FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (MICROBIAL & FOOD TECHNOLOGY)

EXAMINATIONS 2011

--:o:--
Note:
1. A student who has passed the +2 Examination under 10+2+3 system of education of a recognized university/Board/Council or any other examination recognized by the Panjab University as equivalent thereto shall be eligible to offer the subject of Microbial & Food Technology at the B.Sc. level, if the student has passed the +2 examination with Physics, Chemistry, Mathematics, Biology as their subjects.
2. Only such colleges which have all necessary infrastructure of equipment and staff shall admit students to the subject of microbial and food technology. The infrastructure must be approved by the University as per usual practice.

### B.Sc. PART I

<table>
<thead>
<tr>
<th>C.No</th>
<th>Title</th>
<th>M.Marks</th>
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</thead>
<tbody>
<tr>
<td>I.</td>
<td><strong>Principles of Microbiology and Microbial Technology</strong></td>
<td>200</td>
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<tr>
<td>BMF 1001</td>
<td>General and Food Microbiology</td>
<td>75</td>
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<tr>
<td>BMF 1002</td>
<td>Principles of Microbial Technology and Food Biotechnology</td>
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<tr>
<td>BMF 1051</td>
<td>Practicals</td>
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<tr>
<td>II</td>
<td><strong>Principles of Food Biochemistry and Preservation</strong></td>
<td>200</td>
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<tr>
<td>BMF 1003</td>
<td>General and Food Biochemistry</td>
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<tr>
<td>BMF 1004</td>
<td>Principles of Food Preservation and Packaging</td>
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<td>BMF 1052</td>
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<tr>
<td>III</td>
<td><strong>Chemistry (same as for B.Sc. Pass Course Students)</strong></td>
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<tr>
<td>Paper A</td>
<td>Inorganic Chemistry</td>
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<tr>
<td>Paper B</td>
<td>Organic Chemistry</td>
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<tr>
<td>Paper C</td>
<td>Physical Chemistry</td>
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<td>Paper D</td>
<td>Practicals</td>
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<tr>
<td>IV</td>
<td><strong>History Culture Punjab / Punjabi</strong></td>
<td>100</td>
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<td>V</td>
<td><strong>Environmental Education (same as for B.Sc. Pass Course Students)</strong></td>
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<tr>
<td>VI</td>
<td>Job Training: Four weeks training in a reputed Industry / Institution after B.Sc. – I final exams*.</td>
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**Total Marks 700**

### B.Sc. PART II

<table>
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<tr>
<th>I</th>
<th>Recombinant DNA Technology and Bioanalytical Techniques</th>
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<tr>
<td>BMF 2001</td>
<td>Microbial Genetics &amp; r -DNA Technology</td>
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<td>BMF 2002</td>
<td>Bioanalytical Techniques</td>
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<td>II</td>
<td><strong>Food Processing Technology</strong></td>
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<tr>
<td>BMF 2003</td>
<td>Processing of Foods of Plant Origin</td>
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<tr>
<td>BMF 2004</td>
<td>Processing of Foods of Animal Origin</td>
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<td>BMF 2052</td>
<td>Practicals</td>
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<tr>
<td>III</td>
<td><strong>Chemistry (same as for B.Sc. Pass Course Students)</strong></td>
<td>200</td>
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<tr>
<td>Paper A</td>
<td>Inorganic Chemistry</td>
<td>50</td>
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<tr>
<td>Paper B</td>
<td>Organic Chemistry</td>
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<tr>
<td>Paper C</td>
<td>Physical Chemistry</td>
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<td>Paper D</td>
<td>Practicals</td>
<td>50</td>
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<tr>
<td>IV</td>
<td><strong>English (same as for B.Sc. Pass Course Students)</strong></td>
<td>100</td>
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<td>V</td>
<td>On – Job Training: Four weeks training in a reputed Industry / Institution after B.Sc. – II final exams.*</td>
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**Total Marks 700**
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<th>Course Code</th>
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<td>Principles of Bioinformatics</td>
<td>75</td>
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<tr>
<td>BMF 3002</td>
<td>Principles of Environmental Microbiology</td>
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<td>BMF 3051</td>
<td>Practicals</td>
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<td>BMF 3003</td>
<td>Food Engineering</td>
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<tr>
<td>BMF 3004</td>
<td>Food Analysis &amp; Quality Control</td>
<td>75</td>
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<tr>
<td>BMF 3052</td>
<td>Practicals</td>
<td>50</td>
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<tr>
<td>Paper A</td>
<td>Inorganic Chemistry</td>
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<tr>
<td>Paper B</td>
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<td>50</td>
</tr>
<tr>
<td>Paper D</td>
<td>Practicals</td>
<td>50</td>
</tr>
</tbody>
</table>

