Program outcomes (POs)- Engineering & Technology

Engineering Graduates will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in

independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES: (PSOs)-B.Tech(BIOTECH)

At the end of the program the student shall be able to

PSO 1: Attain in-depth knowledge about biological sciences and inculcate research aptitude.

PSO 2: Function professionally in an increasingly international and rapidly changing world due to the advances in technologies and concepts.

PSO3: Exercise excellent leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

PSO 4: Contribute to excel in careers by being a part of success and growth of an organization with which they are associated.

PSO 5: To impart state-of-the-art technology and practical training incommensurate with industrial need.

M.D.UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATION

2ND YEAR B.TECH IN BIOTECHNOLOGY, F SCHEME

SEMESTER III

EFFECTIVE FROM THE SESSION 2010-11

S.N.	Course No.	Subject	Teaching Schedule				Examination Schedule				Duration of Exam
			L	T	P/D	Total	Th.	Sess	P/VV	Total	
1.	BT-201 F	Cell Biology	3	1	-	4	100	50	-	150	3
2.	BT-203 F	Microbiology	3	1	-	4	100	50	-	150	3
3.	BT-205 F	Biochemistry	4	1	-	5	100	50	-	150	3
4.	BT-207 F	Genetics	3	1	-	4	100	50	-	150	3
5.	BT-209 F	Fundamentals of Life Sciences	3	1	-	4	100	50	-	150	3
6.	BT-211 F	Organic Chemistry	3	1	-	4	100	50	-	150	3
7.	BT-213 F	Cell Biology & Genetics Lab.	-	-	2	2	-	50	50	100	2
8.	BT-215 F	Microbiology Lab.	-	-	3	3	-	50	50	100	3
9.	BT-217 F	Biochemistry Lab.	-	-	3	3	-	50	50	100	3
10.	BT-219 F	Fundamentals of Life Sciences Lab.	-	-	2	2	-	50	50	100	2

M.D.UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATION

2ND YEAR B. TECH. IN BIOTECHNOLOGY, F SCHEME

SEMESTER IV

EFFECTIVE FROM THE SESSION 2010-11

S.N.	Course No.	Subject	Teaching Schedule				Examination Schedule				Duration of Exam
			L	T	P/D	Total	Th.	Sess	P/VV	Total	
1.	BT-202 F	Molecular Biology	4	1	-	5	100	50	-	150	3
2.	BT-204 F	Immunology	3	1	-	4	100	50	-	150	3
3.	BT-206 F	Industrial Microbiology	3	1	-	4	100	50	-	150	3
4.	BT-208 F	Bioprocess Engineering-I	3	1	-	4	100	50	-	150	3
5.	BT-210 F	Bio-analytical Techniques	3	1	-	4	100	50	-	150	3
6.	BT-212 F	Biostatistics	3	1	-	4	100	50	-	150	3
7.	BT-214 F	Molecular Biology Lab.	-	-	3	3	-	50	50	100	3
8.	BT-216 F	Immunology Lab.	-	-	3	3	-	50	50	100	3
9.	BT-218 F	Industrial Microbiology Lab.	-	-	3	3	-	50	50	100	3
10.	BT-220 F	Bio-analytical Techniques Lab.	-	-	2	2	-	50	50	100	2

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3rd SEM

BT-201 F **CELL BIOLOGY**

Periods/week L:3 T:1 **MAX. MARKS: 150**
Duration of Ext. Exam: 3 Hrs **Sessional: 050**
External: 100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

Section - A

The Cell: Introduction, Discovery, Cell Theory, Diversity of Cell size, Shape and Structure, Basic properties, Organization, compartmentation, Organelles Architecture, Cell Fractionation.
Cell Membrane and Permeability: An overview, Brief History of Structural Studies, Membrane Proteins and Lipids, concept of Fluidity, Dynamic Nature, Transport of Nutrients.

Section - B

Ultra Structure of Cytoplasm:
Cytoskeleton: Structure and composition of intermediate filaments, Microtubules and Microfilaments.
Endoplasmic Reticulum: Structure and Functions and Role in Protein segregation. **Golgi complex:** Structure, Biogenesis and Role in Protein Secretion.
Lysosomes, Vacuoles, Microbodies: Structure and Function.
Ribosomes : Structure, Function and Role in Protein Synthesis. **Mitochondria :** Structure, Biogenesis and Genomes. **Chloroplast :** Structure, Biogenesis and Genomes.
Nucleus : Structure, Cell Cycle and its regulation.

Section - C

Cell signaling And Communication : General Principles, G Protein linked receptors, Enzyme linked cell surface receptor, Kinase receptors Second messengers, Hormone receptors interaction, Convergence Divergence and crosstalk among different signaling pathway, calcium and NO as intracellular messenger.
Cell interaction: Cell junctions, cell Adhesion and Extracellular matrix, Reception-integerins, Plant Cell wall, Apoptosis.
Cancer : Carcinogenesis, Agents, Process, Tumor Cells, Protooncogenes and viral oncogenes and molecular basis.

Section D

Muscle Contraction: Structure of muscle, Structural proteins of muscles, Energetics and Regulation of muscle contraction.
Neurons and neurotransmitters: Resting potential, Action potential, synaptic transmission, neurotransmitters and receptors, the generation of action potential by sensory stimuli and mechanisms of nerve impulse.

Course Outcomes

CO1 - Describe the fundamental principals cellular biology.
CO2 - Develop a deeper understanding of cell structure and how it relates to cell functions.
CO3 - Understand how cells grow, divide, and die and how these important processes are Regulated
CO4 - Understand cell signaling and how it regulates cellular functions.

List of Text / Reference Books:

1. Cell and Molecular Biology-De Robertes
2. Cell Biology-Sadava, Jonesand Bartlett publisher
3. Essential of Cell Biology-Alberts et Al, Garland Publisher.
4. The Cell- A Molecular Approach. Cooper, ASM Press..
5. Molecular Biology of Cell Albert Et Al, John Wiley and Sons.
6. Cell and Molecular Biology, Concepts and Experiments, Gerald Karp, John Wiley and Sons
7. Molecular Biology of The Cell, Lodish et al, 5^{th} Ed
8. Cell and Molecular Biology, Sheeler & Bianchi

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT-203 F **MICROBIOLOGY**

Periods/week L:3 T:1 **MAX. MARKS: 150**
Duration of Ext. Exam: 3 Hrs **Sessional: 050**
External: 100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Introduction to Microbiology: Scope and brief history of microbiology (Contributions of Leuwenhoek, Pasteur, Koch, Jenner, Winogradsky, Beijerinck); Microbial taxonomy: systems of classification (Haeckel,s three kingdom concept, Whittaker's five kingdom classification, microbial phylogenetic groups, Bergey,s manual); criteria for classification including molecular approaches.

Microbial diversity: Overview of prokaryotes and eukaryotes. Morphology, Structure and chemical composition of bacteria. General characteristics of major groups of bacteria: archebacteria, eubacteria, actinomycetes, rickettsiases, chlamydiae and mycoplasma. Salient features of fungi, protozoa and algae; Structure and life cycle of virus (Lytic and Lysogenic)

SECTION B

Microbial Nutrition and Metabolism:

Nutritional requirements-: Macronutrients, micronutrients and growth factors; classification of microorganisms based on nutrition; Laboratory culture of microorganisms: Culture media, aseptic technique, pure culture and preservation techniques, use of plant residues in media: starch, cellulose, hemicellulose and lignin

Microbial Metabolism: An overview of Metabolism -: Carbohydrate catabolism: glycolysis, alternate to glycolysis-ED pathway, pentose phosphate pathway; cellular respiration : aerobic and anaerobic; photosynthesis; overview of lipid and protein metabolism.

SECTION C

Sterilization methods: Physical methods: Heat sterilization, Radiation Sterilization and Filter Sterilization Chemical methods: Disinfectants and Antiseptics, growth factor analogs and antibiotics

Fermentation technology: A historical perspective, microbiology of industrial fermentation, biomass formation, methods to study biomass, central and intermediary metabolism.

SECTION D

Bacterial reproduction and growth-: Modes of cell division and process of sporulation. Growth curve (log, exponential, stationary and cell death), mathematical expression of growth, diauxic growth, synchronous and continuous growth, methods of growth measurement, effects of environmental factors on growth: temperature, pH, water availability and oxygen.

Preservation of gene pool in industrial organism: Types and handling of culture collections, methods of preserving microbes.

Course Outcomes

CO1 - Students would be able to explain the basic of microbiology, aware about and applications in various fields.
CO2 - Students get familiarity with microbial diversity, morphology and taxonomy.
CO3 - Students would be able to appreciate the nutritional requirements of microbes, their classification and metabolism and microbial photosynthesis
CO4 - Students having familiarization with sterilization methods, microbial growth and reproduction and role of microbes in industrial fermentations.

List of Text / References Books :

1. Brock Biology of Microorganisms M.T. Madigan; J.M. Martinko; J.Parker Prentice Hall Int Inc.
2. Microbiology: Pelczar et al, tata Mc Graw Hill, New Delhi
3. Microbiology: Prescott et al.,2003,5th edition Mc Graw Hill, USA
4. Microbiology An Introduction: Tortora, Funke, Case. Benjamin-Cummings Publishing compay.
5. General Microbiology: Stanier RY, Ingraham JL, Wheelis ML, Painter PR. McMillan.
6. Microbiology: Weistreich GA, Lechtman MD. McMillan Publishing Co.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT-205 F **BIOCHEMISTRY**

Periods/week L:4 T:1 **MAX. MARKS: 150**
Duration of Ext. Exam: 3 Hrs **Sessional: 050**
External: 100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

Section A

Introduction to Biochemistry

Water and its Properties: Physico-chemical properties of water, acids bases an buffers, covalent bonds, non-covalent interactions in biological systems. Dissociation and dissociation constants, pH and buffers. pI.pKa, Hasselbach Hendersson equation and its implications.

Bioenergetics: First and second laws of thermodynamics and concept of free energy, high-energy phosphate compounds, ATP and its participation in metabolic network.

Section B

Amino acids and Proteins: Structure, properties, classification and functions of amino acids, structure and function of proteins. Protein denaturation and renaturation, folding pathways, folding accessory proteins, proteins purification procedures.

Protein metabolism: metabolic fate of amino group, transamination and deamination, decarboxylation and oxidative degradation of amino acids, Nitrogen excretion and urea cycle.

Section C

Carbohydrates: Definition classification, Basic structure, properties and functions of monosaccharides and related compounds, di-saccharides and poly-saccacharides. Structural polysaccharides-cellulose and chitin, storage polysaccharides-starch, glycogen,peptidoglycan and glycosminoglycans, proteoglycans and glycoproteins.

Carbohydrate metabolism: Glycolysis, kreb's cycle. Pentose phosphate pathway, glyoxylate cycle, glycogenolysis and glycogenesis, gluconeogenesis. Pyruvate Dehydrogenase and its regulation. TCA cycle: reactions regulation and Amphibolic nature, glyoxalate cycle, Electron Transport Chain, inhibitors and uncouplers of oxidative phosphorylation.

Lipids: Classification of lipids and fatty acids. General Structure and function of major lipid subclasses, acylglycerols, phosphoglycerides, sphingolipids, glycosphingolipids and terpenses, sterols, steroids.

Lipid metabolism: Biosynthesis of odd and even carbon saturated and unsaturated fatty acids, formation of ketone bodies, biosynthesis of triacylglycerols, membrane phospholipids, cholesterol and steroids.

Section D

Nucleic Acids- Structure and functions: Structure and properties of purine and pyrimidine bases. Nucleosides and nucleotides. Biologically important nucleotides.

Nucleic acid metabolism: Biosynthesis and break down of purine & pyrimidine nucleotide by de-novo and salvage pathway

Enzymes: Nomenclature and classification, co-enzymes and co-factors, reaction and derivation of Michaelis-Menten equation, Lineweaver-Burke plot, inhibition kinetics and allosteric regulation of enzymes, isozymes, mode of catalysis.

Vitamins and Hormones: their structure, properties and biological functions.

Course Outcomes

CO1 - Students will be able to understand the basic concept of water, pH, pH, pK

CO2 - Students will be able to understand the basics concepts of thermodynamics

CO3 - Students will be able to understand the structure of amino acids, proteins, and protein folding

CO4 - Students will be able to understand the structure and metabolism of carbohydrates, lipids and nucleic acids,

CO5 - Students will be able to understand the enzymes kinetics, structure and function of vitamins and hormones

List of Text / Reference Books:

1. A.L. Lehninger, D.L. Nelson, M.M. Cox, "Principles of Biochemistry", 3rd Edn., worth Publishers, 2000.
2. L. Stryer, J.M. Berg, J.L. Tymoezko, "Biochemistry", 5th Edition, W.H. Freeman and Co., 2002.
3. Harper's Biochemistry, 25th edition, by R.K. Murray, P.A Hayes, D.K. Granner, P.A. Mayes and V.W. Rodwell (2000). Prentice Hall International.
4. Fundamentals of Biochemistry by Donald Voet and Judith G Voet (1999), John Wiley & sons, NY
5. Biochemistry, 4th edition, by G. Zubay (1998). Wm.C. Brown Publishers.
6. Biochemistry, 2nd edition, by Laurence A. Moran, K.G. Scrimgeour, H.R. Horton, R.S.Ochs and J. David Rawn (1994), Neil Patterson Publishers Prentice Hall.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT-207 F **GENETICS**

Periods/week L:3 T:1 **MAX. MARKS: 150**
Duration of Ext. Exam: 3 Hrs **Sessional: 050**
External: 100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Classical and Non-Classical Genetics.
Introduction, History, Classical and molecular, Genetics , Mendel's Laws of inheritance and its applications, Monohybrid and Dihybrid Crosses, Types of dominance, Test cross and back cross, common gene interactions: Complementary genes, Supplementary genes, Cumulative genes, Duplicate genes, Inhibiting genes, Lethal genes, Penetrance Expressivity, Plieotropy, Atavism, Modifiers, Qualitative and Quantitative characters, Physical basis of heredity., genetic basis of continuous phenotypic variety, Analysis of genetic data.

