able to understand the reverse engineering of regulatory network.
- Able to know and understand the experimental designs used in microarray technology and also to understand how to interpret the results.
- Able to use software packages for the data analysis.
- Able to imbue the motivation in students for continuous learning and improvement of technical advancement, knowledge & skills.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18) 1

UNIT-I

Introduction (9.01.18, 10.01.18, 15.01.18, 16.01.18 & 17.01.18)

Technology behind DNA microarray 1

Microarray designs 1

Methods of fabrication, hybridization 1

SAGE 1

Parallel sequencing 1

Image analysis (23.01.18, 24.01.18, 29.01.18, 30.01.18, 5.02.18 & 6.02.18))

Basic data analysis 2

Normalization, dye bias 1

Expression indices, fold change	1
Mixed cell population, visualization by reduction of dimensionality	2

UNIT-II

Cluster analysis (12.02.18, 13.02.18, 19.02.18, 20.02.18, 21.02.18, 26.02.18 & 27.02.18)

Hierarchical clustering	1
K-means clustering	1
Self-organizing maps, distance measures	1
Time series analysis	1
Gene normalization, function prediction	1
Integrated analysis and system biology	2

UNIT- III

Reverse engineering of regulatory network (28.02.18, 5.03.18, 6.03.18, 7.03.18, 12.03.18, 13.03.18, 14.03.18 & 19.03.18)

Time series approach	1
Steady state approach	1
Limitation of network modeling	1
Molecular classifiers- feature selection	1
Validation schemes	1
Performance evaluation	1
Genotyping and re-sequencing chips	2

UNIT-IV

Experimental design and interpretation of results (20.03.18, 21.03.18, 26.03.18, 27.03.18, 28.03.18 & 2.04.18)

Factorial design	1
Two channel array	1
Hypothesis driven experiments	1
Independent verification	1
Interpretation of results	1
Limitation of expression analysis	1

Softwares for data analysis (3.04.18, 4.04.18, 9.04.18, 10.04.18, 11.04.18, 16.04.18, 17.04.18, 23.04.18, 24.04.18)

Software issues and data formats	3 & 2
Commercial software packages	3

BOOKS:

1. Guide to Analysis of DNA (Microarray DNA), ed. Steen Knudsen, 2004, John Wiley, U.S.A.
2. DNA Microarray, ed. Bowtell. D
3. DNA Arrays: Technology and Experimental Strategies, ed. Grigorenko *et al*.

Home Assignments: 4 -5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%), B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

1. In the semester examination, the examiner will set 08 questions in all, selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 & 6 from unit III and 7 & 8 from unit IV). The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

BT404B: STEM CELL TECHNOLOGY

L	T	P	Credits
4			
-	-	4	

Class Work Marks : 25

Exam Marks : 75

Total Marks : 100

Duration of Exam : 3 Hrs.

OBJECTIVES:

- To study stem cells and its early stages of development in animal embryo
- To understand the concept of regeneration of different tissues
- To learn the concept of hemopoietic stem cell and its clinical therapy
- To differentiate between various types of connective tissue

OUTCOME:

- Able to know about various types of stem cells
- Students will be able to define the concept of renewal of tissues
- Able to learn the clinical aspect of hemopoietic stem cells
- Able to learn the various types of connective tissues.

Text Books/References:

- Development Biology, ed. Scott F, Gilbert
- Hematology, ed. William J. Williams, Earnest Beutler, Allan J.U and Marshall A.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

UNIT – I

Introduction (08.01.18 to 16.01.18)

Stem cells, properties of stem cells	2
Difference between embryonic and adult stem cell	2
Potential applications/ uses of stem cells	2

Cell Diversification in the early animal embryo (17.01.18 to 31.01.18)

Early development of Xenopus, spatial segregation, inductive interactions	2
Complex pattern of cell responses, cellular response to a signal, the role of an intracellular clock	2
Early mammalian embryo development	1
Control of mammalian embryonic stem cells on pathways of development.	2

