New Curriculum of UG Programme

FOR

B.Sc. (Agril. Biotechnology)

(Layout and Syllabus)

for

VII to VIII Semester
(Cafeteria Courses & Hands on Training)

Associate Dean & Principal
College of Agril. Biotechnology
Latur-413512
Maharashtra
Lay out of the syllabus of VIIth And VIIIth Semester

B. Sc. (Agril. Biotechnology)

- Degree programme: B. Sc. (Agril. Biotechnology)
- Duration: 4 years-8 Semesters
- Layout of the syllabus:
  - Ist to VIth semester - Course work 120 credits (APPROVED)
  - VIIth semester – Seminar : 1 credits
    Cafetaria courses : 20 credits
    (10 credits from major department
    10 credits from 2 minor department)
  - VIIIth semester – Hands on training 20credits
  - Total Credits : 167 credits
  - Non credit courses : NCC/ NSS : 0+1 credits
    : English : 1+1 credits
    : Physical Education :0+1credit
  - Deficiency course : Math : 2+0 credits
  - Grand total : 173 credits
### Department –wise courses

#### SEMESTER: VII

**A. Cafeteria courses for Department of Biochemistry & Molecular Biology**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course No.</th>
<th>Title of cafeteria courses</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>BIO 4710</td>
<td>Advances in Recombinant Technology</td>
<td>1+3=4</td>
</tr>
<tr>
<td>2</td>
<td>BIO 4711</td>
<td>Secondary Metabolites of Commercial Importance</td>
<td>1+3=4</td>
</tr>
<tr>
<td>3</td>
<td>BIO 4712</td>
<td>Immunological techniques and its Application</td>
<td>1+3=4</td>
</tr>
<tr>
<td>4</td>
<td>BIO 4713</td>
<td>Proteins and Proteomics</td>
<td>1+3=4</td>
</tr>
<tr>
<td>5</td>
<td>BIO 4714</td>
<td>Enzyme Technology</td>
<td>1+3=4</td>
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</tbody>
</table>

**Total Credits** 5+15=20

**B. Cafeteria courses for Department of Plant Biotechnology**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>PB 4711</td>
<td>Advances in Plant Tissue Culture</td>
<td>0+4=4</td>
</tr>
<tr>
<td>2</td>
<td>PB 4712</td>
<td>Techniques in Genetic Transformation</td>
<td>1+3=4</td>
</tr>
<tr>
<td>3</td>
<td>PB 4713</td>
<td>PCR Techniques and its Application</td>
<td>1+3=4</td>
</tr>
<tr>
<td>4</td>
<td>PB 4714</td>
<td>Legal issues in GMO’s and LMO’s</td>
<td>1+3=4</td>
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<tr>
<td>5</td>
<td>PB 4715</td>
<td>Plant Genomics</td>
<td>1+3=4</td>
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**Total Credits** 4+16=20
### C. Cafeteria courses for Department of Crop Science

<table>
<thead>
<tr>
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<th>Course No.</th>
<th>Course Title</th>
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<tr>
<td>1</td>
<td>CS 4713</td>
<td>Seminar</td>
<td>0+1=1</td>
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<td>2</td>
<td>CS 4714</td>
<td>Bio-pesticides: Production Technology</td>
<td>1+3=4</td>
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<tr>
<td>3</td>
<td>CS 4715</td>
<td>Bio-fertilizer production technology</td>
<td>1+3=4</td>
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<tr>
<td>4</td>
<td>CS 4716</td>
<td>Vermiculture and Organic Farming</td>
<td>1+3=4</td>
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<td>5</td>
<td>CS 4717</td>
<td>Seed Production Technology</td>
<td>1+3=4</td>
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<td>6</td>
<td>CS 4718</td>
<td>Protected cultivation of Flowers and vegetables</td>
<td>1+3=4</td>
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### D. Cafeteria courses for Department of Post Harvest and Food Biotechnology