**Total Marks 700**

* Marks for job training done in B.Sc I and B.Sc II to be credited in B.Sc III

**GRAND TOTAL (B.Sc I, B.Sc II and B.Sc III) 2100**
B.Sc. PART I
(MICROBIAL AND FOOD TECHNOLOGY)
I PRINCIPLES OF MICROBIOLOGY AND MICROBIAL TECHNOLOGY

BMF 1001 – GENERAL AND FOOD MICROBIOLOGY
Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To introduce to students fundamental concepts of microbiology which includes microbial diversity, their morphological and functional properties, techniques to study microorganisms, growth and control of microorganisms as well as food spoilage and its control.

SECTION A
2. Microscope and Microscopy - Brief account of structure, principle and applications of bright field, fluorescence and electron microscope, fixation and fixatives. Positive, Negative, Acid fast and Gram staining techniques.
3. General information on Sterilization techniques.

SECTION B
4. Microbial Groups –structure and function of Bacteria, a general account of Archaea, Actinomycetes, fungi, and viruses (bacterial, plant and animal).
5. Microbial Nutrition - Requirement of nutrients for microbes, metabolic diversity among microorganisms, culture media.

SECTION C
7. Food Spoilage - A study of environmental factors affecting the growth, Activity and destruction of microorganisms in food; general principles underlying food spoilage, chemical changes caused by microorganisms.
8. Control of microbes - Control of micro-organisms in foods by physical, chemical methods and chemotherapeutic agents. Thermal death time-Z, F & D Values.

SECTION D
11. Food Sanitation & Hygiene - Importance of hygiene & sanitation in food industry, cleaning agents, disinfectants, personal hygiene of food handler, indicator organisms and microbiological standards in foods.

REFERENCES
6. Pelczar, Reid and Chan, 2008, Microbiology, McGraw hill Ed, ND
BMF 1002– PRINCIPLES OF MICROBIAL TECHNOLOGY & FOOD BIOTECHNOLOGY

Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To provide an insight into the basic principles of Fermentation Technology and Downstream Processing which involves strain selection, media formulation, sterilization, inoculum development, design of bioreactors and product recovery. Paper also deals with production and use of various fermented products.

SECTION A

1. Introduction – Introduction to fermentation technology, Historical review with special reference to fermentation technology, application of fermentation processes, fermentation economics.
2. Industrially important microbes – Importance of Industrially important microbes, Methods for Isolation, selection and Preservation of Industrial microorganisms, culture management, starter cultures.
3. Fermentation media and inoculum development – Media for industrial fermentation, Common substrates used in industrial fermentations like molasses, corn steep liquor, sulfite waste liquor etc., sterilization of fermentation media, Inoculum preparation for microbial and food fermentations, aseptic inoculation of plant fermenters.

SECTION B

4. Types of industrial fermentation – Submerged and surface fermentations, solid state fermentations, batch vs continuous culture systems, use of immobilized enzymes in fermentations, Development of Microbial and Food fermentation process at Laboratory, Pilot and Industrial scale.
5. Fermentation Equipment – Design of fermenter, sterilization of fermenter, agitation, aeration, pH, temperature controls during fermentation process, use of antifoam agents, process monitoring and control systems.

SECTION C

8. Alcoholic Beverages: Production of Beer, Wine and Ethanol
9. Organic acids and Amino Acids: Production and uses of Acetic Acid, Citric Acid, Glutamic Acid, Aspartic Acid

SECTION D

10. Polysaccharides and Gums: Microbial polysaccharides and their role in nature, Sources of microbial polysaccharides, Bacterial production of polysaccharides and gums: xanthan gum, dextrin, cyclodextrin and alginate

REFERENCES

SECTION A (GENERAL AND FOOD MICROBIOLOGY)
1. Introduction and study of microbiological instruments.
2. Media preparation and dispensing for cultivation of different types of micro organisms.
3. Microscopy: study, use and care of compound microscope.
4. Different staining techniques for identification of microbes: simple staining, negative staining, gram staining, acid fast staining and spore staining.
5. Determination of viable cell count by haemocytometer.
7. Sampling and observation of microorganisms from natural sources.
8. Bacteriological examination of water.
10. Microbiology of different foods.

