

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

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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.

Text / Reference Books

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

List of Text / Reference Books:

1. *An Introduction to Genetic Engineering* by Desmond S.T. Nicholl, Cambridge University Press.

2. *Genetic Engineering: An introduction to Gene analysis and exploitation in eukaryotes* by Kingsman and Kingsman.
3. *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

ENZYMOLGY

Sub. Code: BTF -303

Periods/week

L:3 T:1

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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.

Text / Reference Books

1. *Fundamentals of Enzymology* by Priles and Stevens Oxford Press (1999)
2. *Principles of enzymology, for Food Science* 1972 by JR Whitkar, M Dekker Publishers.
3. “*Biochemical Engineering*” by James M.Lee Prentice Hall (1992)
4. “*Principles of Biochemistry*” by A. Lehninger (1987)
5. “*Design and Analysis of immobilised Enzyme flow Reactors*” by W.R Vieth etal.
6. *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

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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 $k_L a$. Scale-up based on shear forces, Scale-up for constant mixing time.

List of References Books:

1. Biochemical Engineering fundamentals, Bailey and Ollis, Mcgraw Hill Pub.
2. Principles 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

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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 B₁₂, 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 falciparum*, *Mycobacterium tuberculosis*, *Trypanosoma cruzi* and Sickle cell by DNA hybridization.

Non-radioactive Hybridization procedures: Use of Chromogenic or chemiluminescent substrates and specific enzymes for detecting signal amplification.

DNA Finger Printing and Random Amplified Polymorphic DNA (RAPD) as Diagnostic tools.

Text / Reference Books

1. *Essentials of Diagnostic Microbiology* by Lissa Anne Shimeld.
2. *Diagnostic Microbiology* by Balley and Scott
3. **Recombinant DNA.** By James D Watson and Michael Gilman 2nd Edition, (2001) W. H Freeman and Company NY.

4. ***Molecular Biotechnology: Principles Application of Recombinant DNA*** by Bernard R Glick and Jack J. Pasternak, 2nd Edition ASM press Washington DC.
5. ***Methodology of immunochemical and immuno-logical research*** by Kwapinski-Willey inter science.
6. ***A handbook of practical immunology*** by G.P Talwar. Vikas Publishing house Pvt Ltd.

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

BIOREACTOR ANALYSIS AND DESIGN

Sub. Code: BTF -309

Periods/week

L:3 T:1

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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

Text / Reference Books:

1. Biochemical Engineering fundamentals, Bailey and Ollis, Mcgraw Hill Pub.
2. Principles of fermentation technology, PF Stanbury and A Whitaker, Pergamon press
3. 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**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 301

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

ENZYMOLGY LAB

Sub. Code: BTF -313

Periods/week

**L T P
 3**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 303.

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

BIOPROCESS ENGG LAB

Sub. Code: BTF -315

Periods/week

**L T P
 3**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 305.

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

DIAGNOSTIC LAB

Sub. Code: BTF -317

Periods/week

**L T P
 3**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 307.

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

PLANT BIOTECHNOLOGY

Sub. Code: BTF -302

Periods/week

L:3 T:1

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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 androgenesis. Significance and use of haploids, Ploidy level and chromosome doubling, diploidization, 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 imbibition 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 senescence-tolerance-Oxidative stress, salt stress and fruit ripening, Transgenics for: improved quality, longer life, flower color and shapes, for male sterility, for terminator seed. Transgenic plants as bioreactors: production of carbohydrates, lipids, vitamins and minerals, biodegradable plastics, peptides, proteins and edible vaccines. Commercial transgenic crops.

Text / Reference Books

1. *Introduction to Plant Biotechnology:* by H.S Chawla, 2nd edition, Oxford and IBH Publishing Co. Pvt Ltd. New Delhi
2. *Molecular Biotechnology: Principles and Applications of recombinat DNA* Bernard R Glick, Jack.J. Pasternak, ASM press Washingot DC.
3. *Plant Tissue culture: Theory and Practice.* S.S. Bhojwani and M.K. Razdan, Elsevier Science, Netherlands (1996)
4. 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.
5. *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

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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.

SECTION 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.

Text / Reference Books

1. *Molecular Biotechnology* by Old and Primrose.
2. *Molecular Biotechnology: Principles and Applications of recombinant DNA* By Bernard R. Glick, Jack. J. Pasternak, 2nd Edition. ASM press Washington DC.
3. *Animal Cell biotechnology*: R.E. Spier and J.D Griffiths (1988) Academic press.

4. *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

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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

Text / Reference Books

1. *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

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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 scarce 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 dairy, 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.

Text / Reference Books:

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

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

BIOMATERIAL ENGINEERING

Sub. Code: BTF -310

Periods/week

L:3 T:1

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :150

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 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); Rubberlike 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.

List of Text Books:

1. Ratledge C and Kristiansen B, Basic Biotechnology, Cambridge University Press, 2nd Edition, 2001
2. 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**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 302.

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

ANIMAL BIOTECH LAB

Sub. Code: BTF -314

Periods/week

**L T P
 3**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 304.

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

FOOD BIOTECH LAB

Sub. Code: BTF -316

Periods/week

**L T P
 3**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 306.

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

ENVIRONEMTAL BIOTECH LAB

Sub. Code: BTF -318

Periods/week

**L T P
 3**

Duration of Ext. Exam: 3 Hrs

MAX. MARKS :100

Sessional:50

External:50

Laboratory work to be carried out as per BTF 308.