<table>
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<tr>
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<th>Course No.</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>1</td>
<td>FB 478</td>
<td>Cereal Biotechnology</td>
<td>2+2=4</td>
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<tr>
<td>2</td>
<td>FB 479</td>
<td>Fruit and Vegetable Biotechnology</td>
<td>2+2=4</td>
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<tr>
<td>3</td>
<td>FB 4710</td>
<td>Brewing Technology</td>
<td>1+3=4</td>
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<tr>
<td>4</td>
<td>FB 4711</td>
<td>Wine Technology</td>
<td>1+3=4</td>
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<td>5</td>
<td>FB 4712</td>
<td>Patenting Inventions in Food Biotechnology</td>
<td>2+2=4</td>
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<td><strong>Total Credits</strong></td>
<td>8+12=20</td>
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### E. Cafeteria courses for Department of Animal Biotechnology

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<th>Sr. No</th>
<th>Course No.</th>
<th>Course Title</th>
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<tr>
<td>1</td>
<td>AB 477</td>
<td>Techniques in Animal Cell Culture</td>
<td>1+3=4</td>
</tr>
<tr>
<td>2</td>
<td>AB 478</td>
<td>Transgenic for improvements in animals</td>
<td>1+3=4</td>
</tr>
<tr>
<td>3</td>
<td>AB 479</td>
<td>Artificial Insemination techniques</td>
<td>1+3=4</td>
</tr>
<tr>
<td>4</td>
<td>AB 4710</td>
<td>Advances in Dairy Microbiology</td>
<td>1+3=4</td>
</tr>
<tr>
<td>5</td>
<td>AB 4711</td>
<td>Probiotics in milk and milk products</td>
<td>1+3=4</td>
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**Total Credits** 5+15= 20

**SEMESTER: VIII**

**HANDS ON TRAINING: (0+20)**

A research project will be allotted to individual student and evaluated as under:

<table>
<thead>
<tr>
<th>Sr.No.</th>
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<tbody>
<tr>
<td>1</td>
<td>Outline of Research Work</td>
<td>01</td>
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<tr>
<td>2</td>
<td>Introduction</td>
<td>01</td>
</tr>
<tr>
<td>3</td>
<td>Review of Literature</td>
<td>03</td>
</tr>
<tr>
<td>4</td>
<td>Materials and Methods</td>
<td>03</td>
</tr>
<tr>
<td>5</td>
<td>Result and Discussion</td>
<td>05</td>
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<tr>
<td>6</td>
<td>Viva Voce and Presentation</td>
<td>05</td>
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<tr>
<td>7</td>
<td>General Performance</td>
<td>02</td>
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</table>

**Total credits** 20

**Course Contents (Syllabus)**

**A. Cafeteria courses for Department of Biochemistry & Molecular Biology**

**BIO- 4710 Advances in Recombinant Technology** 1+3

**Theory:**

Introduction to genetic engineering and cloning, Restriction enzymes in cloning. Restriction endonucleases, types, properties and nomenclature, DNA ligase and


Practicals:

1. Isolation of genomic DNA/ RNA (plant)
2. Isolation of DNA from plasmid/bacteria/yeast/ blood
3. Restriction enzyme digestion
4. Ligation of DNA fragment
5. Agarose gel electrophoresis of DNA
6. Quantification of DNA and RNA
7. Conjugation & Transformation
8. Maintenance of cultures
9. Preparation of competent cells

References :

BIO-4711 Secondary Metabolites of commercial importance 1+3

Theory:

Introduction to secondary metabolites like phenols, tannins, quinolic compounds flavonides and all these are including pathways involve in plant metabolism.

Pigments: Like carotenoids, terpenoids, lycopene, chlorophyll, Curcumine, anthocynine their importance, uses, their role in plant metabolism. Plant acids: Details of oxalic acid, their role in metabolism use and function. Alkaloids: Details of alkaloids their role, uses in relation to plant metabolism.