SECTION B (MICROBIAL TECHNOLOGY & FOOD BIOTECHNOLOGY)
1. Isolation technique to obtain pure culture.
2. Maintenance and preservation of pure culture.
3. Identification of micro organism on the basis of morphology and Physiology.
4. Isolation of LAB in pure culture.
5. Evaluation of sterilization technique by determining thermal death time.
6. To study the effect of temperature, pH, aeration and substrate concentration on the growth of microbes.
7. Production of yoghurt.
8. Lab scale preparation of Wine.
9. Production of an enzyme in a Bioreactor.
10. Study of Cell/enzyme immobilization techniques.
II. PRINCIPLES OF FOOD BIOCHEMISTRY AND PRESERVATION

BMF 1003 – GENERAL AND FOOD BIOCHEMISTRY

Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper provides basic information on chemical, physical and functional properties of various biomolecules present in food and how they contribute to the overall quality of foods.

SECTION A
1. Introduction to Biomolecules and their nutritive value - Major and minor constituents of food, Bioavailability of nutrients, their functions, sources, energy and nutritive value.
2. Cell bioenergetics: First and second law of thermodynamics, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, redox potential.

SECTION B
4. Carbohydrates - Classification, structure & properties, metabolism; glycolysis, alcoholic and lactic acid fermentation, citric acid cycle and artificial sweeteners.
5. Vitamins and minerals - Classification, sources, functions and deficiency diseases.

SECTION C

SECTION D
11. Flavours - Definition and basic taste factors, chemistry of food flavors from cocoa, coffee, vanilla beans and spices. Relationship of flavor with taste.

REFERENCES –
3. L Stryer, 2006, Biochemistry, W H Freeman and company, New York
BMF 1004 - PRINCIPLES OF FOOD PRESERVATION AND PACKAGING

Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper deals with different methods of food processing and preservation methods, recent advances and food packaging concepts.

SECTION A
1. Introduction - General principles of food preservation, Historical development.

SECTION B
5. Preservation by Concentration - Methods of concentration, Types of Evaporators.
6. Preservation by Radiations - Historical development, Types of Radiations, Effects of Radiations, Dose – Determining Factors, Status of Irradiated foods in India, Microwave, Ohmic heating.

SECTION C
8. Recent Trends in Food Processing - Microwave processing, Extrusion cooking, Ohmic Heating, Reverse Osmosis, Electrodialysis, Ultrafiltration, High Pressure Processing.
9. Super critical fluid extraction, Fat mimetics.

SECTION D
11. Packaging Methods - Form fill seal packaging, Hermetic closures, Retortable pouches, Aseptic packaging, Inert gas packaging, Active & Intelligent Packaging
12. Packaging of Food Products - Description of packaging of -
   a) Frozen products
   b) Dried products
   c) Chemically preserved foods
   d) Fats and oils
   e) Confectionery
   f) Fruit juices
   g) Heat processed foods
   h) Fresh produce (Eggs, Fruits and Vegetables)

REFERENCES –
BMF 1052 – PRACTICALS

Max. Marks : 50
Int. Ass. : 5
Time : 3 hours

SECTION A (GENERAL AND FOOD BIOCHEMISTRY)
1. Determination of TSS value of given food product.
2. Determination of acidity of food products.
3. Determination of pH of food product.
4. Determination of moisture content on wet and dry basis by Oven drying and Infra – Red Moisture Analyzer.
5. Determination of acid value in given oil.
6. Estimation of salt content in given food stuff.
7. Determination of vitamin C by titration method.
8. Determination of Protein by kjeldhal method.
10. Qualitative estimation of sugars.
11. Determination of ash content and different types of ash.
12. Determination of iodine number.

SECTION B (FOOD PRESEVATION & PACKAGING)
1. To blanch a seasonal fruit or vegetable & assess quality of blanching process.
2. To study the effect of browning on raw fruits & vegetables.
3. Preparation of drying curve.
4. To study effect of heat and acidity on milk proteins.
5. To study the effective-ness of pasteurization by phosphatase test.
6. To study Pasteurization of milk using microwave technique.
7. To study the different packaging materials
8. Determination of water vapour transmission rate for various packaging materials.
9. To determine grease resistance of packaging material.
10. To determine the wax content in given wax paper.
11. To estimate the basis weight of given packaging material.
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PAPER IV: HISTORY AND CULTURE OF PUNJAB

One Paper

General Instructions :

1. In all, nine questions will be set. Each question will carry 18 marks.
2. First question shall be Short Answer type containing 15 short questions spread over the whole syllabus. Candidates will attempt nine questions out of the fifteen questions in about 25 to 30 words each. It shall carry 9x2=18 marks and shall be compulsory.
3. Rest of the paper shall contain 4 units. Each unit shall have two essay type questions and the candidate shall attempt one question from each unit – 4 in all.
4. For private candidates, who have not been assessed earlier for internal assessment, the marks secured by them in theory paper will proportionately be increased to maximum marks of the paper in lieu of internal assessment. The paper setter must put note (4) in the question paper.