SECTION B

Chromosomes:
General Features of chromosomes: Morphology, Chemical composition, Structure and functions, Chromosomal aberrations: Structural and Numerical changes, The chromosomal theory of inheritance, Sex determination, Sex influenced characters, sex limited inheritance.
Organization of chromosomes:
Chromosome organization and molecular structure, The structure of bacterial chromosomes, the structure of Eukaryotic Chromosome Special chromosomes: Lampbrush Chromosomes, Polytene Chromosomes, and Accessory Chromosomes, euchromatin, heterochromatin, Repetitive and non repetitive DNA.
Linkage, Crossing Over and Recombination: Linkage, Crossing Over, Recombination in Chromosomes, Chromosome mapping, Genetic mapping: Gene mapping from two point and three point test cross, mapping by tetrad analysis, Complementation.

SECTION C

Cytoplasmic Inheritance: Cytoplasmic inheritance in Eukaryotes, Maternal Inheritance, Cytoplasmic Inheritance by Cell Organelles, Cytoplasmic Inheritance by Endosymbionts, Cytoplasmic inheritance in haploids, cytoplasmic inheritance in Prokaryotes.
Mutation: Characteristics, Classification and Molecular basis, Physical Mutagens and Chemical Mutagens, Detections of Mutation, Directed Mutagenesis, Application of Mutation, Mechanism of DNA repair.

SECTION D

Population Genetics: Gene frequency, Genotype Frequency, Gene pool, Hardy-Weinberg law, Random Union of gametes, Random mating among Genotypes, Factors affecting gene frequencies : Migration, Mutation, Natural Selection, Random Drift and Founder's Principle, Inbreeding and Outbreeding.

Inheritance of Quantitative Characters: Quantitative and Qualitative Character, Inheritance of Quantitative Characters, Multiple factor hypothesis, Analysis of quantitative data: Mean, Range, Variance, Standard Deviation, Coefficient of Variation, Effect of Environment on Quantitative characters. Cause of Variations.

Genetic And Man: Human Genetics: Introduction to human Genome, genetic Studies: Genetic Diseases, Blood Groups, Disputed Parentage, Histocompatibility, Immune response, Linkage Studies, Somatic Cell Hybridization, Antibodies and Antigens Variability, Cytogenetics, Evolutionary Genetics.

OUTCOMES:

On completion of this course, students will have the knowledge and skills to:

CO1 - recognize and describe genetic phenomena and demonstrate knowledge of important genetic principles.

CO2 - explain the key concepts in population, evolutionary and quantitative genetics including: the basis of genetic variation; heritability.

CO3 - Know about population genetics including Hardy-Weinberg Equilibrium; roles of migration, mutation.

List of Text / Reference Books:

1. Principles of Genetics by Gardner published by John Wiley & Sons.
2. Genetics: Analysis and Principles by Robert J. Brooker, 3rd Edition published by MC Graw Hill Science.
3. Genetic by M.W Strickberger Published by Prentice Hall College Division.
4. Genetic: Analysis of genes and genomes by Daniel Harti, 7th Edition published by jones and Bartlet.
5. Genetic by P.J Russel, 5th Edition published by Addison Wesley Longman, Inc. California.
6. Concept of Genetics by William S. Klug, Michael Charlotte Spencer and Michael A , Palladino, 9th Edition published by Benjamin Cumming.
7. Genetics by Benjamin Pierce, 3rd Edition Published by W.H. Freeman.
8. Essential of Genetics: A genomic perspective by Daniel L Harti and Elizabeth W. Jones , 4th Edition Published by Jones and Bartlet.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT-209 F **FUNDAMENTAL OF LIFE SCIENCES**

Periods/week L:3 T:1 **MAX. MARKS: 150**
Duration of Ext. Exam: 3 Hrs **Sessional: 050**
External: 100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

Section A

The vertebrates: Salient features of Pisces (roheo), amphibians (frog), repltiles (lizard), aves (pigeon), and mammals (human beings).
The kingdom Plantae: General characteristics of Bryophytes (moss), Pteridophytes (pteris), Gymnosperms (pinus) and Angiosperms (rose).
Morphology and anatomy of Angiosperms: General Plant organization: Organ systems of the plant body – root and shoot and their modifications.Characteristics of dicots and monocots.

Section B

Human Anatomy and physiology:
The types of cells and body organisation. The Skin, The Skeleton, Muscles, Cardiovascular System, Respiratory System, Lymphatic System, The Gut and Digestion, Urinary System, Reproductive System, System, The, Endocrine System
Plant Physiology:
Photosynthesis: chloroplasts and light; carbon dioxide fixation and carbohydrate synthesis; Photosynthesis: environmental and agricultural aspects; respiration; assimilation of nitrogen and sulfur; and lipids and other natural products.

Section C

Developmental Biology: Principles of Developmental Biology, blastulation, gastrulation, cleavage, fertilization, parthenogenesis, metamorphogenesis, regeneration, aging and theories of aging.
Plant Reproduction and development: Growth and development; hormones and growth regulators: auxins and gibberellins; cytokinins, ethylene, abscisic acid, and other compounds; the biological clock: rhythms of life; growth responses to temperature; photoperiodism; environmental physiology and stress physiology.

Section D

Biodiversity & Conservation: Conservation biology, Endangered species, Ex-situ conservation, In-situ conservation, Ecology, Gene pool, Genetic pollution, Genetic erosion, Megafauna, National Wildlife Federation, National Wildlife Magazine, Wildlife management, Wildlife Enforcement Monitoring System

Course Outcomes

CO2 - Students will be able to understand about salient features of animals and plants
CO3 - Students will be able to understand basics of animal and plant physiology
CO4 - Students will be able to understand basics of developmental biology
CO5 - Students will be able to understand the concept of Endangered species, Ex-situ conservation, In-situ conservation, wildlife management

Economic botany: Food crops Cereals (general), Legumes (general);
Cash crops: Bamboo, Coconut (*Cocos*), Cotton (*Gossypium*), Sugar cane (*Saccharum*), Mushrooms, Natural rubber (*Hevea* and *Parthenium*), Sunflower (*Helianthus*), and safflower (*Carthamus*), Tea (*Camellia*), Wood and wood characteristics
Medicinal Plants: Foxglove and digitalis (*Digitalis*), Quinine (*Cinchona*), Rauvolfia (*Rauwolfia*), Marijuana (*Cannabis*), poppy (*Papaver*).

List of Text and Reference books

1. Guyton, A.C. and Hall, J.E., 2000, A Text Book of Medical Physiology, XthEdition, W.B. Saunders Company. St
2. Ganong, H, 2003, Review of Medical Physiology, 21 Edition, McGrawHill.
3. Strand Fluer, 1978, Physiology (a regulatory system approach) McMillan Pub. Co.
4. David Shier, Jakie, Butler & Lewis, 1996, Human Anatomy & Physiology, WCB, USA.
5. Scott F. Gilbert, A Companion to Developmental Biology 8th Edition Sinaur Associates
6. Salisbury & Ross, Plant Physiology, Wiley International.
7. Cultler DF, Botha T, Stevenson DW, Plant Anatomy: An Applied Approach, 2008, Wiley-Blackwell
8. Dickison WC, Integrative Plant Anatomy, Academic Press, New York 9.Lersten NR, Flowering Plant Embryology, Blackwell Publishing
9. Greenaway T, Plant Kingdom: A Guide to Plant Classification and Biodiversity, Raintree
10. Maiti RK and Pal V 2006 An Introduction to Modern Economic Botany, Eastern Book Corporation

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT-211 F **ORGANIC CHEMISTRY**

Periods/week L:3 T:1 **MAX. MARKS: 150**
Duration of Ext. Exam: 3 Hrs **Sessional: 050**
External: 100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

Section A

Types of Organic Reaction : Substitution, Addition, Elimination, Rearrangement Reactions: Wanger – Meerwin rearrangement, Cope rearrangement, Hyper conjugation : concept & consequences, hydrogen bonding: nature type, stability and its importance in organic compound.

IUPAC Nomenclature: Sytematic IUPAC nomenclature of alkenes alkynes Cycloalkanes, aromatics bicyclic and polyfunctional organic compounds, bond line notation.

Section B

Reagents: Biological methylating reagents, Bayer & villager reaction, Reducing Agents : There applications in Organic Chemistry with special emphasis on LiAlH4,
NaBH4, Pt / Ni / H_2, METAL / NH_3,Solution,Diimide,Hydroboration Tri –n- butyl tin hydride.

4. Stereo Chemistry : Classification of stereomers , diastereomers , separation of enantiomers, absolute configuration (R & S) projection formulae stereochemistry of compounds containing two asymmetric C-atoms stereochemistry of biphenyls,
Geometrical isomerism - concept ,E & Z nomenclature.
Tautomerism–Concept, Ring chain tautomerism, Ring chain isomerism, properties , reactions of keto enoltautomers, Epoxides: properties & nucleophillic ring opening of epoxides.

Section C

5. Carbonyl Compounds : Nature & structure of carbonyl group ,Relative reactivities of carbonyl compounds , hydration & addition of alcohol to aldehydes and ketone , Addition of ammonia & ammonia derivatives to aldehydes & ketones , wolf – kishner reduction & its mechanism, aldol condensation, claisen , condensation reformatsky reaction & perkin reaction.

6. Acid Derivatives: Acid catalysed & base catalysed hydrolysis of esters & acid amides amono- lysis & alcohol lysis of esters.

Section D

7. Polymers : Classification of polymers functionality , chain growth and step growth polymers, co-ordination polymerization, epoxy resins, urea formaldehyde

resins, Natural rubber & its vulcanizations, elastomers, biopolymers, synthesis of drugs.

8. Peptide Bond Synthesis: Protection of N-terminal & C- terminal of amino acids, formation of peptide bonds, solid phase peptide synthesis.

Course Outcomes

CO1 - Students will understand the basic principles of organic chemistry and the types of reactions in organic chemistry.
CO2 - Students will be able to realize the importance of reducing agents and their use in synthesis of various organic compounds
CO3 - Students will be familiar with the Carbonyl compounds and their reaction mechanism.
CO4 - Students will learn the use, classification and properties of different types of Polymers.
CO5 - Students will be knowledgeable about the concept of stereochemistry and stereoisomers.

List of Text / Reference books:

1. Organic Chemistry by I. L. FINAR
2. Modern Organic Chemistry by D.R.Boyed.
3. Organic chemistry by Paula Yurkanis Bruice.
4. Principle of organic synthesis by Richard Norman & James M Coxon.
5. Reaction Mechanism by O.P. Aggarwal.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT - 213 F CELL BIOLOGY & GENETICS LAB

Periods/week L:0 T:0 P: 2 **MAX. MARKS : 100**
Duration of Ext. Exam: 2 Hrs **Sessional: 50**
External: 50

1. To study and observe the structure of prokaryotic cell.
2. To study and observe the structure of eukaryotic cell.
3. To count the number of cells using haemocytometer
4. To prepare temporary stained mounts of onion root tips to study mitosis cell division.
5. To prepare temporary stained mounts of insect gonads to study meiosis cell division.
6. To prepare temporary stained mounts of dicot stem.
7. To prepare temporary stained mounts of monocot stem.
8. To study cell membrane properties.
9. Isolation subfractionation and enzymatic analysis of cell organelles.
10. To study the technique of microtomy.

Course Outcomes

CO1 - Students will be able to understand the morphology prokaryotic cell and eukaryotic cell
CO2 - Students will be able to count the cells using hemocytometer
CO3 - Students will be able to prepare the slide of onion root tip for mitosis study
CO4 - Students will be able to prepare of slides of monocot and dicot stem.
CO5 - Students will be able to learn the use of microtome, perform sub fractionation of cell organelles

TEXT / REFERENCES BOOKS

1. Cell and Molecular Biology, Sheeler & Bianchi
2. Cultler DF, Botha T, Stevenson DW, Plant Anatomy: An Applied Approach, 2008, Wiley-Blackwell

NOTE. :
A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 3RD SEM

BT- 215 F MICROBIOLOGY LAB

Periods/week L:0 T:0 P: 3 **MAX. MARKS : 100**
Duration of Ext. Exam: 3 Hrs **Sessional: 50**
External: 50.

1. Microscopy: Use fo microscopes, microscopic examination of microorganism.
2. Micrometry: Microscopic measurement of microorganisms.
3. Staining methods.
4. Preparation of culture media.
5. Isolation and enumeration of microorganisms from different sources.
6. Pure culture techniques – Streak plate, Pour plate, Spread plate
7. Measurements of growth and study of effect of various factors on growth of Microorganisms temp. , pH, salt concentration, U.V. & R.H.
8. Biochemical tests useful in bacterial taxonomy.
9. Water microbiology – BOD, multiple tube fermentation tests.
10. Milk Microbiology –SPC, testing the quality of milk.

Course Outcomes

CO1 - Students get familiarity with principle of simple and compound microscopes and their application for morphological study of microorganisms.
CO2 - Students would learn the techniques of smear preparation, simple staining and Gram staining of microbial cultures.
CO3 - Students would be able to prepare liquid and solidified media by using the sterilization technique.
CO4 - Students would be able to enumerate microbes and isolate the pure culture of microorganisms from the soil and water.
CO5 - Student would become aware of growth phases by measurement of microbial growth and impact of various environmental factors on growth, biochemical tests for bacterial identification.

TEXT / REFERENCES BOOKS

1. Experiment in Microbiology, Plant pathology,Tissue Culture & Mushroom production technology: Aneja K.R, .2001, 3RD Edition, New Age International Publishers, New Delhi.

2. Microbiology –A Lab manual, Cappuccino J. & Sheeman N, 2000, 4th Edition, Addison Wesley California .

NOTE. :

A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT- 217 F BIOCHEMISTRY LAB

Periods/week L:0 T:0 P: 3 **MAX. MARKS : 100**
Duration of Ext. Exam: 3 Hrs **Sessional: 50**
External: 50

1. Units, Volume/Weight measurements, concentration units, pH measurements and preparation of buffers.

2. Qualitative estimation of amino acids.
3. Spectrophotometric estimation of amino acids by Ninhydrin method.
4. Qualitative and quantitative estimation of proteins.
5. Qualitative and quantitative estimation of lipids.
6. Qualitative and quantitative estimation of Carbohydrates.
7. Estimation of alpha-amylase from saliva and effect of temperature and pH on its activity.
8. Biochemical analysis of normal and abnormal constituents of urine.
9. Determination of Km and Vmax for salivary amylase.
10. To study the Isozyme pattern by gel electrophoresis.
11. Quantitative determination of DNA and RNA by spectrophotometric method.