Practicals:

1. Estimation of total phenols
2. Separation and detection of phenol by paper chromatography
3. Estimation of tannins, flavonoids, lignins, terpenoids.
4. Estimation of chlorophyll
5. Separation of different pigments by paper or thin layer chromatography
6. Estimation of oxalic acid

References:


BIO-4712 Immunological Techniques and Its Applications 1+3

Theory:
Introduction to immunology, innate immunity, acquired immunity, immune response, Antigen and antibodies ; structural organization and their properties, receptors for antigen. Immunological methods and applications, detection and quantification of antigen by antibody. Immunodetection of antigen in cell and tissues. The primary interaction with antigen.


Practicals:

1. To study the structure and function of the immunoglobulin classes.
2. Immunodiffussion
3. To study the major histocompatibility complex
4. ELISA
5. To study the antigen-antibody reactions
6. Purification of antigen and antibodies by affinity chromatography
7. Immunofluorecence microscopy
8. Radioimmunoassay (RIA)
9. Immunocytochemical Techniques
10. Agglutination reacton, precipitation reaction, CFT, Serum-blood separation

References :

Theory:

Introduction. Proteomics and functional genomics; Protein structure, functions and properties; protein synthesis; Protein separation techniques; Protein interactions. Protein Identification and Analysis, Protein preparation and separation; Two-dimensional gel electrophoresis, Limitations of two-dimensional gel electrophoresis, Protein fractionation prior to electrophoresis, Protein Digestion Techniques, Mass Spectrometers for Protein and Peptide Analysis, Protein Identification by Peptide Mass Fingerprinting, Protein identification by mass spectrometry; Basics of mass spectrometry analysis, Ionization of biological macromolecules Tandem mass spectrometry, Peptide Sequence Analysis by Tandem Mass Spectrometry, Protein Identification with Tandem Mass Spectrometry Data, Multidimensional liquid chromatography and tandem mass spectrometry Identification of post-translational modifications; Identification of phosphorylated Proteins, Protein chips, arrays and functional proteomics : Different types of protein chips; Antibody arrays, Antigen arrays, Broad-specificity capture chips, Functional protein chips, Manufacture of protein chips, Detecting and quantifying proteins bound to protein chips, Emerging protein chip technologies; Bead and particle arrays in solution, Cell and tissue arrays Applications of proteomics : Proteomics and plant biotechnology; Proteomics in plant breeding and genetics, Proteomics for the analysis of genetically modified plants, Proteomics and the analysis of secondary metabolism.

Practical:

1. Protein isolation & purification by different techniques
2. SDS-PAGE analysis
3. Two dimensional gel electrophoresis.
5. Protein identification by mass spectrometry.
6. Protein analysis by liquid chromatography.
7. Protein analysis by gas chromatography.
8. Protein motif sequence analysis.

References:

2. PROTEOMICS by Timothy Palzkill, Kluwer Academic Publisher, New York, 2002

BIO 4714: Enzyme Technology 1+3

Theory:

Large scale production and purification of enzymes Production of enzymes on an industrial scale, Large scale purification of enzymes, Synthesis of artificial enzymes, Immobilized enzymes: Preparation of immobilized enzymes, properties, application, enzyme utilization in industry, application in food drink and other industries, use of microorganisms in brewing and cheese making, use of microorganisms in organic chemicals, use of isolated enzymes in industrial processes, clinical aspects of enzymology, introduction to enzyme inhibitors and drug design, enzyme therapy, Indigenous enzymes of Bovine Milk: lipases, proteinases and phosphatases, exogenous enzymes used in dairy industry.