UNIT- II

Renewal by Stem Cells (02.02.18 to 23.02.18)

Epidermis, division of stem cells, epidermal stem cells	3
Differentiation of epiderm al cells and synthesis of keratins	3
Epidermal stem cells as a su bset of basal cells, regulation of basal cell proliferation	2
Secretory cells in the epidermis and their population kinetics.	2

Genesis, modulation and regeneration of skeletal muscle (26.02.18 to 14.03.18)

New skeletal m uscle cells form by the fusion of myoblasts	3
Muscle cells can vary their properties by changing the p rotein isoforms that they contain	4

Some myoblasts persists as quiescent stem cells in the adult 3

UNIT-III

The concept of the hemopoietic stem cell (16.03.18 to 05.04.18)

Hemopoietic stem cell disorders, classification and manifestations 2
Aplastic and myleodysplastic disorders, clinical applications of colony stems 2
Complications of gene therapy, replacement therapy, marrow transplantation 4
Immunological principles, preservation and clinical use of blood and blood components 3

UNIT - IV

Fibroblast and their transformations (06.04.18 to 27.04.18)

Connective tissue cell family 1
Fibroblasts and their character in response to signals in the extracellular matrix, its influence on connective tissue
Cell differentiation 4
Action of signaling molecules on regulation of cell production 3
Remodeling of bone, osteoblasts secretion of bone matrix, erosion 2
Cartilage development, bone structure stabilization by connective tissue framework and selective cohesion of cells 3

Home Assignments : 4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Assignment / Project / Performance in the Class	10Marks
2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
3.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

- In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
- The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
- The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

BT458B: BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS (ELECTIVE-I)

L T P Credits

4 - - 4

Class Work Marks : 25 **Exam Marks : 75**

Total Marks : 100 **Duration of Exam : 3 Hrs.**

COURSE OBJECTIVES:

- To understand the Biosafety and IPR issues in biotechnology.
- Awareness of Biotechnology Research implication.
- Awareness about the GMO and environment.
- Guidelines related to IPR and Biosafety.
- National and international conventions related to IPRs developments.

OUTCOME:

- Able to understand the concept and utility of Biosafety issues in Biotechnology.
- Able to understand the from examples of case studies related to the concept of the course.
- Able to comprehend and develop the scientific temper related to the biotechnology, IPR and Biosafety issues.
- Discussion of the related few specific research papers to understand the implications of biotechnology, patenting of biological material and biosafty issues.
- Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

BOOKS/WEB REFERENCES:

- Sasson A, Biotechnologies and Development, UNESCO Publication, 1988. Sasson A. Biotechnologies in developing countries present and future, UNESCO publisher, 1993.
- Ben Mepham, Bioethics: An introduction to Biosciences. Oxford University Press.
- Singh K. Intellectual Property Rights on Biotechnology, BCIL, New Delhi
- IMPORTANT LINKS:
- http://www.w3.org/IPR/
- http://www.wipo.int/portal/index.html.en

- http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
- www.patentoffice.nic.in
- www.iprlawindia.org/ - 31k - Cached - Similar page

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)	1
UNIT- I, Bioethics	
09.01.18 to 20.01.18	
Reviews of basic concepts of Ethical issues in BT	1
Ethical issues related to biotechnology and biomedical research	2
Bioethics and their impact to living system,	1
public education of the processes of biotechnology involved in generating new forms of life forms	2
23.01.18 to 31.01.18	
Biotechnology, bioethics and informed decision making	2
Discussion of issues and implications of unit objectives	2
UNIT- II, Socioeconomic Impacts of Biotechnology	
02.02.18 to 23.02.18	
Introduction, and historical aspects	1
Beneficial applications and development of research focus to the need of the poor, identification of directions for yield effect in agriculture	4
bioremediation and environmental impacts of release of GMOs	3
social issues to biotechnology	2
Case study/ discussion/ review of unit objectives	1
UNIT – III Bio-safety	
26.02.18 to 14.03.18	
Introduction, Bio-safety regulation and national and international guidelines r-	3