12. Determination of Tm value from thermal denaturation characterstics.

Course Outcomes

CO1 - Students will be able to understand the preparation of molar solutions, adjust the pH of the solutions.
CO2 - Students will be able to understand the estimation of amino acids, DNA and RNA.
CO3 - Students will be able to understand the estimation of proteins, lipids and sugars.
CO4 - Students will be able to learn the enzymatic activity of amylase present in saliva and effect of temperature and pH on its activity.
CO5 - Students will be able to understand the estimation DNA and RNA by spectrophotometer.

List of Reference Books

1. Principal and techniques of Practical Biochemistry : K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.

2. Introductory Practical Biochemistry by S.K. Sawhney and Randhir singh (2000), Norosa Publishing House, New Delhi.
3. An Introduction to practical biochemistry by David T.Plummer (1988), McGraw-Hill, Book Company ,UK.

NOTE. :

A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 3RD SEM

BT-219 F FUNDAMENTAL OF LIFE SCIENCES LAB.

Periods/week L: 0 T: 0 P: 2 **MAX. MARKS: 100**
Duration of Ext. Exam: 2 Hrs **Sessional: 50**
External: 50

1. Study of specimens from Animal kingdom (vertebrates).

2. Histology of animal tissues and organ systems (Nervous, Digestive, Reproductive, Respiratory and Circulatory system).

3. Study of specimens from Plant kingdom (as mentioned in theory syllabus).

4. Histology of plant tissues and organs: dicots and monocots.

5. Microtomy: preparation of permanent slides.

Course Outcomes

CO1 - Students will be able to understand the basic features of animal kingdom by visualizing specimens
CO2 - Students will be able to learn the histology of animal tissues
CO3 - Students will be able to learn the histology of dicot and monocot plant tissues.
CO4 - Students will be able to learn the preparation of slides of plant tissues.

TEXT / REFERENCES BOOKS

1. Cultler DF, Botha T, Stevenson DW, Plant Anatomy: An Applied Approach, 2008, Wiley-Blackwell
2. Guyton, A.C. and Hall, J.E., 2000, A Text Book of Medical Physiology, Xth Edition, W.B. Saunders Company.

NOTE. :

A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 202 F MOLECULAR BIOLOGY

Periods/week L:4 T:1 MAX. MARKS :150

Duration of Ext. Exam: 3 Hrs Sessional:50
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

DNA: Introduction, structure, properties: physical and chemical, biological significance of double strand, DNA bending, DNA super coiling, cruciform and ZDNA structure, DNA Triplex, DNA protein interactions, organization of chromosomes, euchromatin and heterochromatin packaging in nucleosomes, chromosome organization in cell. Denaturation and renaturation of DNA-Tm values and cot curves analysis. C-value paradox, Repetitive and non repetitive DNA and its relevance to plants and animals, inverted and tandem repeats. Gene, split genes, housekeeping genes.

SECTION B

DNA Replication: Origin of replication, DNA polymerase, mechanism of DNA replication in prokaryotes and eukaryotes, DNA replication models, DNA damage, DNA repair.

Transcription: Mechanism in prokaryotes and eukaryotes, RNA polymerase, sigma factor, regulation of transcription, transcriptional factors, post transcriptional processing (5' and capping and 3' polyadenylation), Zinc finger motifs, helix loop helix, leucine Zippers.

RNA splicing: Intron and exon, splicing mechanism for mRNA,tRNA, spliceosome, lariat formation, Ribozymes, cis splicing and trans splicing.

SECTION C

Operon model: Regulation of gene expression in prokaryotes and eukaryotes; Lactose and Tryptophan operon, inducible and repressible systems; positive and negative control.

Protein synthesis: Genetic code, Wobble hypothesis, Component of protein synthesis-ribosomes, tRNA, mRNA, rRNA, mechanism of protein synthesis, regulation of protein synthesis, post transitional modification, chaperones, transport of protein, degradation of protein.

SECTION D

Transposons: The dynamic genome: Mobile genetic elements in prokaryotes-insertion sequences, composite and non composite transposones, replicative and conservative transposition, retrotranposon, eukaryotic jumping genes-relevance to plants.

List of Text/ Reference Books:

1. DNA structure and function: Richard R Sindex, Academic Press.

2. Genes VII, Lewin B, Oxford University Press
3. Molecular Cell Biology: Bruce Alberts, James D.Watson, Garland Publishing.

4. The Cell-a molecular approach,. Cooper, A.S.M Press
5. Cell & Molecular Biology, concepts & experiments, Gerald Karp, John Wiley & Sons
6. Essential of Molecular Biology: Malacinski,, Freifelder Jones, Bartlet Publisher 3rd ed.

7. Cell & Molecular Biology: E.D.P. Robertis. 8th ed.
8. Genomes: T.A. Brown, John Wiley & Sons Pvt. LTS

Course Outcomes:

At the end of this course, the student should be able to –

CO1 present a broader picture of living systems by integrating the reductionistic concepts of molecular biology with holistic concepts such as evolution.
CO2 gain knowledge of DNA replication, transcription and RNA translation
CO3 develop a critical approach and enhance their analytical abilities.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 204 F IMMUNOLOGY

Periods/week L:3 T:1 MAX. MARKS :150

Duration of Ext. Exam: 3 Hrs Sessional:50
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Basic Immunology : Types of immunity: innate and acquired: cells and organs of immune system B-Lymphocytes and T- Lymphocytes, Primary and secondary lymphoid organs, humoral and cell mediated immune response.

SECTION B

Immune System : Antigens, immunoglobulins : structure and function, antigenic determinants : Isotype, allotype & idiotype; Monoclonal Ab , Hybridoma techonology Organization and expression of immunoglobulin genes, Generation of Ab. Diversity, class switching , and Ab. Engg.

SECTION C

Generation of B-Cell and T-Cell Responses : Major histocompatibility complex , Peptide binding by class I and class II molecules , Ag. Processing presentation, T-Cell receptor ,T-cell maturation , activation & differtiation , Positive & negative selection, ignaling pathways.

Immunological Techniques : ELISA , Radio immunoassay , immuno-precipitin reactions.

SECTION D

Immune Effector Responses : Cytokines properties , The complement system, Role ofT- helper cells in cytokine production , cell mediated effector responses .

Immune system in Health & Disease : Hypersensitive reaction, auto immunity, and immune response to infectious disease, tumor immunity, tissue and organ transplant , vaccines & peptide vaccines.

COURSE OUTCOMES:

After completing the course students will:

CO1 - have a detailed understanding of Component of immunity
CO2 - know antigen presentation on a detailed molecular level
CO3 - understand the concept immunology and the immune system .
CO4 - have a in depth knowledge of the cellular and molecular basis for autoimmune disease and allergies.

CO5 - have basic knowledge of tumor immunology and the development of novel, recombinant antibodies for treatment of cancer and autoimmune disease.

TEXT / REFERENCE BOOKS

1. Kuby,s Immunology 4th edition) R.A. Goldsby ,T. J. Kindt, B.A. Osborne, W.H.Freeman & company, New.York.

2. **Essential Immunology** (10th edition), Ivon Roitt, Peter Delves, Blackswell, Scientific Publications. Oxford.

3. **Fundanental of immunology** . Paul W.E.(Eds) Raven press ,New York.

4. **Immunology** by Presscot .

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 206 F INDUSTRIAL MICROBIOLOGY

Periods/week L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A
Basics of industrial microbiology:

Introduction: An overview, history, scope and applications of industrial microbiology. Fermentation: Basic principle, component, range and types of fermentation.
Strain development:

Isolation and screening methods of industrially important microorganisms. Improvement of industrial microorganisms using classical and recombinant DNA approaches.

SECTION B Production of microbial metabolites I:
Industrial production of alcohols (ethanol, butanol), organic acids (citric acid, acetic acid) enzymes (amylases, proteases, cellulases) and alcoholic beverages (beer,wine)
SECTION C

Production of microbial metabolites II:

Industrial production of amino acids (glutamic acid, lysine, tryptophan), vitamins (vitamin B12, Riboflavin) and antibiotics (penicillin, Steptomycin, tetracycline).

SECTION D

Bioproducts specific to agricultural and food industries:

Biopesticide, biofertilizers, biopolymers (dextran, xanthan & PHB), prebiotics & Probiotics, single cell protein.
Fermentation Economics:
Introduction to fermentation economics, production decisions, cost and investment decisions, market potential, case studies.

Course Outcomes

CO1 - Students would be able to explain the basic of industrial microbiology and applications in various fields.

CO2 - Students get familiarity with isolation, screening and improvement of industrially important microorganisms.

CO3 - Students would be able to appreciate the importance and applications of microbes for production of array of metabolites ranging from alcohols ,enzymes , organic acids and antibiotics.

CO4 - Studnts having familiarization with positive impact and role of microbes in agriculture as biopesticides, bio fertilizers and in food industry for production of polysaccharides, single cell proteins and probiotics.

List of References Books :

1. Biotechnology: a handbook of Industrial Microbiology: W. Cruger & , second edition, Panima
2. Industrial Microbiology: L.E Casida, Wiley Eastern Ltd(1989)
3. Principles of fermentation technology, p F Stanbury and A Whitaker, Pergamon Press (1986)
4. Industrial Microbiology: Prescott & Dunn, CBS Publisher (1987)
5. Biology of microorganisms, eighth edition, M.T.Madigan; J.M. Martinko; J.Parker, Prentice Hall International
6. Microbial technology: fermentation technology, second edition, peppler & Perlman, Elsevier Publications (2004)

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 208 F BIOPROCESS ENGINEERING-I

Periods/week L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Introduction to bioprocess engineering: Microbial and biochemical interaction with chemical engineering. Comparison of chemical and biochemical engineering, and role of bioprocess engineering in biotechnology.

Fluid Mechanics: Principle of microbial nutrition, formulation of culture media, selective media, factors influencing the choice of various carbon and nitrogen sources, vitamins, minerals, precursors and antifoam agents, importance of pH. Classification of fluids and Bernoulli's equation.

SECTION B

Sterilization: Introduction , Batch sterilization ,Continuous sterilization ,Sterilized media for microbiology ,Sterilization of media for stoke cultures , Sterilization of bacterial media ,Sterilize Petri dishes ,Dry heat sterilization, Sterilization with filtration, Microwave sterilization, Electron beam sterilization ,Chemical sterilization.

SECTION C

Extraction of fermentation products: Removal of solids: filtration, centrifugation, coagulation, flocculation, foam fractionation, whole broth treatment. Primary product isolation: cell disruption, liquids extraction etc. Purification of products, product isolation: crystallization, drying process.

SECTION D

Mass and heat transfer in bioprocess: Molecular diffusion, role of diffusion in Bioprocessing, convective mass transfer, liquid-solid mass transfer, liquid-liquid mass transfer, gas-liquid mass transfer, oxygen uptake in cell culture, factor affecting cellular oxygen demand, oxygen transfer in fermenter, measurement of k_La.

Basic concepts of heat transfer in bioreactor, mechanism and general principle. An overview of material and energy balance.

Course Outcomes

CO1 - Students will be able to understand basic principles of bioprocess techniques such as role of mass transfer, heat transfer and fluid mechanics during bioprocesses

CO2 - Students will be able to understand importance of bioprocess engineering principles in biotechnology.

CO3 - Students will be able to understand sterilization of bioprocess equipments, materials, downstream processing of fermented

List of References Books :

1. Bioprocess engineering Basic concepts M.A Shuler, Fikiret Kargi, PHI, India

2. Priciples of fermentation technology, PF stanbury and A Whitaker, Pergamon press
3. Process Engineering in Biotechnology, AT Jackson
4. Bioprocess Engineering Principle
5. Coulson & Richardson's Chemical Engineering- Volume 3 (Chemical and Biochemical Reactors and process controls) ed. Richardson, J.F., Peacock, D.G., First Indian ed. Asian Books Pvt. Ltd. 1998

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 210 F BIOANALYTICAL TECHNIQUES

Periods/week L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Microscopy: Principle, Sample Preparation, technical arrangement and working of instrument: Light Microscopy- Bright Field, Dark Field and Phase Contrast microscopy, Fluorescence microscopy, Electron microscopy- Scanning & Transmission.

SECTION B

Centrifugation: Principles of Sedimentation, types of centrifuges and their applications, Differential, and Density Gradient centrifugation, Ultracentrifugation, Sub-Cellular Fractionation, Marker enzymes.

SECTION C

Chromatography: General principles, Adsorption, Partition. Ion-exchange, Molecular Exclusion , Affinity Chromatography, High Pressure Liquid Chromatography, Gas Chromatography, Paper Chromatography and thin layer Chromatography(one and two dimensional), selection of chromatographic systems.

Electrophoresis:

Principles of Electrophoresis, electrophoresis of proteins and nucleic acids immuno-electrophoresis, Isoelectric Focusing, Two-dimensional gel Electrophoresis, Capillary Electrophoresis, Microchip electrophoresis.

SECTION D

Spectroscopy: Basic Concepts, U.V/ Visible Spectroscopy, X-ray Spectroscopy, Spectrofluorimetry, Circular Dichorism Spectroscopy, Turbidimetry and Infra Red and Raman Spectroscopy, Nuclear Magnetic resonance.

Radioisotope Techniques: Nature of radioactivity, properties of , and rays, detection and measurement of radioactivity, Geiger Muller and Scintillation counting, Double labeling, instruments for monitoring radioactivity, Auto-radiography, Radio-immunoassay, Safety aspects and radio-waste management.

Course Outcomes

CO1 - Students will be able to understand basic principles of techniques used in analysis of biological samples

CO2 - Students will be able to understand working of various instruments used in biotechnology.

CO3 - Students will be able to operate the basic instruments used in biotechnology laboratories such as

spectrophotometer, microscope, HPLC, gel electrophoresis etc.