Practicals:

1. Enzyme assays, measurement of catalytic activity of enzymes.
2. Purification of enzyme by different methods like Dialysis, Ammo.sulphate precipitation, Gel filtration, and ion exchange chromatography etc.
3. Preparation of Immobilized enzyme
4. Use of immobilized enzyme for production of HFCS
5. Use of immobilized yeast for production of alcohol
6. Production of enzymes using various microorganisms.
7. Production of taq. Polymerase using microorganism on laboratory scale.

Reference Books:

7. Food Biotechnology by K.Shetty CRC publication.

B. Cafeteria courses for Department of Plant Biotechnology

PB 4711 Advances in Plant Tissue Culture 0+4=4

Practical:

1. Sterilization and culturing of seeds, bulbs, leaves, stems, roots, suckers, and flower buds etc.
2. Seed germination, Embryo culture and embryo rescue after wide hybridization.
3. Meristem tip culture for virus elimination.
4. *In Vitro* pollination and Fertilization.
5. Cell suspension culture.
6. Organogenesis and embryogenesis.
7. Protoplast isolation and fusion (Somatic hybrid production).
8. Secondary metabolite production,
9. Somaclonal Variations,
10. Agrobacterium mediated gene transfer,

**References:**

1. An introduction to plant biotechnology by H. S. Chawala.

**PB 4712 Techniques in Genetic Transformation 1+3=4**

**Theory:**

Practicals:

1. Induction of transformed Hairy roots using wild strains of Agrobacterium rhizogenes and production of secondary metabolites.
2. Induction of transformed shoots using wild specialized strains of Agrobacterium tumifaciens and production of secondary metabolites.
3. Introduction of foreign DNA into plants by using Particle bombardment/
5. Transformation of Chloroplast genome in higher plants by using Agrobacterium and particle gun method.
6. Regeneration of transformed plants.
7. Study of transformed plants for regulated gene expression.

References:

1. An introduction to plant biotechnology by H. S. Chawala.

PB 4713  PCR Techniques and its Application  1+3=4

Theory:
Introduction, History, Stages and components of the PCR, Working principle, Thermo stable DNA polymerases used in PCR, Primer design in PCR, Sensitivity of PCR, Variants of PCR Inverse PCR, Anchored PCR, PCR for site directed mutagenesis, Asymmetric PCR for DNA Sequencing, RT-PCR, Overlap Extension PCR, Nested PCR,
Touch down PCR, Hot Start PCR, ARMS PCR, etc. Analysis of PCR products, Applications of PCR in biotechnology Study of DNA polymorphism using PCR, PCR & RAPD markers, PCR & VNTR loci, PCR & SSR loci, Molecular Mapping using PCR, Gene tagging using PCR, PCR for the conformity of the presence of transferred gene DNA fingerprinting using PCR, Gradient PCR.

Practicals:
1. Amplification of DNA.
2. Study of DNA polymorphism.
3. Cultivar identification using PCR,
4. Studying genetic diversity using PCR,
5. DNA fingerprinting by using PCR,
6. Screening of varieties for characterization,
7. Detection of transgene by using PCR,
8. RAPD, AFLP, SSR analysis.
9. Primer Designing

References:


PB 4714    Legal Issues of GMO’s and LMO’s      1+3

Theory:

Biosafety and risk assessment issues , Regulartory framework, DBT = Department of Biotechnology; GEAC = Genetic Engineering Approval Committee; RCGM = Review Committee for Genetic Modification (constituted by DBT); ICAR = Indian Council of Agriculture Research; MEC = Monitoring & Evaluation Committees (constituted by
GEAC and RCGM). National biosafety policies and law, the cartagena protocol on biosafty, WTO and other international agencies.

**Practicals:**

The international food code or the Codex Alimentarius, Guidelines for GMO -Recombinant DNA Safety Guidelines, 1990 by Department of Biotechnology, field trials and commercial applications; Revised Guidelines for Research in Transgenic Plants, 1998 by Department of Biotechnology; Protocols for Food and Feed Safety Assessment of GE Crops, 2008 by Department of Biotechnology; Guidelines for the Safety Assessment of Foods Derived from Genetically Engineered Plants, 2008 by Indian Council of Medical Research (ICMR); Guidelines and Standard Operating Procedures (SOPs) for Confined Field Trials of Regulated, Genetically Engineered (GE) Plants, 2008 by Department of Biotechnology and Ministry of Environment and Forests. IBSE Guidelines and application forms.