HISTORY AND CULTURE OF PUNJAB 1200 A. D.

1. Society in the Punjab during the Afghan rule.
2. The Punjab under the Great Mughals.

UNIT-II

4. Guru Nanak: His teachings; concept of Langar and Sangat.

UNIT-III

7. Martyrdom of Guru Tegh Bahadur; foundation of the Khalsa by Guru Gobind Singh.
8. Banda Bahadur and his achievements; Sikh Struggle for sovereignty from 1716 to 1765; role of Dal Khalsa, Rakhi, Gurmata and Misls.
9. Ranjit Singh’s rise to power; civil and military administrations; relations with the British.
UNIT-IV

10. Social change with special reference to the position of women.

11. New developments in language, literature, architecture in the Punjab during the Medieval Period.

12. Famous Folk tales of Medieval Punjab.

**Suggested Readings :**


   N.B. - The required detail and depth would conform to the treatment of the subject in the above survey. (This book will also form the basis of the short answer questions).


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*Note :-* The following categories of the students shall be entitled to take the option of History & Culture of Punjab in lieu of Punjabi as compulsory subject:

(a) That the students who have not studied Punjabi upto class 10th.

(b) Wards of/and Defence Personnel and Central Government employee/employees who are transferable on all India basis.

(c) Foreigners.
ENVIRONMENT EDUCATION

ENVIRONMENT EDUCATION

1. Environment Concept:
   Introduction, concept of biosphere – lithosphere, hydrosphere, atmosphere; Natural resources – their need and types; Principles and scope of Ecology: concepts of ecosystem, population, community, biotic interactions, biomes, ecological succession.

2. Atmosphere:
   Parts of atmosphere, components of air; pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. Hydrosphere:
   Types of aquatic systems; Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water, permissible limits, risks and possible control measures.

4. Lithosphere:
   Earth crust, soil – a life support system, its texture, types, components, pollution and pollutants, reasons of soil erosion and possible control measures.

5. Forests:
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, Chipko Andolan.

6. Conservation of Environment:
   The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems – soil, water, air, wildlife, forests.

7. Management of Solid Waste:
   Merits and demerits of different ways of solid waste management – open dumping, landfill, incineration, resource reduction, recycling and reuse, vermicomposting and vermiculture, organic farming.

8. Indoor Environment:
   Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles; possible adulterants of the food; uses and harms of plastics and polythene; hazardous chemicals, solvents and cosmetics.

9. Global Environmental Issues:
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity; Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment:
    Indian laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about laws relating to control of air, water and noise pollution. What to do to seek redressal.
11. **Biodiversity** :
What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. **Noise and Microbial Pollution** :
Pollution due to noise and microbes and their effects.

13. **Human Population and Environment** :

14. **Social Issues** :
Environmental Ethics : Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. **Local Environmental Issues** :
Environmental problems in rural and urban areas. Problem of Congress Grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

**Practicals** :
Depending on the available facility in the college, a visit to vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

*Note*: Above 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topics from 2 to 11 and one each for the topics 1 and 12 to 15.

- **Examination Pattern** :
Fifty multiple choice questions (with one correct and three incorrect alternatives and no marks deduction for wrong answer or un-attempted question)

- All questions compulsory i.e. no choice.

- Qualifying marks 33 per cent i.e. 17 marks out of 50.

- Total marks : 50.

- Duration of Examination : 60 minutes.

- Spread of questions : Minimum of 2 questions from each of the topics 1 and 12 to 15.
  Minimum of 4 questions from topics 2 to 11.
B.Sc. PART II
(MICROBIAL AND FOOD TECHNOLOGY)

I. RECOMBINANT – DNA TECHNOLOGY & BIOANALYTICAL TECHNIQUES

BMF 2001 – MICROBIAL GENETICS & r-DNA TECHNOLOGY
Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To make the students understand the fundamental concepts of genetics which includes DNA structure, replication, transcription, translation, mutation, gene regulation and techniques related to genetic engineering.