List of Reference Books:

1. **Principles and techniques of practical Biochemistry:** K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge
2. **Physical BioChemistry**, 2nd edition by D. Friefelder, W.H. Freeman and company, U.S.A

3. **Introduction to instrumental analysis:** Robert. D. Braun (1987). McGraw Hill International Edition. Chemistry Series.
4. **Physical Biochemistry**, 2nd edition by K.E. Vanholde (1985), Prentice Hall Inc., New Jersey
5. **Biological Spectroscopy**: Campbell and Durek.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 212 F BIOSTATISTICS

Periods/week L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A
Introduction to Biostatistics:

Definition, types of data and Application, data collection, random and non random, Data representations, Bar, Histogram, Frequency Polygon, frequency curve, relative frequency curve, pie chart (with merits and demerits).
Descriptive Statistics:
Introduction to basic quantities methods, Measure of central tendency, mean , mode, median, Harmonic mean, Geometrical mean, Partitions, measure of dispersion, Range, Quartile deviation, mean deviation, standard deviation and, coefficient of variation, Lorentz's curve, difference between dispersion and skewness, measures of skewness and kurtosis (with merits and demerits).

SECTION B
Probability Distributions:
Introduction to probability and types of probability with applications in biostatistics, expected value of a random variable (discrete and continuous). Probability Distributions function, moment of generating function, properties and application of binomial, poisson and Normal distributions.

SECTION C
Sampling:
Introduction to sampling, Types of sampling, errors, standard error, confidence limits, large sample test, single probability test, deference of probability, single mean difference of mean difference of standard deviation, tests of significance of small samples, Student's t-distribution (applications only), Chi-square test of goodness of fit, comparisons of several means: A prior tests, Posteriori tests two ways Variance.
Anova and Nonparametric Test:
Introducing to F-test, Z-test, Introduction, Types of Anova-one way, two ways, Nonparametric methods, Advantages and Disadvantages of Non parametric and parametric method.
SECTION D
Correlation and regression:
Introduction to correlation, Rank's Correlation methods, Introduction to regression lines, linear and nonlinear fitting (least squares methods). Multiple regressions. Advantages and disadvantages of Correlation and regression.

Course Outcomes

CO1 - Students would be able to understand basic mathematical terms used in statistical data analysis.
CO2 - Students will be able to find out mean, mode, median, and other terms of statistics.
CO3 - Students will be able to understand the application of statistics in biology

List of Text / Reference Books:

1. Mathematical Statistics: S C Gupta and V K Kapoor, Sultan Shand & Sons

2. Fundamentals of Biostatistics: Bernard A. Rosner, Published by Thomson Brooks/ Cole
3. Statistics-An Introductory Analysis: Taro Yamane, Harper and Row Publisher.

4. Biostatistical Methods: J H Zar.
5. Biostatistical Methods: Khan & Khanum, Unkar Publication Hyderbad.
6. Text Book of Biostatistics II : A.K. Sharma, Discovery Publishing House

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 214 F MOLECULAR BIOLOGY LAB.

Periods/week L:0 T:0 P:3 **MAX. MARKS :100**
Duration of Ext. Exam: 3 Hrs **Sessional: 50**
External: 50

LIST OF EXPERIMENTS/PRACTICALS

1. Isolation of Prokaryotic genomic DNA

2. Isolation of Prokaryotic plasmid DNA
3. Isolation of DNA from Eukaryotes
4. To purify given DNA sample
5. Molecular weight characterization of a given DNA sample using Agarose Gel Electrophoresis
6. To perform the technique of Gel Extraction of DNA.
7. To study and perform the basic scheme of Polymerase Chain Reaction

8. To carry out the Simultaneous extraction of RNA, DNA and proteins
9. Isolation of protein fraction from different sources.
10. To study the technique of SDS-PAGE
11. To perform native PAGE of protein
12. To perform and compare different staining methods of proteins
13. To study and perform the technique of Restriction mapping.
14. To study DNA Sequencing Data Analysis.

Course Outcomes

CO1 - Students will be able to isolation of prokaryotic DNA.
CO2 - Students will be able to isolation of plasmid DNA.
CO3 - Students will be able to isolation of eukaryotic DNA and prokaryotic DNA.
CO4 - Students will be able to characterization of DNA by electrophoresis.
CO5 - Students will be able to perform amplification of DNA by PCR, isolation and electrophoresis of proteins.

List of References/Suggestive Books.

1. Molecular Cloning-a laboratory manual; 3rd edition vol.1-3 (2001), J. Sambrook and D.W Russell, Cold Spring Harbor Laboratory press, New York

NOTE. :

A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 216 F IMMUNOLOGY LAB.

Periods/week L:0 T:0 P:3 **MAX. MARKS :100**
Duration of Ext. Exam: 3 Hrs **Sessional: 50**
External: 50

LIST OF EXPERIMENTS/PRACTICALS

1. Handling and study of anatomy of the experimental model-mice / rabbit

2. To determine the concentration and partial purification of serum immunoglobulins by precipitation with ammonium sulphate and polyethylene glycol.
3. Planning of immunization schedule and preparation of adjuvants
4. Preparation of antigen
5. To perform immuno-diffusion by Ouchterlony method. (qualitative method)

6. To perform precipitation reaction by quantitative method
7. To perform immuno-diffusion by RIA method
8. To perform Immuno-electrophoresis with a given antigen-antibody system.

9. To perform DOT ELISA
10. To perform Indirect ELISA
11. To Perform Sandwich ELISA
12. To Identify different IgG isoforms

Course Outcomes

CO1 - Students will be able to learn the handling of animal model.
CO2 - Students will be able to learn the preparation of antigen
CO3 - Students will be able to learn the immuno-diffusion
CO4 - Students will be able to learn the immuno-precipitation
CO5 - Students will be able to learn the immuno-electrophoresis, ELISA test.

List of References:

1. Practical Immunology, Edition 4, by Frank C., Hay Ollwyn M R, Paul N, Nelson Lelie Hudson, Publisher Blackwell Science.
2. Practical & Clinical Immunology, Talwar G P, Gupta S K, CBS Publisher

NOTE. :

A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 4TH SEM

BT - 218 F INDUSTRIAL MICROBIOLOGY LAB.

Periods/week L:0 T:0 P:3 **MAX. MARKS :100**
Duration of Ext. Exam: 3 Hrs **Sessional: 50**
External: 50

LIST OF EXPERIMENTS/PRACTICALS

1. Isolation and identification of industrially important microbes.

2. To plot a growth curve of the given bacterial culture.
3. To plot a growth curve of yeast culture.
4. Isolation of antibiotic resistant mutants by replica plate technique.
5. Isolation of antibiotic resistant mutants by gradient plate technique.
6. Isolation and production of UV induced auxotrophic mutants by replica plate technique.
7. To isolate antibiotic producing microorganisms from soil.
8. To determine the antimicrobial spectrum of the isolated antibiotic producing microorganism.
9. To isolate amylase producing microorganisms from soil.
10. To compare the amylase activity of different isolates.
11. Production of alcohol from molasses.
12. To carry out the distillation of alcohol.
13. Penicillin Production and testing of antimicrobial activity.
14. Industrial Visit (to study the role of yeast in baking industry).

Course Outcomes

CO1 - Students would be able to isolate and identify the industrially important microorganisms using morphological and biochemical methods

CO2 - Students would revive yeast culture and plot the growth curve by measuring the yeast growth.

CO3 - Students would be able to isolate the pure culture of amylase producing microorganisms from the soil and compare the amylase activity of different isolates using biochemical test.

CO4 - Students get familiarity with isolation of pure culture of antibiotic producing microorganisms from the soil and assay the antimicrobial spectrum of different isolates.

CO5 - Students would learn isolation and production of UV induced auxotropic mutants by replica plating.

List of References/Suggestive Books:

1. Microbiology Lab. Manual: Cappuccino J. & Sheeman N.,2004,4th Edition & Addison Wesley, California.

NOTE. :

A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 4TH SEM

BT - 220 F BIOANALYTICAL TECHNIQUES LAB.

Periods/week L:0 T:0 P:2 **MAX. MARKS :100**
Duration of Ext. Exam: 2 Hrs **Sessional: 50**
External: 50

LIST OF EXPERIMENTS/PRACTICALS

1. Study of Phase Contrast Microscopy Technique.
2. Study of Density Gradient Centrifugation Technique.
3. Separation of biomolecules by paper chromatography.
4. Extraction of biomolecules from plant tissues and their separations using TLC.
5. Separation of biomolecules using two-dimensional TLC.
6. Partial Purification of an enzyme/protein by Ion exchange chromatography.
7. Desalting of protein by Gel filtration.
8. Determination of molecular weight of an enzyme/protein by Gel filtration.
9. Isolation and estimation of biomolecules by HPLC.
10. To purify protein by Affinity chromatography.
11. Separation of proteins by SDS-PAGE.
12. Separation of proteins by Isoelectric Focussing.
13. To determine the molar extinction coefficient of NADH.
14. To prepare an absorption spectrum of NADH.

Course Outcomes

CO1 - Students will be able to understand the slide preparation, staining of biological sample, and analysis by microscopy
CO2 - Students will be able to understand the separation of biomolecules by centrifugation
CO3 - Students will be able to understand the analysis of biomolecules by chromatography
CO4 - Students will be able to understand the determination of molar extinction coefficient and analysis of

concentration by spectrophotometer

LIST OF REFERENCE BOOKS:

1. **Principles & techniques of practical Biochemistry:** K.Wilson & J.Walker (1994), Cambridge University Press, Cambridge.
2. **Introductory Practical Biochemistry** by S.K. Sawhney & Randhir Singh (2000) Narosa Publishing House, New Delhi.
3. **An Introduction to practical biochemistry** by David T. Plummer (1988), McGraw-Hill, Book Company,UK.

NOTE. :

A College must offer 70% of the above listed exp. The remaining 30% exp. may be modified by college according to facilities available.

M.D.UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
3RD YEAR B. TECH. IN
BIOTECHNOLOGY, SEMESTER V
EFFECTIVE FROM THE SESSION 2010-11

S.No	Course No.	Subject	Teaching Schedule				Examination Schedule				Duration of exam
			L	T	P/D	Total	Th.	Sess	P/VV	Total	
1.	BTF –301	Genetic Engineering	3	1	-	4	100	50	-	150	3
2.	BTF – 303	Enzymology	3	1	-	4	100	50	-	150	3
3.	BT F– 305	Bioprocess Engineering II	3	1	-	4	100	50	-	150	3
4.	BTF-307	Diagnostic techniques	3	1	-	4	100	50	-	150	3
5.	BTF-309	Bioreactor analysis and design	3	1	-	4	100	50	-	150	3
6.	BTF – 311	Genetic engineering Lab.	-	-	3	3	-	50	50	100	3
7.	BTF– 313	Enzymology Lab.	-	-	3	3	-	50	50	100	3
8.	BTF– 315	Bioprocess Engg lab	-	-	3	3	-	50	50	100	3
9.	BTF– 317	Diagnostic Lab	-	-	3	3	-	50	50	100	3
		Total	**15**	**5**	**12**	**32**	**500**	**450**	**200**	**1150**	

M.D.UNIVERSITY, ROHTAK
3RD YEAR B. TECH. IN BIOTECHNOLOGY, SEMESTER VI
EFFECTIVE FROM THE SESSION 2010-11

S.No	Course No.	Subject	Teaching Schedule				Examination Schedule				Duration of exam
			L	T	P/D	Total	Th.	Sess	P/VV	Total	
1.	BTF –302	Plant Biotechnology	3	1	-	4	100	50	-	150	3
2.	BTF – 304	Animal Biotechnology	3	1	-	4	100	50	-	150	3
3.	BTF – 306	Food Biotechnology	3	1	-	4	100	50	-	150	3
4.	BTF – 308	Environmental Biotech	3	1	-	4	100	50	-	150	3
5.	BTF-310	Biomaterial engineering	3	1	-	4	100	50	-	150	3
6.	BT F– 312	Plant Biotech lab	-	-	3	3	-	50	50	100	3
7.	BTF– 314	Animal biotech lab	-	-	3	3	-	50	50	100	3
8.	BT F– 316	Food Biotech lab	-	-	3	3	-	50	50	100	3
9.	BTF – 318	Environmental Biotech lab	-	-	3	3	-	50	50	100	3
		Total	**15**	**5**	**12**	**32**	**500**	**450**	**200**	**1150**	

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

GENETIC ENGINEERING

Sub. Code: BTF -301
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Genetic Engineering: Introduction, scope, milestones and guidelines.

Tools of Recombinant DNA: Restriction Endonucleases, modification enzymes and markers, hybridization.

DNA amplification: Polymerase chain reaction, alternative techniques, applications and nucleotide sequencing of DNA.

SECTION B

Gene cloning: Construction of Gene libraries, cloning vectors, gene probes, screening applications, analysis of gene expression, site directed Mutagenesis, microarrays and DNA chips.
Gene Expression: Vector and host engineering, expression in bacteria, yeasts, mammalian cells and plants.

SECTION C

Gene Regulation: DNA transfection, blotting techniques, processing of recombinant proteins, transposon and tagging.

SECTION D

Gene Therapy: Strategies of gene delivery, gene replacement, gene augmentation, gene correction, gene editing and gene regulation, gene silencing.

Course Outcome:
CO1 - Understand the importance of genetic engineering. Define recombinant DNA (rDNA), and list the most common laboratory techniques used to generate it.
CO2 - The importance of plasmids and viruses to genetic engineering.
CO3 - Know the natural function of restriction endonucleases and how a normal bacterial cell protects its DNA from their activity.
CO4 - Explain DNA cloning, PCR, blotting, mutagenesis and sequencing techniques and their applications
CO5 - Describe how transgenic bacteria, plants, and animals may be used to generate products useful to humans, gene therapy techniques

Text / Reference Books

9. *Recombinant DNA.* By James D Watson and Michael Gilman. 2nd Edition, (2001). W. H Freeman and Company NY.
10. Molecular Biotechnology: *Principles Application of Recombinant DNA* by Bernard R Glick and Jack J. Pasternak, 2nd Edition. ASM press Washington DC.
11. *Genetic Engineering* by Kavita B Alhuwalia, New Age International (P) Ltd.