**References:**

4. Web sites:
   1) www.agbios.com
   2) www.dbt.nic.in,
   3) www.bcil.nic.in,

**PB 4715 Plant Genomics 1+3=4**

**Theory:**

Mapping of Eukaryotic genomes-

- Construction of linkage maps with molecular markers
- Gene libraries
• Screening of libraries
• Constructing contigs Sequencing

Gene location in DNA sequences
• Sequence inspection and Hybridization tests
• Southern hybridization Northern Hybridization Detection/ Autoradiography

Requirement:
Vertical electrophoresis unit, Softwares for linkage maps (mapmaker), Contigs
Sequencer, Hybridization chamber, Dark Room

Practical:
1. Construction of linkage maps with molecular markers like RAPD, SSR, AFLP etc.
2. Construction of gene libraries by using suitable vector.
3. Southern hybridization
4. Northern Hybridization
5. Use of suitable softwares for analysis of DNA polymorphism.

C. Cafeteria courses for Department of Crop Science

CS 4713 Seminar 0+1
CS 4714 Bio-Pesticides: Production Technology 1+3

Theory
Defination, scope and importance of Biological control Microbial control, Definition and concept Production of biopesticide based on Fungi, bacteria, Viruses and Nematodes Important industries producing biopesticides Safety testing and registration New technologies and microbial control Promising plant species for pest control.

**Practicals:**

Importance terms related to the course
Mass production technique of white muscardine fungus *Beauveria bassiana*
Mass production technique of green muscardine fungus *Metrhazium anisoplae*
Mass production technique of *Verticillium lecanii*
Mass production technique of *Trichoderma spp.*
Mass production and standardization of *Bacillus thuriengensis*
Mass production of HaNPV and SLNPV
Mass production and standardization of G.V
Mass production technique of Neoplectina Spp.(DD-136)Nematode
Packaging and Labelling of Biopesticide.

**Reference books**

**Theory:**


**Practical:**

Introduction to different microorganisms used in biofertilizer production
Introduction, definition, types, scope of biofertilizers
Isolation of Phosphate solubilizing micro-organisms from rhizosphere
Isolation of *Rhizobium* from root nodules of leguminous crop
Isolation and purification of *Azotobacter* from soil
Isolation and purification of *Beijerinckia* from soil
Isolation of *Azospirillum*
Isolation Blue Green Algae from soil
Isolation of organic matter decomposing microorganisms
Mass multiplication of *Rhizobium, Azotobacter, and Azospirillum* inoculum
Production and application of blue green algae
Production of Azolla biofertilizers
Methods of application of biofertilizers
Standards for commercial production of biofertilizers- Quality control of biofertilizers.

**References:**

1. Soil microorganisms by N.S.Subba Rao, Oxford and IBH Publication Co. New Delhi

CS 4716 Vermiculture and Organic Farming 1+3

Theory


Practicals:

Analysis of organic manures-organic carbon, total NPK and C: N ratio
Fertilizer analysis-Urea, Ammonium sulphate, Pottassium nitrate, Murate of potash and Rock phosphate for their respective nutrients
Plant tissue testing
Study of materials required for vermicomposting
Study of requirements for vermicomposting
Preliminary treatment for composting material
Preparation of vermin beds
Setting up of a vermin wash unit
Harvesting and economics of vermin composting
Chemical composition of vermin compost

Reference books:
1. Earthworm Cinderella of organic farming by Radha D Kale, Prism books Pvt Ltd. Bangalore
2. Vermiculture and organic farming by T.V. Sathe, Daya publishing house, New Delhi
4. Organic farming for sustainable Agriculture by A.K Dahama, Agribios (India) Jodhpur
5. Plant and soil analysis by Piper C.S Hans Publisher, Bombay
7. Manures and Fertilizer by Yawalkar K.S., J.P. Agarwal and S. Bond, Agril. Horticulture publication house, Nagpur, India

CS 4717 Seed Production Technology 2+1

Theory:


Practical:

Seed Tests: - Sampling, Purity test, germination test, moisture content, physical purity.