SECTION A
2. Genome Organization - Physical and genetic features of prokaryotic genome and of bacteriophages.
3. Genes to Proteins - DNA replication, transcription and translation mechanisms.

SECTION-B
6. Gene Regulations - Operon concept, the Lactose and the Tryptophan operon.

SECTION-C
7. Enzymes involved in Genetic Engineering - Restriction enzymes, ligases, phosphatase, polymerases, modifying enzymes etc.
8. DNA Transferring Mechanisms - CaCl₂ method, biolistic gun, Electroporation, phage transfection.
9. Genes to clones – Vectors (plasmids, cosmids, phagemids, shuttle vectors, expression vectors, BAC/YAC vectors), techniques used to clone genes, construction and screening of DNA libraries.

SECTION-D
11. DNA amplification methods with particular emphasis on PCR, its types and applications.
12. Site directed mutagenesis and its applications.
13. Applications of rDNA technology in the food sector. Brief exposure of this technology to other industries and environment.

REFERENCES -
Malacinski, George M., 2005, Freifelder’s Essentials of Molecular Biology, Narosa Publishing House, ND.
Karp, Gerald, 2005, Cell and Molecular Biology, Wiley International, USA.
Snusted and Simmons, 2006, Principles of genetics, John Wiley and Sons, Inc
Weaver R.F., Molecular biology (2005), McGraw hill publisher.
Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper is designed to impart knowledge on basic principle, types, technique and applications of various analytical instruments viz. chromatography, electrophoresis, spectroscopy etc.

SECTION A
2. Electrophoresis - Principle of Electrophoresis, Theory, Techniques and applications of Paper Electrophoresis, Disc and Zone Electrophoresis and Gel Electrophoresis, Electrophoresis of protein, Nucleic acid, Capillary Electrophoresis.

SECTION B
4. Polarimetry - Basic principle, Different Components of Polarimeter and its applications
5. Electrometric determinations - Electrochemical cells; Reference Electrodes- Colomel, Ag/AgCl Electrodes; Indicator Electrodes- Glass Membrane, Solid State Sensors, Liquid Membrane, Gas Sensing and Enzyme Electrodes, Applications.

SECTION C
7. Fluorescence spectroscopy - Fluorescence methods, filter fluorometers, Fluoroscence Spectrophotometer

SECTION D
9. Atomic absorption and emission spectroscopy - Principle, Different types, Instrumentation and applications of atomic absorption and Emission Spectroscopy

REFERENCES -
BMF 2051 – PRACTICALS

Max. Marks :  50
Int. Ass.    :   5
Time        :   3 hours

SECTION A (MICROBIAL GENETICS & R- DNA TECHNOLOGY)
Laboratory emphasis is on the techniques used in bacterial mutagenesis, genetic exchange, gene mapping, and gene cloning.

1. Preparation of reagents involved in DNA work.
2. Isolation of plasmid DNA.
3. Preparation and running of agarose gel and detection of DNA and RNA on the gels.
4. Isolation of genomic DNA.
5. Restriction enzyme cutting of DNA.
6. Preparation of competent cells.
7. CaCl₂ transformation of plasmid and screening for positive transformants.
8. Isolation of mutant by U.V. or a chemical mutagen.
9. Quantitative estimation of DNA and RNA.

SECTION B (BIOANALYTICAL TECHNIQUES)

1. Determination of pK and pI values of an amino acid
2. Determination of molar absorption coefficient of L-tyrosine
5. Separation of amino acids by paper electrophoresis.
6. Separation of blue dextran and potassium dichromate by gel-filteration chromatography.
7. Separation of plant pigments by TLC
8. Estimating enzyme activity of β-amylase
9. Estimation of total serum cholesterol by zak & henly’s method
10. Determination of glucose by means of enzyme glucose oxidase.
11. To study the effect of ultraviolet light on Vitamin A.
PAPER II – FOOD PROCESSING TECHNOLOGY

BMF 2003 PROCESSING OF FOODS OF PLANT ORIGIN

Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To introduce to students to post harvest processing of fruits, vegetables, cereals, pulses and oil seeds, FPO standards of processed fruit and vegetable products, preparation of processed foods of plant origin and their utilization.

SECTION A
1. Post harvest handling and storage of fresh fruits and vegetables. Preparation of fruits and vegetables for processing. Preparation of fruit juices and pectin.
2. FPO Standards of jam, jellies, marmalades, tomato products, preserves and pickles.
3. By– product utilization of fruits and vegetable processing industry.