List of Text / Reference Books:

7. *An Introduction to Genetic Engineering* by Desmond S.T. Nicholl, Cambridge University Press.
7. *Genetic Engineering: An introduction to Gene analysis and exploitation in eukaryotes* by Kingsman and Kingsman.
8. *DNA cloning*: *A Practical Approach* by Glover and Hames

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

ENZYMOLOGY

Sub. Code: BTF -303
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Introduction of enzymes: General properties and significance, classification and nomenclature. Terms and definition in enzymology: enzyme activity, specific activity, turnover number, active site, isoenzyme, marker enzyme, multienzyme complex, extracellular enzymes, extremozymes, abzymes, ribozymes, induced enzyme. Factor affecting enzyme activity: pH, Temperature, substrate concentration etc.

SECTION B

Isolation, purification of enzyme, enzyme kinetics: steady rate kinetics, Derivation of Michaelis-Menten equation using steady state/equilibrium kinetics, plots of Lineweaver- Burke etc. mechanism of substrate and multi-substrate enzyme catalyzed reaction.

SECTION C

Immobilized Enzymes: Free vs immobilized enzymes, economic argument for immobilization, methods, kinetics and effect of solute partition and diffusion on it , uses, enzymes deactivation and bioreactors using immobilised enzymes

SECTION D

Enzyme used in detergents, use of proteases in food, leather and wool industries, production of glucose syrup from starch using starch hydrolyzing enzymes, 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.

Course Outcomes

CO1 - Students will be able to understand the general characteristics of enzymes
CO2 - Students will be able to understand the factor effecting enzyme activity
CO3 - Students will be able to understand the kinetics of enzymes and its attributes
CO4 - Students will be able to understand the importance of immobilization of enzymes and application of enzymes in various factors.

Text / Reference Books

9. *Fundamentals of Enzymology* by Prices and Stevens Oxford Press (1999)
10. *Principles of enzymology, for Food Science* 1972 by JR Whitkar, M Dekker Publishers.
11. "*Biochemical Engineering"* by James M.Lee Prentice Hall (1992)
12. " *Principles of Biochemistry"* by A. Lehninger (1987)
13. *"Design and Analysis of immobilised Enzyme flow Reactors"* by W.R Vieth etal.
14. *Enzyme*: Dixon & Webb IRL Press.

List of Text / Reference Books

1. *Principles of Enzymology for technological Applications* (1993). Butterworth, Heinemann Ltd. Oxford.
2. *Enzymes in Industry: Production and Applications:* W.Gerhartz (1990), VCH Publishers, New York.
3. *Biocatalyst for Industry:* J.S Dordrick (1991), Plenum press, New York.
4. *Enzyme Technology*- M.F. Chablin and C.Buoke, Cambridge University Press Cambridge 1990.
5. *Enzyme structure & function* by S Blackburn, Marcel Dekker Inc, NY.

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

BIOPROCESS ENGINEERING II

Sub. Code: BTF -305
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Introduction: Upstream and downstream aspects of bioprocess. Application of downstream processing in bioprocesses, its chronological developments, economics, scope.

Physio-chemical basis of bioseparation: size, charge, affinity, hydrophobic and hydrophilic interactions. Properties of bioproducts, classification of bioproducts: pharmaceutical, food, beverages and agricultural products.

SECTION B

Primary purification techniques: separation of particulate matter using following techniques: filtration: filter aid, plate and frame filter, rotary vacuum filters, crossflow filtration, filtration at constant pressure, centrifugation: batch and continuous, foam based separation.

SECTION C

Enrichment techniques: Aqueous two phase extraction, adsorption-desorption process, protein precipitation: with salt, organic solvents and polymers, super critical fluid extraction, membrane based separation: ultra filtration and microfiltration, reverse osmosis, dialysis.

SECTION D

Scale-up**:** Introduction, scale-up procedure from laboratory scale to plant scale, Scale-up for constant k_La. Scale-up based on shear forces, Scale-up for constant mixing time.

Course Outcomes

CO1 - **Students will be able to understand the Upstream and downstream aspects of bioprocess and applications**

CO2 - **Students will be able to understand the basics concepts of bioseparation and purification**

CO3 - **Students will be able to understand the extraction process and protein precipitation,**

CO4 - **Students will be able to understand the concept of scale up, K_La , shear forces.**

List of References Books:

1. Biochemical Engineering fundamentals, Bailey and Ollis, Mcgraw Hill Pub.
2. Priciples of fermentation technology, PF stanbury and A Whitaker, Pergamon press
3. Unit Operation of Chemical Engineering, McCabe, Smith and Hariot, Mc Graw Hill Pub.
4. Coulson & Richardson's Chemical Engineering- Volume 1-6 (Chemical and Biochemical Reactors and process controls) ed. Richardson, J.F., Peacock, D.G., First Indian ed. Asian Books Pvt. Ltd. 1998

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 5TH SEM

DIAGNOSTIC TECHNIQUES

Sub. Code: BTF -307
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Introduction: Comparison of the methods to diagnose bacterial & parasitic infections.
Immunological Diagnostic Procedures:

Basic considerations: Antigen-antibody reactions. Signal amplification systems. Isolation and characterization of antibodies. Immuno assay systems. Assay development, evaluation and validation. Reagent formulation and their shelf life evaluation.

SECTION B

Enzyme-Linked Immunosorbent Assay (ELISA) system: Applications in clinical diagnosis and prognosis of various diseases.
Membrane based Rapid Immuno assays.

Monoclonal Antibodies: Formation and selection of Hybrid cells. Screening for specific antibodies producing Hybrid cell lines.

SECTION C

Applications of Monoclonal Antibodies: Detection of Polypeptide hormones, Tumor Markers and Cytokines. Diagnosis of infectious diseases and Drug monitoring. Detection of Miscellaneous targets e.g. Thyroxin, Vit B_{12}, Ferritin
Degradation products, Tau Protein etc.

SECTION D

DNA Diagnostic Systems: **Nucleic acid hybridization assay systems:** Basic considerations. Production of various types of hybridization probes. Diagnosis of *Plasmodium faliciparum, Mycobactrium tuberclosis, Trypanosoma cruzi* and Sickle cell by DNA hybridization.

Non-radioactive Hybridization procedures: Use of Chromogenic or chemiluminesent substrates and specific enzymes for detecting signal amplification.
DNA Finger Printing and Random Amplified Polymorphic DNA (RAPD) as Diagnostic tools.

OUTCOMES:
CO1 - Learners will be able to define basic terminology and describes basic concepts in molecular diagnostics
CO2 - The students will know the importance and the relevance of molecular diagnostic techniques
CO3 – The students will know applications of molecular diagnostics in various field including medical, forescenic, etc.

Text / Reference Books

6. ***Essentials of Diagnostic Microbiology*** **by Lissa Anne Shimeld.**
7. ***Diagnostic Microbiology*** **by Balley and Scott**
8. **Recombinant DNA. By James D Watson and Michael Gilman 2nd Edition, (2001) W. H Freeman and Company NY.**
6. ***Molecular Biotechnology*****: Principles Application of Recombinant DNA by Bernard R Glick and Jack J. Pasternak, 2nd Edition ASM press Washington DC.**
7. ***Methodology of immunochemical and immuno-logical research*** **by Kwapinski-Willey inter science.**
8. ***A handbook of practical immunology*** **by G.P Talwar. Vikas Publishing house Pvt Ltd.**

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MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

BIOREACTOR ANALYSIS AND DESIGN

Sub. Code: BTF -309
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Bioreactor: Introduction, Basic functions of a fermenter for microbial or animal cell culture, Aseptic operation and containment, Overall containment categorization, Body construction, Construction materials, Temperature control.

Types of Bioreactors – STR, Air lift reactor, bubble column reactor, PBR, FBR, TBR, Hollow fibre reactor, perfusion reactor, reactors for SSF.

SECTION B

Concept of ideal and non-ideal reactors, residence time distribution, models of non-ideal reactors- plug flow with axial dispersion, tanks-in-series model.

Aeration and agitation: The agitator (impeller),Stirrer glands and bearings, The stuffing box (packed-gland seal),The mechanical seal, Magnetic drives, Baffles, The aeration system (sparger),Porous sparger, Orifice sparger, Nozzle sparger, Combined sparger-agitator

SECTION C

The achievement and maintenance of aseptic conditions: Sterilization of the fermenter, Sterilization of the air supply, Sterilization of the exhaust gas from a fermenter, The addition of inoculum, nutrients and other ,supplements, Sampling, Feed ports, Sensor probes, Foam control, Monitoring and control of various parameters

Valves and steam traps: Gate valves, Globe valves, Piston valves, Needle valves, Plug valves, Ball valves, Butterfly valves, Pinch valves, Diaphragm valves, The most suitable valve, Check valves, Pressure-control valves, Pressure-reduction valves, Pressure-retaining valves, Safety valves, Steam traps, Complete loss of contents from a fermenter.

SECTION D

Instrumentation and Control: Introduction, Methods of measuring process variables like Temperature, Mercury-in-glass thermometers, Electrical resistance thermometers, Thermistors, Temperature control, Flow measurement and control, Gases, Liquids, Pressure measurement, Pressure control, Safety valves, Agitator shaft power, Rate of stirring, Foam sensing and control, Weight, Microbial biomass, Measurement and control of dissolved oxygen, Inlet and exit-gas analysis, pH measurement and control, Redox, Carbon dioxide electrodes, On-line analysis of other chemical factors, Ion-specific sensors, Enzyme and microbial electrodes, Near infra-red spectroscopy, Mass spectrometers, Control systems: Manual control, Automatic control, Two-position controllers (on/off), Proportional control, Integral control, Derivative control Controllers, More complex control systems, Components of a computer-linked system, Data logging, Data analysis, Process control

Course Outcomes

CO2 - Students will be able to understand about the bioreactors and its applications
CO3 - Students will be able to understand various parts of the bioreactor and their functioning
CO4 - Students will be able to understand sterilization of various parts of the bioreactors and aseptic inoculation with maintenance of sterile conditions
CO5 - Students will be able to understand the concept of flow measurement, dissolved oxygen, online analysis of the process etc.

Text / Reference Books:

11. Biochemical Engineering fundamentals, Bailey and Ollis, Mcgraw Hill Pub.
12. Priciples of fermentation technology, PF stanbury and A Whitaker, Pergamon press
13. Unit Operation of Chemical Engineering, McCabe, Smith and Hariot, Mc Graw Hill Pub.

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

GENETIC ENGINEERING LAB

Sub. Code: BTF -311
Periods/week

L	**T**	**P**
		3

MAX. MARKS :100
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:50

Laboratory work to be carried out as per BTF 301

Course Outcomes

CO1 - Students will be able to isolate and quantify genomic DNA from eukaryotic tissue.
CO2 - Students will be able to carry out extraction of genomic DNA from bacterial cells and analysis of extracted DNA by agarose gel electrophoresis.
CO3 - Students will be able to carry out DNA purification using agarose gel electrophoresis and silica.
CO4 - Students will learn determination of molecular size of DNA fragments, DNA fingerprinting by RAPD-PCR techniques
CO5 - Students will be able to perform the restriction digestion of lambda DNA with Eco RI and Hind III and analyse the restriction pattern by agarose gel electrophoresis.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

ENZYMOLOGY LAB

Sub. Code: BTF -313
Periods/week

L	T	P	
		3	**MAX. MARKS :100**
Duration of Ext. Exam: 3 Hrs			**Sessional:50**
			External:50

Laboratory work to be carried out as per BTF 303.

Course Outcomes

CO1 - Students will be able to learn the isolation and analysis of protein (enzyme) concentration in sample
CO2 - Students will be able to learn the factor effecting enzyme activity
CO3 - Students will be able to learn the kinetics of enzymes.
CO4 - Students will be able to learn the immobilization of enzyme and analysis of enzyme activity in immobilized form

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

BIOPROCESS ENGG LAB

Sub. Code: BTF -315
Periods/week
L T P
3

MAX. MARKS :100
Sessional:50
External:50

Duration of Ext. Exam: 3 Hrs

Laboratory work to be carried out as per BTF 305.

Course Outcomes

CO1 - Students would be able to isolate the pure culture of amylase producing microorganisms from the soil and compare the amylase activity of different isolates.
CO2 - Students would be able to produce amylase in shake flask batch culture .
CO3 - Student would be able to isolate the crude amylase extract by centrifugation .
CO4 - Students would be able to primarily purify amylase by ammonium sulphate precipitation.
CO5 - Students would further purify the protein by dialysis.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 5TH SEM

DIAGNOSTIC LAB

Sub. Code: BTF -317
Periods/week
L T P
3

MAX. MARKS :100
Duration of Ext. Exam: 3 Hrs
Sessional:50
External:50

Laboratory work to be carried out as per BTF 307.

Course Outcomes

CO1 - Students will be able to learn the antigen antibody reaction.
CO2 - Students will be able to learn blood group determination
CO3 - Students will be able to learn rocket electrophoresis
CO4 - Students will be able to learn ELISA test.
CO5 - Students will be able to calculate hemoglobin content in blood

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 6TH SEM

PLANT BIOTECHNOLOGY

Sub. Code: BTF -302
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Introduction, Cryo and organogenic differentiation, Types of culture: Seed, Embryo, Callus, Organ, Cell and Protoplast culture.

Micropopagation

Axillary bud proliferation, Meristem and shoot tip culture, bud culture, organogenesis, embryogenesis, advantages and disadvantages of micropopagation.

SECTION B

In Vitro haploid production

Androgenic methods: Anther culture, Microspore culture, factors effecting and rogenesis. Significance and use of haploids, Ploidy level and chromosome doubling, diplodization, Gynogenic haploids, factors effecting gynogenesis, chromosome elimination techniques for production of haploids in cereals.