Grow out tests: - Breeding of new varieties. Certified seed production of selected crops,

References:


CS 4718  Protected cultivation of Flowers and vegetables 1+3

Theory:

Types of Protected structures- glass house, poly house, shade house, rainshade structures, climate control structures, etc. Cultivation of flower crops like roses, carnation, gerbera, orchids, anthurium etc. and vegetables like capsicum, cucumber, tomato, cherry tomato. Propagation methods for various flowers and vegetables crops. Methods of controlling environmental factors in polyhouse. Varieties of flowers and vegetable crops Harvesting, grading, post harvest handling and packaging and storage of flowers and vegetables

Practicals:

Layout of Green house

Control of environmental factors in greenhouses.

Study of media and preparation of beds

Cooling system and ventilation for green houses

Study of root substrates

Methods of sterilization of media

Containers used for protected cultivation

Methods of propagation

Special horticultural practices in cultivation of different cut flowers and vegetables.
Irrigation systems and fertigations for greenhouse crops

Harvesting, grading, post harvest handling, packaging and storage of cut flowers.

Preparation of pulsing and holding solution

Identification and control measures of pest and diseases

Export standards for cut flowers and vegetables

Economics of production of one vegetable or one flower crop

Visit to Hi-Tech project.

Reference books:

7. Protected Cultivation by A. S. Jadhav, P. V. Patil and M. T. Patil.
8. Commercial Protected Floriculture by M. T. Patil and P. V. Patil

D. Cafeteria courses for Department of Post Harvest and Food Biotechnology

FB 478 : CEREAL BIOTECHNOLOGY 2+2

Theory:

Introduction, Genetic transformations of wheat, barley, rice and maize. Problems and future trends in genetic transformation, Commercial targets for cereal biotechnology, using biotechnology to add value to cereals: weed control, Disease resistance, improved
nutritional properties, improved processing properties, improved cereal quality control, Deployment of molecular markers, current practice in milling, baking, malting, brewing and distilling. Risk assessment and legislative issues.

**Practical:**

1. Isolation of DNA from Wheat, Barley, Rice and Maize.
2. Isolation of Protoplast.
3. QTLs detection.
5. Gene transformation via *Agrobacterium*, *Biolistic*, *Electroporation* and *Micro-injection* method

**References books:**

2. Food Biotechnology by Dietrich Knorr, Dekker publication 2005.

**FB 479 FRUIT AND VEGETABLE BIOTECHNOLOGY 2+2**

**Theory:**

Introduction, the nutritional importance of fruits and vegetables. Strategies for nutritional enhancement: The application of traditional breeding methods for selection of varieties, a reduction in the content of anti-nutritional factors, the use of genetic manipulation to introduce new traits. Nutritional health benefits through biotechnology. Relationship of structure to nutritional quality (Bioavailability). Nutritional enhancement versus food fortification. Constraints on innovation, further trends in food biotechnology. Food safety. Case studies to improve Nutritional quality and shelf life of fruits and vegetables- e.g. Potato, tomato, Grape etc. Case studies of grape, tomato, papaya and other fruits and vegetables,
Practicals:

1. Biochemical analysis of nutritionally important fruits and vegetables.
2. DNA isolation.
3. DNA fingerprinting of fruits and vegetables.
4. Identification of novel gene(s) related to nutritional character by using various markers.
5. MAS for the quality characters.