SECTION B
4. Structure and composition of different grains like wheat, rice, etc. Milling of wheat. Flour quality and Bread technology.

SECTION C
7. Nutritional value of pulses.

SECTION D
11. Processing of oils and fats.

REFERENCES –
**BMF 2004 PROCESSING OF FOODS OF ANIMAL ORIGIN**

**Max. Marks : 75**

**Theory : 67**

**Int. Ass. : 8**

**Time : 3 hours**

**Instructions for the examiner:** The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

**Objectives:** The paper provides an insight to milk composition, milk processing techniques, milk products, meat structure and processing as well as egg and fish technology.

**SECTION A**

1. PFA Definition of milk; Chemical composition of milk of different species i.e. Buffalo, Cow (foreign), Cow (sindhi), Goat, Murrah, Jersey.
3. Processing of different types of market milk – Pasteurized, Sterilized, Homogenized, Flavored, Single and Double Toned milk and Humanized milk.

**SECTION B**

4. Definition, composition and technology of milk products –
   a. Butter.
   b. Ghee.
   c. Ice cream.
   d. Evaporated and condensed milk.
   e. Dried milk.
6. Cheese – Definition, composition and types of cheese; Basic steps in cheese making; Cottage Cheese, Cheddar cheese, Blue cheese, Mozzarella cheese and Processed cheese.

**SECTION C**

7. Chemistry and microscopic structure of meat tissue; Meat pigments and color changes.

**SECTION D**

12. Nutritional value of fish; procurement of fish. Canning of fish and fish products; Spoilage in canned fish. Fish products – Fish oil, Fish flour, Fish sauce, Dried fish meal and Fish protein concentrates.

**REFERENCES –**

2. 2.Walstra, P., 2005, Dairy Technology, Oxford Univ. Press, ND.
SECTION A (PROCESSING OF FOODS OF PLANT ORIGIN)

1. Estimation of Ascorbic Acid content spectrophotometrically.
2. Determine Brix : Acid ratio of fruits and vegetable products.
3. To study the physical characteristics of cereals.
4. Estimation of WAP and Gluten content of wheat flour.
5. Estimation of particle size of different types of flour.
6. Determination of physical characteristics (Specific gravity, Refractive index & Melting point) of Peanut Butter.
8. Determine Acid Value of a given oil sample.
9. Qualitative and Quantitative determination of oil rancidity.
10. Cup test for Soluble Coffee powder.
11. Estimation of total aldehydes by hydroxylamine titration in citrus oils.
12. Preparation of jellies and marmalades.

SECTION B (PROCESSING OF FOODS OF ANIMAL ORIGIN)

1. To check the heat stability of milk by COB and Alcohol tests.
3. Determination of specific gravity, SNF % and TS% of milk.
4. Estimate the milk fat by Gerber method.
5. To determine the Casein content of the milk.
6. To check the sterility of milk by Turbidity test.
7. Bacteriological estimation of milk by MBRT.
8. Color determination of ghee by Tintometric method.
9. To estimate the purity of ghee by Baudouin test.
10. To prepare a chart of physico – chemical properties and microbiological standards of milk and milk products.
11. Preparation of Ghee by different methods.
12. To determine different components of egg.
13. Examination of meat cuts – Poultry, Beef, Pork, Bacon, Lamb and Mutton.
B.Sc. Part III  
(MICROBIAL AND FOOD TECHNOLOGY)  

PAPER I BIOINFORMATICS & ENVIRONMENTAL MICROBIOLOGY

BMF 3001: PRINCIPLES OF BIOINFORMATICS  
Max. Marks : 75  
Theory : 67  
Int. Ass. : 8  
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To learn basic concepts of statistics, computers and required manipulation of DNA/protein sequence data and learn genetic code.

SECTION A
1. **Real Number**: Different kinds of numbers, Integer, Rational and Irrational, Surds and their properties, Fractional indices. Complex Numbers: Extending the Number System, Operation with Complex Numbers.
2. **Elementary Statistics**: Representation of Data- Discrete data, Continuous data, Histogram, Polygons, Frequency curves. The mean variability of data, Standard deviation, Median, Quantiles, Percentile, Skewness. Introduction to Statistical sampling from a population, Random sampling, Box and Whisker diagram (Box plot).

SECTION B
4. **Query Language and Query Optimization**: Domain types in SQL, Schema definition in SQL. Type commands, SQL Operators, Tables, Views, Indexes, aggregate functions, insert, delete and update operations, join, union, intersection, minus etc. in SQL queries, sub-queries, equivalence of queries.