SECTION C

Protoplast Isolation and fusion

Methods of protoplast isolation, Protoplast development, Somatic hybridization, identification and selection of hybrid cells, Cybrids, Potential of somatic hybridization, limitations Somaclonal variation: Nomenclature, methods, applications basis and disadvantages. Gametoclonal variation

Plant Growth Promoting bacteria

Nitrogen fixation, Nitrogenase, Hydrogenase, Nodulation, Biocontrol of pathogens, Growth promotion by free-living bacteria

SECTION D

Plant Molecular Biology

Plant gene structure as a discontinuous gene, Control sequences

Gene transfer in plants: Transient and stable gene expression, Marker genes, selected markers, Chimeric gene vectors.Gene transfer methods: Agrobacterium, Viruses and Transposable elements. Vectorless or direct DNA transfer: Physical, Chemical and imbibation methods of gene transfer.

Transgenics in crop improvement: *Resistance to biotic stresses- insect, virus and disease (fungus and bacterium) resistance, Herbicide resistance, Development of stress and senecsence-tolerance-Oxidative stress, salt stress and fruit ripening, Transgenics for: improved quality, longer life, flower color and shapes, for male sterility, for terminator seed. Trangenic plants as bioreactors: production of carbohydrates, lipids, vitamins and minerals, biodegradable plastics, peptides, proteins and edible vaccines. Commercial transgenic crops.*

Course Outcome:

CO1 - The students would be able to understand importance of plant tissue culture for commercial applications.
CO2 - The students will have knowledge of methods of plant genetic engineering, selection systems and detection and characterization of transgenic plants.
CO3 - Students will be able to understand the role of plant genetic engineering in crop improvement by introduction of agronomically important traits.
CO4 - Creation of transgenic plant for biotic and abiotic stress tolerance.
CO5 - Knowledge about commercial transgenic crops, terminator technology, edible vaccines.

Text / Reference Books

3. *Introduction to Plant Biotechnology:* by H.S Chawla, 2nd edition, Oxford and IBH Publishing Co. Pvt Ltd. New Delhi

4. *Molecular Biotechnology: Principles and Applications of recombinat DNA* Bernard R Glick, Jack.J. Pasternak, ASM press Washingot DC.

5. *Plant Tissue culture: Theory and Practice.* S.S. Bhojwani and M.K. Razdan, Elsevier Science, Netherlands (1996)

6. Improving Plant draught, salt and freezing tolerance by gene transfer of a single stress-inducible transcription factor (1999*) Nature Biotechnology* 17(3): 287-291. Kasuga, M., Q Liu, et al.

7. *Heterologous expression of Arabidopsis* phytochrome B in transgenic potato influences photosynthetic performance and tuber development (1999) *Physiology* 120, (1): 73-81 Thiele, A., M. Herold, et al.

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 6TH SEM

ANIMAL BIOTECHNOLOGY

Sub. Code: BTF -304
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Introduction: History and scope of animal biotechnology.

Basic technique of animal cell culture & their applications. Balanced salt solutions and simple growth media. Serum quality and cell culture.

Preservation and maintenance of animal cell lines. Cryo preservation and transport of animal germ plasm (i.e. semen, ovum and embryos)

SECTION B

Transgenic animals; *Methodology* – retroviral vector method, DNA microinjection method and engineered embryonic stem cell method. Cloning by nuclear transfer. Yeast artificial chromosome transgenesis.
In Vitro fertilization and embryo transfer.

SECTION C

Molecular biological techniques for rapid diagnosis of genetic diseases and gene therapy. Molecular maps of animal genomes. Chemical carcinogenesis. Transfection. Oncogenes and antioncogenes.

SCETION D

Gene cloning techniques for mammalian cells, Establishment of immortal cell lines, cloning in mammalian cells, expression of mammalian genes in prokaryotic and eukaryotic systems. Extinction of gene function by antisense RNA and DNA.

Course Outcomes

CO1 - Students will be able to understand animal biotechnology and its applications.
CO2 - Students will be able to understand the principles of animal tissue culture techniques
CO3 - Students will be able to understand the transgenic animals and method to produce the transgenic animals.
CO4 - Students will be able to understand the basic principles and applications of gene therapy

Text / Reference Books

11. *Molecular Biotechnology* by Old and Primrose.
12. *Molecular Biotechnology: Principles and Applications of recombinant* DNA By

Bernard R. Glick, Jack. J. Pasternak, 2nd Edition. ASM press Washington DC.
13. *Animal Cell biotechnology:* R.E. Spier and J.D Griffiths (1988) Academic press.

14. *Living resources for Biotechnology, Animal cells:* A. Doyle, R. Hay and B.E. Kirsop (1990), Cambridge University Press, cambridge.

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 6TH SEM

FOOD BIOTECHNOLOGY

Sub. Code: BTF -306
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Historical Background: history of Microorganisms in food, Historical Developments.

Sources, types, Incidence, and behaviour of Microorganisms in Foods: The Role and significance of Microorganisms, Primary sources of Microorganisms found in foods

Production of culture for food fermentations, Microbial, Intrinsic and Extrinsic parameters of foods. Industrial units involved in production of fermentated foods

SECTION B

Determine Microorganisms and their products in foods: Culture, Microscopic and Sampling Methods, Conventional, SPC, Membrane Filters, Microscopic Colony Counts, Agar droplets, Dry films, MPN, DMC, Dye reduction, Roll Tubes, Microbiological Examination of surfaces and sampling, Metabolically Injured Organism, Enumeration and Detection of food borne Organisms. Physical, Chemical and Immunological Methods and Bioassay.

SECTION C

Food additives: Need for food additives, types of food additives. Development of novel food and food ingredients; SCP, polysaccharides, low calorie sweeteners, naturally produced flavor modifier, food coloring agent, food supplements and Nutraceuticals.

SECTION D

Food Spoilage: General principle of spoilage, factors affecting spoilage; Spoilage of fruits and Vegetables, Spoilage of Miscellaneous Foods, Food preservation, Characteristics of Radiations of Interest in Food Preservation, Destruction of Microorganisms and Applications, Radappertization, Radicidation and Radurization of food legal status of food irradiation. **Storage and Stability of irradiated foods Preservation:** High and Low Temperature, Drying, Pathogens, Psychrotrophs, thermophiles and radiation resistance Microorganisms

Course Outcomes

CO1 - Students will be able to understand the role of microorganisms in food, and their microbiological analysis.
CO2 - Students will be able to understand importance of food spoilage and food preservatives.
CO3 - Students will be able to understand food additives, food supplements and nutraceuticals

Text / Reference Books

13. *Modern Food Micro-Biology* by J.M. Jay (1986) Van Nostrand Reinhold company New York.

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 6TH SEM
ENVIRONMENTAL BIOTECHNOLOGY

Sub. Code: BTF -308
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Environment: Introduction, basic concept and issues, current status of biotechnology in environment protection, approaches for management methodology and limitations. **Environment Pollution:** types of pollution in air, water and soil, water as a scare natural resource, sources of pollution, measurement, collection and treatment.

SECTION B

Microbiology of Waste Water Treatment: Waste water collection, treatments – physical, chemical and biological process, aerobic and anaerobic process, activated sludge, oxidation ditches, filters, rotating discs and drums, and bioreactors.
Treatment schemes for waste waters of diary, distillery, tannery, sugar, antibiotics industries.

SECTION C

Microbiology of degradation of xenobiotics: Xenobiotic compounds, Hazardous wastes, Biodegradation, ecological consideration, biological detoxification, biotechnological management. **Bioremediation:** introduction, types, advantages, systems, applications and current market, restoration of degraded soil and waste land.

SECTION D

Biopesticides in integrated pest management and solid waste management.

Global Environmental Problems: Ozone depletion, UV-B, green house effect, acid rain, their impact and management.

Novel Methods for Pollution Control: Vermitechnology, Waste Water Treatment Using Aquatic Plants, Root Zone Treatment. Aiming for Biodegradable and Ecofriendly Products.

Course Outcomes

CO1 - Obtain knowledge on basic principles and technologies of decontamination of persistent organic pollutants
CO2 - Obtain knowledge of bioremediation, mycoremediation, and phytoremediation technologies, as well as physico-chemical technologies
CO3 - Understand about global environmental problems
CO4 - Understand the technologies such as Vermitechnology and other waste water treatment processes

Text / Reference Books:

4. *"Waste water Engineering Treatment and Disposal and Reuse*" by Metcalf & Eddy.
5. "*Water Pollution Management hand Book"* by Lepathak.
6. "*Waste Water Management*" by Arceivala.
7. "*Environment Biotechnology"* by C.F. Forster and D.A. J. Wase.
8. "*New Processes of Waste water treatment and recovery"* by G. Mattock (ED) Ellis Horwood.

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MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 6TH SEM

BIOMATERIAL ENGINEERING

Sub. Code: BTF -310
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

SECTION A

Definition of biomaterials – biologically derived materials or materials compatible with biology. Common biomaterials: some proteins, many carbohydrates and some specialized polymers. Collagen (protein in bone and connective tissues): Structure production and its use. Fibroin (protein in silk): Production a and its use. Production of these proteins by conventional cloning methods.

SECTION B

Carbohydrates: Modified carbohydrates actin gas lubricants for biomedical applications; Polydextrose made from bacteria; Carbohydrates modified from enzymes; artificial wood.

SECTION C

Biopolymers: Synthesis from a simple biological monomer (eg hyaluronate polymers); Dextrans (used in chromatography columns); Rubberllike materials produced by bacteria and fungi (Polyhydroxybutyrate PHB), Polycaprolactone(PCL).

SECTION D

Industrial biopolymers: Production of polyphenol resins by the enzyme soybean peroxidase; Evaluation of the properties of biopolymers to make good biomaterials; Tensile strength(both elasticity and breaking strength); Hydration, visco –elastic properties; viscosity.

Production of a copolymer of PHB and PHV(polyhydrovaleric acid), sold as Biopol by fermentation on *Alcaligenes eutrophus*; Biodegradable polymers.

Course Outcomes

CO1 - Students will be able to understand the role of biomolecules, biopolymers, and industrial polymers in biomaterials.
CO2 - Students will be able to understand the property of biomaterials.
CO3 - Students will be able to understand the basics of production of biomaterials from bacteria and fungi.

List of Text Books:

6. Ratledge C and Kristiansen B, Basic Biotechnology, Cambridge University Press, 2nd Edition, 2001
7. Doi Y, Microbial Polyesters, VCH Weinheim, 1990

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight

questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 6TH SEM

PLANT BIOTECH LAB

Sub. Code: BTF -312
Periods/week
L T P
3

MAX. MARKS :100
Duration of Ext. Exam: 3 Hrs
Sessional:50
External:50

Laboratory work to be carried out as per BTF 302.

Course Outcome:

CO1 - The students would be able to understand cutting edge technologies in plant genetic engineering

CO1 - Importance of plant transformation for production of nutritionally better products.

CO1 - Students would be able to understand role of marker assisted selection and breeding through techniques like RAPD, RFLP, AFLP, QTL mapping.

- Molecular methods for breeding tissue culture for commercial applications.
- The students will have knowledge of IPRs in agriculture, patents and socio-economic issues related to foods security.

MAHARSHI DAYANAND UNIVERSITY

3. TECH. BIOTECH. 6TH SEM

ANIMAL BIOTECH LAB

Sub. Code: BTF -314
Periods/week

L	T	P	
		3	**MAX. MARKS :100**
Duration of Ext. Exam: 3 Hrs			**Sessional:50**
			External:50

Laboratory work to be carried out as per BTF 304.

Course Outcomes

CO1 - Students will be able to carry out primary cell culture of human lymphocytes
CO2 - Students will be able to carry out induction of interferon in cell culture.
CO3 - Students will be able to carry out culture of Fibroblast and Epithelial cells

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 6TH SEM

FOOD BIOTECH LAB

Sub. Code: BTF -316
Periods/week

L	T	P
		3

MAX. MARKS :100
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:50

Laboratory work to be carried out as per BTF 306.

Course Outcomes

CO1 - Students will be able to learn role of microorganisms in food (preparation and analysis of curd)
CO2 - Students will be able to learn the presence of microflora in food samples by different methods.
CO3 - Students will be able to calculate the sugar content, lipid content, protein content of food sample.
CO4 - Students will be able to learn the spoilage of food samples, and food preservation
CO5 - Students will be able to learn the destruction of microorganisms by radiation

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 6TH SEM

ENVIRONEMTAL BIOTECH LAB

Sub. Code: BTF -318
Periods/week

L	T	P
		3

MAX. MARKS :100
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:50

Laboratory work to be carried out as per BTF 308.

Course Outcomes

CO1 - Students will be able to carry out determination of water TDS, salinity, alkalinity, hardness and BOD.
CO2 - Students will learn the estimation of heavy metals in water/soil samples.
CO3 - Students will learn the estimation of nitrate, phosphate and sulphate in drinking water
CO4 - Students will be able to carry out determination of chemical oxygen demand (COD) of sewage samples
CO5 - Students will be able to carry out isolation of xenobiont degrading bacteria by selective enrichment techniques

M.D.UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATION 4th YEAR B. TECH. IN BIOTECHNOLOGY, SEMESTER VII
EFFECTIVE FROM THE SESSION 2012-13

S. No	Course No.	Subject	Teaching Schedule				Examination Schedule				Duration of exam
								Marks Of Class			
			L	T	P/D	Total	Th.	Work	P/VV	Total	
1.	BT 401-F	Concepts of Bioinformatics	3	1	-	4	100	50	-	150	3
2.	BT403-F	Metabolic Engineering	3	1	-	4	100	50	-	150	3
3.	BT 405-F	Intellectual Property Rights in Biotech	3	1	-	4	100	50	-	150	3
4.	BT 407F	Bioentrepreneurship	3	1	-	4	100	50	-	150	3
5.	BT- 409F	Concepts of Biofuels and Bioenergy	3	1		4	100	50	-	150	3
6.		Elective	3	1		4	100	50	-	150	3
7.	BT – 411F	Bioinformatics Lab	-	-	3	3	-	50	50	100	3
8.	BT– 413F	Bioenergy Lab	-	-	3	3	-	50	50	100	3
9.	BT– 415F	Metabolic Engg. Lab	-	-	3	3	-	50	50	100	3
		Total	**18**	**6**	**9**	**33**	**600**	**450**	**150**	**1200**	

Electives:

BT-417-F Stem Cells in health care
BT-419F Bioethics and Biosafety
BT–425F Virology
BT–427F Energy and Environment
BT–429F Genomics & Proteomics
BT–437F Fundamentals of Nanobiotechnology

M.D.UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATION 4th YEAR B. TECH. IN BIOTECHNOLOGY, SEMESTER VIII EFFECTIVE FROM THE SESSION 2012-13

Sl. No.	Course No.	Subject	Internal Marks	External Marks	Total Marks
1.	**BT- 402F**	Industrial Training/Institutional Project Work	150	150	300

Note:

The students are required to undergo Industrial Training or Institutional Project Work of duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the mid-term progress report at the Institute. The presentation will be attended by a committee. Alternately, the teacher may visit the Industry to get the feedback of the students.