References books:

4. Introduction to Plant Tissue Culture by Razdan, 2007, Oxford IBH.
6. An introduction to Plant Tissue Culture by Kalyani Kumar De.
7. Fruit and Vegetable Preservation principals and practices 3rd revised and enlarged edition by R. P. Srivastava and Sanjeev Kumar.

FB 4710 BREWING TECHNOLOGY 1+3

Theory:

Introduction, History of brewing, Malts, Mash tun adjuncts and brewing liquour. Milling and mashing in, Mashing and wort separation systems. The hop-boil and copper adjuncts,
wort clarification, cooling and aeration. Fermentation process development, scale of up process.

Practicals:

1. Biochemical analysis of nutritionally important fruits and vegetables used in brewing.
2. Media preparation and instrument required for brewing.
3. Preparation of mother culture and starter culture for alcohol production.
5. Contamination of beer during processing and effect of contaminants on quality of beer.
8. Major problems in Beer production.
9. Defects in Beer
10. Studies on factors affecting quality of beer.

References books:


FB 4711 WINE TECHNOLOGY 1+3

Theory:

Introduction, Grape cultivars and wine types: Vitis vinifere cultivars, white cultivars, red cultivars, Advance techniques in production, Genetic engineering in wine grapes, clonal
selection and somaclonal selection, Biotechnology in Viti culture, Genetic engineering for Yeast fermentations, Ideal Yeast; Yeast breeding and wine quality. Wine as a functional food, Factors affecting during storage or aging of wine.

**Practicals:**

1. White wine production and recommended varieties.
2. Red wine production and recommended varieties.
3. Production of wines other than grapes.
4. Techniques of testing wine:- Selection of glass, serving temperature, Design of room for wine testing
5. Timing of testing wine, test the wine on the basis of senses (Vision, small / aroma and palate structure).
6. Sensory evaluation and score card:- Rose worthy score card, Devis score card and sparkling wine score card.
7. Visit to the winery
8. Production of wines on lab scale / industrial scale.
9. Tartarate and bitartrate stability test / cold stability test
10. Determination of acetaldehyde / phenol content of wine.
11. Spoilage and Adulteration of wine.

**References books:**


**FB 4712 PATENTING INVENTIONS IN FOOD BIOTECHNOLOGY 2+2**

**Theory:**

Nature of patent, patent application, patent ability, official examination, Re-examination, Features of US patent application, Conflicting patent application, Duration of patent,

**Practical:**

1. Application formats for patenting.
2. Patenting of various strains.
3. Patenting of various proteins.
4. Patenting of extracted proteins.
5. Patenting of sweeteners.
6. Patenting of various genetically modified cultivars.
7. Enforcing patent.
8. Licensing and duration of patent.

**References books:**


E. **Cafeteria courses for Department of Animal Biotechnology**

**AB 477** Techniques in Animal cell culture 1+3

**Theory:**
Development of primary, secondary cell culture and cell lines. Cell characterization by cell morphology, chromosome analysis, DNA content, enzyme activity and antigenic
markers. Scaling up of cells for production of vaccines, diagnostic antigen and other pharmaceuticals agents. Cytotoxicity assay.

**Practical:**
1. Packing and sterilization of glass and plastic wares for cell culture.
2. Preparation of reagents and media for cell culture.
3. Primary culture of chicken embryo fibroblast.
4. Secondary culture of chicken embryo fibroblast.
5. Cultivation of continuous cell lines.
6. Quantification of cells by trypan blue exclusion dye.
7. Isolation of lymphocytes and cultivation of lymphocytes
8. Study of effect of toxic chemicals on cultured mammalian cells
10. Suspension culture technique
11. Cryopreservation of cell primary cultures and cell lines.