SECTION C
5. **Biotechnology Database**: EST, STS, GSS, HTG, SNP; Nucleic acid and Protein database: GenBank, EMBL, DDBJ, SWISS PROT, INTERPRO, UNIPROT.
6. **Biodiversity Informatics**: Biological diversity of life, Species Diversity, Genetic Diversity; Database for Species Identification and classification: GBIF, Species 2000, IOB, ICTV, Taxonomy Browser at NCBI.
7. **Structural Databases**: Pdb, PDBsum, ndb.
8. **Motifs and Pattern Databases**: PROSITE, Pfam, BLOCKS, PRINTS.

SECTION D
10. **Database Retrieval and Deposition System**: SRS, Entrez, Bankit, Sequin, Webin, AutoDep.
12. **Data Models**: Instances and Schemes; Network data model basic concepts, Hierarchial data model basic concepts; Multimedia databases; Basic concepts of: B+ tree indexed files, Suffix trees; Static hash functions, Dynamic hash functions. Database System Architecture: Introduction to Centralized System; Client Server System; Parallel and Distributed system.

References:
BMF 3002: PRINCIPLES OF ENVIRONMENTAL MICROBIOLOGY

Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper basic knowledge on microbial diversity in natural sources, microbial interactions and adaptations, role of microorganism in maintenance of life on earth and in water quality

SECTION- A
2. The Habitat and its microbial inhabitants: Microbial populations of soil, air and water environment. Characteristics and stratification of atmosphere, lake, ocean and soil.
3. Microbial Community Dynamics: Population selection in community, succession within microbial community- Primary and secondary succession, autotrophic and heterotrophic succession, causes and examples of succession, Homeostasis.

SECTION - B

SECTION- C
7. Quantitative Microbiology: Sampling procedures and devices, Measurement of Microbial Numbers, Biomass and Activities.

SECTION- D
12. Microorganisms in Biological Control: Microbial control of insects, pests, weeds and other disease causing organisms.
References-

BMF 3051 – PRACTICALS

Max. Marks : 50
Int. Ass. : 5
Time : 3 hours

SECTION A (BIOINFORMATICS)
1. Search the web servers- NCBI, EBI, INDIANA, GNU and PDRB
2. Submit the given sequence and find out the 3D structure of proteins.
3. Submit the given sequences and run BLAST for it.
4. Vivid biological databases and find out their salient features.
5. Search the website of Expasy and find out the mirror sites
6. To show the use of standard input (scanf) and standard output (printf) functions.
7. To show the use of variables and keywords.
8. To show the use of arithmetic operators, relational operators logical operators, unary operators, assignment operators and conditional operators
9. To show the use of getchar, putchar, gets, puts, getch, getche.
10. To expertise branching statements like if, if-then, if-then-else
11. Using the following tables:
   • PET-OWNER (ownerID, name, phone, email, street, city, state, zip)
   • PET (petID, name, type, breed, DOB, ownerID.
12. Write SQL Statements to do the following:
   i. Write Create Table statements to create the tables shown above
   ii. Write SQL statements to add at least 3 rows to the PET-OWNER table.
   iii. Write a Sql statement to display the Name, Breed and type of all pets on file.
   iv. Write a SQL Statement to display the name, breed and type of all the pets on the file.
   v. Write a SQL statement to display the name, breed and type of all pets that are of type “dog” and the breed “poodle”

SECTION B (ENVIRONMENTAL MICROBIOLOGY)
1. Isolation of amylase producing bacteria from soil.
2. Isolation of protease producing bacteria from soil.
3. Isolation of lipase producing bacteria from soil.
4. Isolation of antibiotic producer from soil.
5. Demonstration of rhizosphere effect.
6. Determination of TS, TDS, TSS in industrial effluent.
7. Determination of BOD of industrial effluent.
8. Determination of COD of industrial effluent.
10. Detection of Coliforms for determination of purity of potable water.
12. Demonstration of Biogas production.
PAPER II  FOOD ENGINEERING AND QUALITY CONTROL

BMF 3003:  FOOD ENGINEERING

Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To educate students in different aspects of food engineering and their applications in food processing, it also deals with concepts of heat and mass transfer and food processing equipments.