The final viva-voce of the Industrial Training or Institutional Project Work will be conducted by an external examiner and one internal examiner appointed by the Institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the Board of Studies in Engg. & Technology. Assessment of Industrial Training or Institutional Project Work will be based on seminar, viva-voce, report and certificate of Industrial Training or Institutional Project Work obtained by the student from the industry or Institute.

The internal marks distributions for the students who have undergone Industrial Training consist of 50 marks from the industry concern and 100 marks by the committee members consisting of faculty members of concerned department of the parent institute.

The teachers engaged for Institutional Project work shall have a workload of 2 hours per group (at least 4 students) per week.

Course Outcomes:

At the end of this course the student shall be able to

CO1 have an understanding how to work in actual industry environment

CO2 utilise the technical resources

CO3 write technical/training reports

CO4 give oral presentation related to the work completed

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

CONCEPTS OF BIOINFORMATICS

Sub. Code: BT -401F

Periods/week

L:3 T:1 **MAX. MARKS :150**

Duration of Ext. Exam: 3 Hrs **Sessional:50**

External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Introduction to Bioinformatics, Databanks – Nucleotide databanks – Genbank, NCBI, EMBL, DDBJ, protein databanks –Sequence databanks – PIR, SWISSPROT, TrEMBL; Structural databases – PDB,SCOP, CATH, PDB; Sequence storage – Sequence accuracy – EST, STS

SECTION B

Sequence analysis: Analysis tools for sequence data banks, Dynamic programming: Needleman and Wunsch algorithm, Smith Waterman algorithm; Global and local aligment, Database searches: BLAST, FASTA, Multiple sequence alignment.

SECTION C

Predictions: Chao-Fasman algorithm, Hidden Markov model, Neural Networking, Protein classification, Fold recognition (threading), homology detection, SRS-Access to biological data banks and integrated data analysis tools.

Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation – Paralogues and orthologues, Tree building and tree evaluation, Phylogenetic software.

SECTION D

Managing Scientific data: Introduction, challenges faced in integration of Biological information, SRS/MRS, Kleisli Query System and TAMBIS, for a Bioinformatics Database.

Text / Reference Books

1. Developing Bioinformatics Computer Skill by Gibes & Jombeck, Shroff publication
2. Bioinformatics by David W. Mount
3. Bioinformatics by Higgins & Taylor
4. Bioinformatics by Lacroin & Critchlow

Course Outcomes:-

At the end of this course, the student should be able to –

CO1 Develop an understanding of the basic theory of these computational tools.
CO2 Gain working knowledge of these computational tools and methods.
CO3 Appreciate their relevance for investigating specific contemporary biological questions.
CO4 Critically analyse and interpret the results of their study

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

METABOLIC ENGINEERING

Sub. Code: BT – 403F

Periods/week

L:3 T:1 **MAX. MARKS :150**

Duration of Ext. Exam: 3 Hrs **Sessional:50**

External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION-A

Basic concepts of Metabolic Enginerring - Overview of cellular metabolism; Different models for cellular reaction for primary and secondary metabolites (with reference to polyketide, flavonoid).

SECTION B

Metabolic flux & modelling - Intergration of anbolism and catabolism, metabolic flux distribution analyis bioprocess, material, kinetic types, equilibrium reaction. Experimental determination method of flux distribution, metabolic flux analysis and its applications, Thermodynamics of cellular processes.

SECTION C

Metabolic Profiling & Transcription Factors for metabolic Engineering Metabolic Engineering to improve tolerance of plants to abiotic factors,/ climate change.

Metabolic engineering. with Bioinformatics, Metabolic pathway modeling, Analysis of metabolic control and the structure, metabolic networks, metabolic pathway synthesis algorithms.

SECTION D

Applications of metabolic Engineering - in pharmaceuticals, chemicals bioprocess food technology, nutriceuticals, agriculture, biofuels, environmental bioremediation and biomass conversion.

Course Outcomes

CO1 - Students will be able to understand about Metabolic Engineering concepts and models

CO2 - Students will be able to understand flux analysis, thermodynamics, kinetics, distribution analysis etc.

CO3 - Students will be able to understand improvement of plants using metabolic engineering, network analysis and relation of Metabolic Engineering with bioinformatics.

CO4 - Students will be able to understand the applications of Metabolic Engineering in pharmaceuticals, environmental bioremediation and biomass conversion.

Text Books

1. Gregory N. Stephanopoulos, Aristos A. Aristidou, Metabolic Engineering – Principles and Methodologies,

1st Edition, Jens Nielsen Academic Press, 1998
2. Relevant research papers
3. Gerhard Gottschalk, Bacterial Metabolism, 2nd Edition, Springer Verlag, 1986
4. S. A. Teukolsky, W. T. Vellerling, B. P. Flannery, W. H. Press, Numerical Recipes in C, Cambridge University
Press, 1993

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 7TH SEM

INTELLECTUAL PROPERTY RIGHTS IN BIOTECH

Sub. Code: BT – 405F
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION-A

Intellectual property rights: Meaning,-Evolution-Classification and forms, Rationale for protection of IPRs- Importance of IPRs in the field of science and technology.

Scientific and Commercial breakthroughs of Biotechnology at national and intellectual level. **SECTION-B**

Intellectual Property: A Copy Right & Industrial Properties, Trademarks, Designs, Geographical Indications; IPR & Technology transfer, Role of patentee & Licensor, Breakthroughs of IPR at National and International level.

SECTION-C

Patents-Concepts and principles of patenting-Patentable subject matter; Procedure of obtaining patents- Rights of patents- Infringement of patent rights; Remedies for infringement of patent rights- Patentability and emerging issues.

Patentability of life forms with special reference to Microorganisms, Pharmaceutical industries

Biodiversity, naturally occurring substances.

SECTION-D

Human genome and IPR, in Public-Private partnership, Government Policies at National and International level in patenting IPR. Availability of Patent facilitating funds, Subtentative Patent Law Treaty, (SPLT), Word Patent, European Patent.

Course Outcomes

CO1 - Students will be able to understand about meaning of IPR, and importance of IPR in science and technology

CO2 - Students will be able to understand the concept of copy right, trade mark, IPR at national and international level

CO3 - Students will be able to understand the concept and principles of patents, patentability of life forms and infringements

CO4 - Students will be able to understand Government Policies at National and International level in patenting IPR, SPLT, concept of world patent, European patent

Text / Reference Books

The law and Strategy of Biotechnology Patents, Sibley Kenneth.

MAHARSHI DAYANAND UNIVERSITY

8. TECH. BIOTECH. 7TH SEM

BIOENTREPRENEURSHIP

Sub. Code: BT-407F
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION-A

Introduction: Creativity & Entrepreneurial personality and Entrepreneurship in Biotechnology, Concept and theories of Entrepreneurship, Entrepreneurial traits and motivation, Nature and importance of Entrepreneurs, Government schemes for commercialization of technology (Eg. Biotech Consortium)

SECTION-B

Project management: Search for a business idea, concept of project and classification, project identification, project formulation, project design and network analysis, project report, project appraisal.

SECTION-C

Financial analysis: Ratio analysis, Investment process, Break even analysis, Profitability analysis, Budget and planning process.

Sources of finance: Source of development finance, Project financing, Institutional financing to Entrepreneurs, Financial institutions, Role of consultancy organizations.

SECTION-D

Marketing channels: Methods of marketing, marketing channels, Marketing institutions and assistance.

Biotech enterprises: Setting up Small, Medium & Large scale industry, Quality control in Biotech industries, Location of an enterprise, steps for starting a small industry, incentives and subsidies, exploring export possibilities.

Course Outcomes

CO1 - Students will be able to understand the general characteristics of entrepreneurships and Government schemes for commercialization of technology

CO2 - Students will be able to understand the basics of project management such as project formulation, project report and appraisal

CO3 - Students will be able to understand the financial analysis of projects and financial institutions

CO4 - Students will be able to understand the concept of setting of business, marketing, and other attributes

Text/References:

1. Innovation and entrepreneurship in biotechnology: Concepts, theories & cases by D. Hyne & John Kapeleris, 2006.

2. The Buisiness of Biotechnology: From the Bench of the Street: By Richard Dana Ono Published Butterworth- Heinemann, 1991.

3. Entrepreneurship in Biotechnology: Managing for growth from start-up By Martin Grossmann, 2003.

4. Best Practices in Biotechnology Education: By Yali Friedman, Published by Logos Press, 2008. 356 pages.

5. Plant Development and Biotechnology: by Robert Nicholas Trigiano, Dennis John Gray; Published by CRC Press, 2004, 358 pages.
6. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2005.
7. Projects: Planning Analysis, Selection, Implemantation & Review, Prasannan
8. Chandra, Tata Mc Graw-Hill Publishing Co. 12997.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 7TH SEM

CONCEPTS OF BIOFUELS AND BIOENERGY

Sub. Code: BT – 409F
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

Section A

Current energy consumption, overview of biofuel/bioenergy and biorefinery concepts. Fundamental concepts in understanding biofuel/bioenergy production. Alternate source of energy, Biomass as source of energy; Biofuels; Bioethanol and biohydrogen; Solid waste management Renewable feedstocks and their production.

Section B

Feedstocks availability, characterization and attributes for biofuel/bioenergy production Biomass preprocessing: drying, size reduction, and densification, Various biofuels/bioenergy from biomass, Biomass conversion to heat and power: thermal gasification of biomass, anaerobic digestion

Section C

Biomass conversion to biofuel: thermochemical conversion, syngas fermentation, Biochemical conversion to ethanol: biomass pretreatment, Different enzymes, enzyme hydrolysis, and their applications in ethanol production.

Section D

Biodiesel production from oil seeds, waste oils and algae Environmental impacts of biofuel production, Energy balance and life-cycle analysis of biofuel production,Value-added processing of biofuel residues and co-products; Field visit to a biofuel/bioenergy plant.

Course Outcomes

CO1 - Students will be able to understand the general characteristics of energy and alternative sources of energy
CO2 - Students will be able to understand the factor effecting bioenergy production
CO3 - Students will be able to understand the conversion of biomass into biofuel and its associated aspects
CO4 - Students will be able to understand the importance of biodiesel, and its production from different sources

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

BIOINFORMATICS LAB

Sub. Code: BT -411F

Periods/week

L	**T**	**P**
		3

MAX. MARKS :100

Duration of Ext. Exam: 3 Hrs

Sessional:50

External:50

Laboratory work to be carried out as per BT-401F

Course Outcomes

CO1 - Students will be able to learn basics of computer.
CO2 - Students will be able to learn online databases and retrieval of information
CO3 - Students will be able to learn BLAST and FASTA analysis.
CO4 - Students will be able to learn CLUSTAL and Phylogenetic analysis
CO5 - Students will be able to learn gene finder.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

BIOENERGY LAB

Sub. Code: BT -413F
Periods/week

L	T	P
		3

MAX. MARKS :100
Sessional:50
External:50

Duration of Ext. Exam: 3 Hrs

Laboratory work to be carried out as per BT-409.F

Course Outcomes

CO1 - Students will be able to learn isolation of DNA and RNA.
CO2 - Students will be able to learn the electrophoresis methods for separation of DNA
CO3 - Students will be able to learn the amplification of DNA by PCR.
CO4 - Students will be able to learn the blotting of DNA.
CO5 - Students will be able to learn the RFLP and RAPD.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

METABOLIC ENGINEERING LAB

Sub. Code: BT -415F

Periods/week

L	**T**	**P**
		3

MAX. MARKS :100

Duration of Ext. Exam: 3 Hrs

Sessional:50

External:50

Laboratory work to be carried out as per BT-403F.

Course Outcomes

CO1 - Students will be able to learn synthesis of nanoparticles by chemical and green synthesis methods

CO2 - Students will be able to learn characterization of nanoparticles using spectroscopic methods

CO3 - Students will be able to study effect synthesis parameters of nanoparticles

CO4 - Students will be able to study antimicrobial activity of nanoparticles

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

STEM CELLS IN HEALTH CARE

Sub. Code: BT – 417F

Periods/week

L:3 T:1 **MAX. MARKS :150**

Duration of Ext. Exam: 3 Hrs **Sessional:50**

External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION-A

Cell Diversification in the Early Animal Embryo: Early development of Xenopus, Spatial Segregation, Inductive Interactions, Complex Pattern of Cell Responses, Cellular response to a signal, the role of an Intracellular clock, early mammalian embryo development, Control of mammalian embryonic stem cells on pathways of development.

SECTION-B

Renewal by Stem Cells: Epidermis: Division of Stem cells, epidermal stem cells, differentiation of epidermal cells and synthesis of keratins, epidermal stem cells as a subset of basal cells, regulation of basal cell proliferation, secretory cells in the epidermis and their population kinetics.

SECTION –C

Genesis, Modulation and Regeneration of skeletal muscle: New skeletal Muscle cells form by the fusion of myoblasts, muscle cells can vary their properties by changing the protein isoforms that they contain, some myoblasts persists as Quiescent stem cells in the adult summary

Fibroblast and their Transformations: Connective tissue cell family, Fibroblasts and their character in response to signals in the extracellular matrix, its influence on connective tissue cell differentiation, action of signaling molecules on regulation of cell production, Remodling of bone, Osteoblasts secretion of bone matrix, Erosion, Cartilage development, bone structure stabilization by connective tissue framework and selective cohesion of cells.