**Suggested Readings:**


**AB 478  Transgenic for improvement of Animals  1+3**

**Theory:**

Practicals:
Preparation of chicken embryo fibroblast.
Preparation of lamb kidney cells.
Lymphocyte culture.
Subcultivation of cell culture.
Cell viability count.
Preparation of inoculums for virus isolation.
Virus isolation- egg inoculation I
Virus isolation- egg inoculation II
Virus inoculation-cell culture.
Cytopathic effect staining.
Extraction of RNA by trizol method.
Extraction of RNA by phenol-isoamyl alcohol method.
RNA PAGE.
Extraction of DNA by Chelax method.
Agarose gel electrophoresis.
Restriction endonuclease analysis.
Quantitation of nucleic acids.
Amplification of Canine Distemper virus VP2 gene.
Amplification of ND F-gene.
Amplification of PPR virus N gene.

Suggested readings:
AB 479  Artificial Insemination  1+3

Theory:

Practical:
1. Layout of artificial insemination and semen collection centre.
2. Care, sterilization and upkeep of artificial insemination equipments.
3. Collection of semen.
4. Evaluation of semen.
5. Study of bacteriology of semen.
6. Dilution of semen.
7. Cryo preservation of semen.
8. Progeny testing, sire index.
10. Transport of semen.
11. Study of artificial insemination techniques.

Suggested Readings:
1. Reproduction in domestic animals – Hafiz.
2. Reproduction in farm animals by Sane, Deshpande, Velhankar and Huikeri.

AB-4710  Advances in Dairy Microbiology  1+3

Theory:
Milk and milk constituents, factors influencing composition of milk, microorganisms associated with milk and milk products. Microbiology of fermented milk, microbiology of Cheese, role of starter and non starter organisms during cheese making, role of enzymes in cheese making, microbiological quality of milk: milk pathogens *Staphylococcus aureus, Salmonella, Coliforms, Listeria monocytogens*.

**Practical:**

1. Collection and examination of milk.
2. Grading of milk on the basis of dye reduction test.
3. Bacteriological examination to determine quality of water (MPN index).
4. Test for Pasteurization (phosphatase test).
5. Microbiological analysis of milk and milk products.
7. Test for detection of mastitis milk.
8. Use of biopreservatives in milk and milk products.

**Suggested readings:-**


**AB 4711 Probiotics in milk and milk products 1+3**

**Theory-**

Types of starter culture, single strain, mixed strain, multiple. Methods of propagation of starter culture. Factors affecting starter activities. Concept of Probiotic- Probiotic starter organisms, nutritional and therapeutic importance. Technology of manufacturing of

**Practicals**-

Sampling milk and milk products for different tests.

Plate form Tests

Study of cream separation

Activation of Probiotics starter culture

Propagation Probiotics starter culture

Examination of purity of Probiotic starter culture liquid culture and freezing

Preparation of Probiotics Lassi Chhach.

Preparation of Probiotics Dahi Yoghurt, Butter, Chakka, Shrikhand

Preparation of Kumiss, Kefir, Acidophilus milk, and cultured butter milk

Preparation of Probiotics Ice cream, Kulfi.

Preparation of Probiotic cheese.

**Suggested Readings**:-


**SEMESTER: VIII**

**HANDS ON TRAINING: (0+20)**

A research project will be allotted to individual student and evaluated as under:

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Particulars</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>Outline of Research Work</td>
<td>01</td>
</tr>
<tr>
<td>2</td>
<td>Introduction</td>
<td>01</td>
</tr>
<tr>
<td>3</td>
<td>Review of Literature</td>
<td>03</td>
</tr>
<tr>
<td>4</td>
<td>Materials and Methods</td>
<td>03</td>
</tr>
<tr>
<td>5</td>
<td>Result and Discussion</td>
<td>05</td>
</tr>
<tr>
<td>6</td>
<td>Viva Voce and Presentation</td>
<td>05</td>
</tr>
<tr>
<td>7</td>
<td>General Performance</td>
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