SECTION – A
1. Units and Dimensions: Concept of Unit operation, Mass Energy balance, Dimensions and Units, Unit Conversion, Dimensional Analysis
2. Psychrometric chart: Dry and wet bulb temperature, specific saturation, adiabatic saturation temperature, Dew point, Information about psychometric chart
3. Refrigeration: Reverse Carnot’s cycle, Pressure enthalpy chart, temperature entropy chart, vapor compression refrigeration system, equipment’s C.O.P., Refrigeration load calculation, Application of refrigeration in food processing operations

SECTION – B
4. Freezing: Principles and methods, Different types of Freezers, Industrial problems associated of frozen storage food products
5. Introduction to Heat Transfer: Heat Transfer, modes of heat transfer, conduction through a flat wall, conduction through hollow cylinder, convective heat transfer, radiation heat transfer
6. Heat transfer Equipments and Design: Heat Transfer equipments, parallel and counter current flow heat exchangers, Logarithmic mean temperature difference, heat transfer coefficient, heat exchanger design (preliminary), concept of black body, Emissivity and Absorptivity

SECTION - C
7. Mass Transfer: Principles of mass transfer and Diffusion process, diffusivity
8. Evaporation: Mechanisms of vaporization, Boiling Point elevation, Different types of evaporators, Evaporation of heat sensitive materials

SECTION-D
10. Mixing: Principles, mixing equipment, mixing index
11. Separation processes: Principles and methods of gas absorption, Distillation, Extraction and washing, Filtration, sedimentation, sieving, centrifugation
12. Membrane Separation Processes: Reverse Osmosis, Nano filtration and Ultra filtration

References-
BMF 3004 – FOOD ANALYSIS AND QUALITY CONTROL

Max. Marks : 75
Theory : 67
Int. Ass. : 8
Time : 3 hours

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper focuses on physical, chemical, microbial and sensory analysis of food, concepts of quality control and quality management, national and international food loss and adulterants in various food products

SECTION A

1. Sampling – Sampling techniques and preparation of food samples.
2. Techniques used in food analysis –
   Chromatography
   Electrophoresis
   Electrometric determinations
   Refractometry & Polarimetry
   Spectrophotometry
   Fluorimetry
   Radio – active tracer techniques
   Atomic absorption
3. Physico chemical methods for food analysis
   Moisture & Total solids
   Carbohydrates
   Proteins
   Fats
   Fiber
   Ash & its types
   Minerals
   Vitamins
   Enzymatic methods
4. Biological methods of food analysis
   Standard plate count; Plate loop method; Spiral plate; Droplet technique;
   Dye reduction; Catalase test and ELISA.
   Testing of food for organisms such as E. coli, S. aureus, B. cereus, C. botulinum, L. monocytogenes, Salmonella & Shigella.

SECTION B

5. Sensory assessment of food quality –
   Appearance of food
   Flavor of food
   Texture of food.
7. Quality control of following food products –
   Milk & milk products
   Oils & Fats
   Cereal grains & flours
   Fruits & vegetable products
   Canned foods
   Egg & egg products
   Meat & Meat products


**References**

**PAPER 3052 – PRACTICALS**

**Max. Marks : 50**

**Int. Ass. : 5**

**Time : 3 hours**

**SECTION – A (Food Engineering)**
1. Measurement of rupture angle and angle of intergranular friction of grains and powders
2. Particle size analysis and energy requirement in comminution
3. Homogenization of milk and measurement of size of fat globules before and after homogenization
4. Coefficient of viscosity of water, milk, juices etc. by flow through a capillary tube
5. Surface tension of water by Jaeger’s method
6. Mechanical equivalent of heat by calendar and Borne’s apparatus
7. Design of piping and piping network
8. Design of conveyor system for solids
9. Drying rate curves for different wet materials
10. Study of different types of heat exchangers
11. Food Plant Design and preparation of layout
12. To solve problems based on. Psychometric chart

**SECTION-B (Food analysis and Quality Control)**
1. Detection of different type of sugars in fruit juices by TLC
2. Electrophoretic separation of Amino Acids
3. Separation of amino acids by two dimensional paper chromatography
4. Testing of given canned product
5. Shelf life testing of packaged product by HVP method
6. Proximate analysis of Butter
7. Determination of Consistency of tomato ketchup
8. Determination of adulterants in milk, oils & Fats, spices, Tea and Coffee
9. Estimation of Vitamin C spectrophotometrically
10. Estimation of Iron content in given food sample spectrophotometrically
11. To prepare a chart of specifications for different Food products as specified by BIS
12. Determine the Critical Control Points for production line of Milk, Fruits & Vegetables and Meat industry as per HACCP system
13. Estimation of total sugars and reducing sugars spectrophotometrically