SECTION –D

The concept of the Hemopoietic stem cell: Hemopoietic Stem cell disorders, Classification and manifestations, Aplastic and myleodysplastic disorders, Clinical applications of colony stems, complications of gene therapy, Replacement therapy, marrow transplantation, Immunologicalprinciples, Preservation and clinical use of blood and blood components.

Course Outcomes

CO1 - Obtain knowledge of cell diverfication and different stages of development

CO2 - Obtain knowledge of fusion of mycoblasts, formation of skeletal muscles, quiescent stem cells

CO3 - Understand about connective tissues, fibroblasts and osteoblasts etc.

CO4 - Understand the technologies of marrow transplantation, immunological principles and other therapies by stem cells

Texts/References

9. Ann A. Kiessling, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential,
Jones and Bartett, 2003.

10. Peter J. Quesenberry, Stem Cell Biology and Gene Therapy, 1st Edition, Willy-Less, 1998.
11. Robert Lanja, Essential of Stem Cell Biology, 2nd Edition, Academic Press, 2006.
12. A.D.Ho., R.Hoffiman, Stem Cell Transplantation Biology Processes Therapy, Willy-VCH, 2006.
13. C.S.Potten, Stem Cells, Elsevier, 2006.

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 7TH SEM

BIOETHICS AND BIOSAFETY

Sub. Code: BT – 419F
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION-A

Introduction- causes of unethical acts, ignorance of laws, codes, policies and Procedures, recognition, friendship, personal gains, Professional ethics-professional conduct.
Ethical decision making, ethical dilemmas good laboratory practices, good manufacturing practices, laboratory accreditation.

SECTION-B

Social- genetic discrimination: insurance and employment, human cloning & its impact on feticide sex determination Artificial Insemination, In Vitro Fertilization (IVF), Gamete Intrafallopian Transfer (GIFT) & Zygote Intrafallopian Transfer (ZIFT), Surrogacy,Involuntary Sterilization, Drug abuse during Pregnancy. Transplantation and Xenografting: Fetal Tissue Transplantation. Xenografts.

SECTION-C

Ethical: Eugenics, Genetic Disease and Genetic Screening. Somatic and germ line gene therapy, clinical trials, the right to information, ethics committee function. Social and ethical issues. AIDS: Disclosure, Transmission-Health Care Industry. Euthanasia (Right to Die): Advance Directives, Living Wills, Resuscitate Orders. Physician Assisted Suicide vs. death due to withdrawing/ withholding treatment.

SECTION-D

Biosafety- Definition, Requirement, Containment facilities, biohazards, genetically modified organisms (GMOs) living modified organisms (LMOs), Biosafety for human health and environment designing and management of laboratory and culture room as per the norm of GLP, GMO and FDA. Social and ethical aspects of biological weapons. The Cartagena Protocol on Biosafety. Biosafety Management: environmentally responsible use of biotechnology.

Course Outcomes

CO1 - Students will be able to understand the basic concept of unethical acts, professional ethics, good manufacturing practices and laboratory accreditation

CO2 - Students will be able to understand the concepts ofhuman cloning & its impact on feticide sex determination, different types of assisted fertilization, and drug abuses in pregnancy

CO3 - Students will be able to understand the concept of Eugenics, Genetic Disease and Genetic Screening, ethics committee function, clinical trials and Euthanasia.

CO4 - Students will be able to understand the biohazard, modified organisms, Biosafety for human health and Protocol on Biosafety

Text / Reference Books

1. Moral Matters: Ethical Issues in Medicine and the Life Sciences (1995) by Caplan, A, John Willey & Sons, Inc.
2. In the Name of Eugenics (1995) by Kevles, D., Cambridge: Harvard University Press.
3. Altered fates Gene Therapy and retooling of Human Life (1995) by Lyon, J. & Gorner, P., New York: W.W. Norton &Co., Inc
4. Case Studies in Bioetheics (1995) by Yashon, R.., R.J. Publications.
5. Cartagena Protocol in Biosafety, January (2000)
6. Biological warfare in the 21st century (1994), by M.R. Dano, Brassies London.
7. Safety Considerations for Biotechnology (1992) OECD, Paris.
8. *Biosafety Management* (2000) by P.L. Traynor. Virginia Polytechnic Institute's Publication.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

VIROLOGY

Sub. Code: BT –425F **MAX. MARKS :150**

Periods/week **Sessional:50**

L:3 T:1 **External:100**

Duration of Ext. Exam: 3 Hrs

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

General Virology

Brief outline on discovery of viruses, nomenclature and classification of viruses; distinctive properties of viruses; morphology & ultrastructure; capsids &their arrangements; types of envelopes and their composition-viral genome, their types and structures; virus related agents(viroids, prions).

SECTION B

General Methods of Diagnosis and Serology.

Cultivation of viruses in embryonated eggs, experimental animals, and cell cultures; primary

15. secondary cell cultures; suspension cell cultures and monolayer cell cultures; cell strains, cell lines and transgenic systems; serological methods - haemagglutination & HAI; complement fixation; immunofluorescence methods, ELISA and Radioimmunoassays; assay of viruses -physical and chemical methods (protein, nucleic acid, radioactivity tracers, electron microscopy)-Infectivity assay (plaque method,end point method) – Infectivity assay of plant viruses.

SECTION C

Bacterial Viruses

Bacteriophage structural organization; life cycle; one step growth curve; transcription; DNA replication; eclipse phase; phage production; burst size; lysogenic cycle; bacteriophage typing; application in bacterial genetics; brief details on M13,Mu,T3,T4, and Lamda P1.

SECTION D

Plant Viruses

Classification and nomenclature; effects of viruses on plants; appearance of plants; histology, physiology and cytology of plants; common virus diseases of plants; paddy, cotton, tomato, and sugarcane; viruses of cyanabacteria, algae, fungi; life cycle; type species of plant viruses like TMV, Cauliflower Mosaic Virus and Potato Virus X; transmission of plant viruses with vectors (insects, nematodes, fungi) and without vectors (contact, seed and pollens); diagnostic techniques in seeds; seed stocks and diseased plants (seed morphology, seedling; symptomatology, indicator plants, serological methods, histochemical tests and fluorescent microscopy); prevention of crop loss due to virus infection-virus-free planting material; vector control.

Animal Viruses

Classification and nomenclature of animal human viruses; epidemiology, lifecycle, pathogenicity, diagnosis, prevention and treatment of RNA Viruses Picorna.Ortho myxo, Paramyxo, Toga and other arthropod viruses, Rhabdo. Rota, HIV and other Oncogenic

viruses; DNA viruses; Pox, Herpes, Adeno, SV 40; Hepatitis viruses, viral vaccines (conventional vaccines, genetic recombinant vaccines used in national immunisation programmes with examples, newer generation vaccines including DNA Vaccines with examples) interferons, and
antiviral drugs.

Learning Outcomes

CO1 - Students will be able to understand the general aspects of viruses as; discovery, classification, and structure.

CO2 - Students will be able to learn cultivation of viruses, serological methods for viruses.

CO3 - Students will be able to understand the life cycle of bacteriophase and application in bacterial genetics.

CO4 - Students will be able to understand the properties of different plant and animal viruses, ttransmission of plant viruses, and vector control of plant viruses.

CO5 - Students will be able to understand the properties of different animal viruses, their Classification and nomenclature, viral vaccines, interferons, and antiviral drugs

Text Books

1. Morag C and Timbury M.C (1994) Medical virology-X Edition. Churchill Livingstone, London.
2. Dimmock NJ, Primrose SB (1994). Introduction to Modern Virology, IV Edition, Blackwell Scientific Publications, Oxford
3. Conrat HF, Kimball PC and Levy JA (1994) Virology-Ill Edition Prentice Hall, Englewood cliff, New Jersey.
4. Mathews, RE.,(1992) Functionals of Plant virology, Academic press, San Diego.
5. Topley and Wilson's (1995) Text Book on Principles of Bacteriology, Virology and Immunology. Edward Arnold, London.
6. Lennetter, EH (1984) Diagnostic procedures for Viral and Rickettsial diseases. American Public Health association, NY.
7. William Hayes (1985) The genetics of Bacteria and their Viruses. Blackwell Scientifi Publishers, London.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

ENERGY AND ENVIRONMENT

Sub. Code: BT -427F
Periods/week
L:3 T:1 **MAX. MARKS :150**
Duration of Ext. Exam: 3 Hrs **Sessional:50**
External:100

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Fundamental Concepts of Energy: Laws of thermodynamics as applied to energy transformations, Heat transfer and insulation.

SECTION B

Energy Sources: Conventional - Fossil fuel, Hydro-power and nuclearpower, Non conventional - Solar, geothermal and ocean, flow and fund energy resources.

SECTION C

Energy Conversion Systems: Fuels and combustion processes, Environmental aspects and their management in energy conversion systems - Thermal power plants, nuclear power plants and hydel power plants, Fuel cell technology.

SECTION D

Non-Conventional Energy Resources: Solar energy conversion systems, Solar photo-voltaic and solar thermal, Ocean thermal energy conversion (OTEC) Systems. Wind farms, Tidal energy conversion, Mini and micro hydel power plants, Energy storage technology.

Energy Management - Problems and Prospects: Energy management strategies both at generation and demand ends, Need for appropriate technologies, Strategies for energy conversion, Energy efficiency, Energy management in domestic, industrial sector, commercial establishments and transport sector. Energy Audit as a tool for energy efficiency and conservation.

Course Outcomes

CO1 - Students will be able to understand the laws of thermodynamics.

CO2 - Students will be able to understand conventional and non conventional energy sources.

CO3 - Students will be able to understand the energy management strategies at different levels, energy conservation and energy efficiency.

MAHARSHI DAYANAND UNIVERSITY

B. TECH. BIOTECH. 7TH SEM

GENOMICS AND PROTEOMICS

Sub. Code: BT -429F **MAX. MARKS :150**

Periods/week **Sessional:50**

L:3 T:1 **External:100**

Duration of Ext. Exam: 3 Hrs

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Introduction: Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA mitochondrial, chloroplast; DNA sequencing principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping: Physical mapping of genome: Conventional cytogenetics, Physical mapping by restriction hybridization analysis, FISH and related techniques, Chromosome painting and microdissection, Long range physical mapping Contig assembly, Chromosome walking and map-based cloning.

SECTION B

Genome sequencing projects

Microbes, plants and animals; Accessing and retrieving genome project information from web; Identification and classification using molecular markers-16S rRNA typing/sequencing, EST's and SNP's.

Comparative-genomics

Introduction, comparative genomics of plants, cereal and legume comparative genomics Evolutionary Genomics

Introduction to genome evolution, Acquisition of new genes, Evolution of non-coding regions, Molecular phylogenetics and applications, Evolution of multigene families in the genome

SECTION C

Proteomics

Protein analysis (includes measurement of concentration, aminoacid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid system.

SECTION -D

Pharmacogenetics

High throughput screening in genome for drug discovery identification of gene targets, Pharmacogenetics and drug development

Functional genomics and proteomics

Introduction, Strategies to find functional genes in the genome, Gene tagging strategies and application. ESTs and its utility in genomics, Differential gene profiling methods, DNA chips/Microarrays, SAGE and SNPs analysis, Protein and peptide microarray-based technology; PCR-directed protein *in situ* arrays; Structural proteomics

Course Outcomes

CO1 - Students will be able to understand the Structural organization of genome in Prokaryotes and Eukaryotes, RFLP, DNA fingerprinting, RAPD, PCR, mapping of genome

CO2 - Students will be able to understand the genome project information, 16sRNA typing, ETS, comparative genomics of plants, and genome evolution.

CO3 - Students will be able to understand the protein analysis by electrophoresis, peptide fingerprinting, LC/MS-MS, MALDI for protein analysis, and analysis of protein-protein interaction.

CO4 - Students will be able to understand the analysis of genome for drug discovery, gene targets, functional genomics and proteomics, gene profiling, microarray, SAGE and structural proteomics.

Texts/References:

1. Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2nd ed. Wiley 2006
2. Brown TA, Genomes, 3rd ed. Garland Science 2006
3. Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd ed. Benjamin Cummings 2007
4. Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th ed, Blackwell, 2006
6. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd ed, ASM Press, 1998

MAHARSHI DAYANAND UNIVERSITY
B. TECH. BIOTECH. 7TH SEM

FUNDAMENTALS OF NANOBIOTECHNOLOGY

Sub. Code: BT -437F **MAX. MARKS :150**
Periods/week **Sessional:50**
L:3 T:1 **External:100**
Duration of Ext. Exam: 3 Hrs

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 20 marks.

SECTION A

Introduction, History and basic concepts of Nanotechnology; Man made and natural nano-materials; future scopes of nanotechnology
Nanomaterials, Metal nanocluster, Semiconducting nanoparticles. Molecular clusters; DNA nanowires; Methods for synthesis
Carbon nanocluster; Nanotube; Mechanism and applications

SECTION B

Methods of measuring properties; Atomic structure, particle size determination,
surface structure, Microscopy (TEM, SEM and Field Ion), Spectroscopy (IR, Raman and X-ray)

SECTION C

Nanobiotechnology- Catalysis: Nanocrystals; Biological building blocks; Nucleic acids;
Biological nanostructures Nano-medicine; synthesis; drug delivery; application
Biomolecular Design and Biotechnology : Molecular Modelling and Biomolecular structure determination.
Functional Principles of Bionanotechnology : Information driven nano assembly, Energetics , chemical transformation, regulation,

SECTION D

Biomolecular motors, Biomolecular motors, Biomolecular sensing, self replication and machine - phase Bionanotechnology.
Bionanotechnology Today and Future : basic capabilities, Nanomedicine today, DNA computers, hybrid materials, artificial life and biosensors.

Learning Outcomes

CO1 - Students will be able to understand the concept of nanotechnology, scope of nanotechnology, nanomaterials, nanotubes.

CO2 - Students will be able to understand the analysis of nonmaterials by TEM, SEM, and spectroscopy.

CO3 - Students will be able to understand the nanocrystals, biological nanostructures, nano-medicine, nano assembly, and chemical transformation of nonmaterial.

CO4 - Students will be able to understand the bimolecular sensing, present status of nanomedicine, DNA computers, artificial life and biosensors.