DNA guidelines

Experimental protocol approval, levels of containment, environmental aspects of biotech applications 4

16.03.18 to 26.03.18

Use of genetically modified organisms and their release in environment , special 2

Methods/procedures for r-DNA based product production (GMP). 2

UNIT – IV Intellectual Property Rights-I

27.03.18 to 17.04.18

Intellectual property rights, and Intellectual Property protection 1

patents and methods of application of patents 1

Trade secret, copy rights, , trade mark, 1

legal implications, farmers rights, plant breeder's rights 1

Intellectual Property Rights-II: (18.04.18 to 27.04.18)

International and National conventions on Biotechnology and related area 1

GATT, TRIPS, Biodiversity convention, etc. 1

Home Assignments : 2-4 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: In vacant period.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks. All questions will carry equal marks.

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BT466B: PROTEIN ENGINEERING (ELECTIVE-II)

L	T	P	Credits	Sessional Marks: 25
4	-	-	04	Theory Marks: 75
				Duration of Exams: 3 Hours

OBJECTIVES:

- To review the basic concept of protein engineering.
- To develop an intuitive understanding Conformation of proteins in general and enzymes in particular.
- To identify Chemical and physical characterization of proteins (properties of amino acids, peptides and proteins)
- To study Structural classification of proteins (primary, secondary, tertiary and quarternary structures),
- To develop an intuitive understanding of Ramachandran plots.
- To determine protein structures through Chemical (Edman degradation) and physical (X-ray crystallography) NMR and MS-MALDI TOF.
- To study the importance of protein engineering and Protein database analysis
- To analyze Site- directed mutagenesis for specific protein function.
- To study the Methods to alter primary structure of proteins, examples of engineered proteins
- To analyze Applications of protein engineering and protein folding
- To study the importance protein design (principles and examples).

OUTCOME:

- Able to know concept of protein engineering, Chemical and physical characterization of proteins (properties of amino acids, peptides and proteins)
- Able to find Structural classification of proteins (primary, secondary, tertiary and quarternary structures), and Ramachandran plots.
- Able to find determine protein structures through Chemical and physical methods.
- Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

Books :

- Moody PCE, and AJ Wilkinson, Protein Engineering, IRL press Oxford, 1990.
- Köhrer C and Raj Bhandary U.L., Protein Engineering (Nucleic Acids and Molecular Biology), Springer, 1 edition.
- Cleland J. L. and Craik C.S., Protein Engineering: Principles and Practice, Wiley-Liss, 1edition.
- Lehninger, Principles of Biochemistry 4th Ed. By David L. Nelson and Michael M. Cox, WH Freeman and
- Company.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)	1
UNIT- I	
INTRODUCTION (09.01.18 to 31.01.18)	
Conformation of proteins in general and enzymes in particular	3

Chemical characterization of proteins (properties of amino acids, peptides and proteins)	3
Physical characterization of proteins	2
Effect of amino acids on structure of proteins.	2
S	

UNIT- II

STRUCTURE OF PROTEINS: (02.02.18 to 28.02.18)

Structural classification of proteins (primary, secondary, tertiary and quarternary structures),	3
Ramachandran plots	3
super secondary structures and motifs.,	3

UNIT – III

DETERMINATION OF PROTEIN STRUCTURES: (01.03.18 to 30.03.18)

Chemical (Edman degradation)	3
physical (X-ray crystallography)	2
NMR	2
MS-MALDI TOF	2
in silico methods.	3

UNIT – IV

PROTEIN ENGINEERING:: (01.04.18 to 27.04.18)

Introduction - Protein database analysis	2
Site- directed mutagenesis for specific protein function	3
Methods to alter primary structure of proteins, examples of engineered proteins	2
Applications of protein engineering and protein folding	3
Protein design (principles and examples).	3

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

12. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
13. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
14. The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted