FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. MICROBIAL & FOOD TECHNOLOGY

EXAMINATIONS 2014
SCHEME OF STUDIES FOR B.Sc. (MICROBIAL & FOOD TECHNOLOGY) – 2013-14

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.

<table>
<thead>
<tr>
<th>B.Sc. PART I</th>
<th>M.Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Principles of Microbiology and Microbial Technology</strong></td>
<td>200</td>
</tr>
<tr>
<td>BMF 1001 General and Food Microbiology</td>
<td>75</td>
</tr>
<tr>
<td>BMF 1002 Principles of Microbial Technology and Food Biotechnology</td>
<td>75</td>
</tr>
<tr>
<td>BMF 1051 Practicals</td>
<td>50</td>
</tr>
</tbody>
</table>

| **II Principles of Food Biochemistry and Preservation** | 200     |
| BMF 1003 General and Food Biochemistry             | 75      |
| BMF 1004 Principles of Food Preservation and Packaging | 75      |
| BMF 1052 Practicals                                | 50      |

| **III Chemistry (same as for B.Sc. Pass Course Students)** | 200 (Qualifying) |
| Paper A Inorganic Chemistry                         | 50        |
| Paper B Organic Chemistry                           | 50        |
| Paper C Physical Chemistry                          | 50        |
| Paper D Practicals                                  | 50        |

| **IV History Culture Punjab / Punjabi (same as for B.Sc. Pass Course Students)** | 100 |
| **V Environmental & Road Safety Education (same as for B.Sc. Pass Course Students)** | 70 (Qualifying) |

| **VI Job Training: Four weeks training in a reputed Industry / Institution after B.Sc. I final exams**. |        |

Total Marks 700

<table>
<thead>
<tr>
<th>B.Sc. PART II</th>
<th>M.Marks</th>
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<tbody>
<tr>
<td><strong>I Recombinant DNA Technology and Bioanalytical Techniques</strong></td>
<td>200</td>
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<tr>
<td>BMF 2001 Microbial Genetics &amp; r-DNA Technology</td>
<td>75</td>
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<tr>
<td>BMF 2002 Bioanalytical Techniques</td>
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<td>BMF 2051 Practicals</td>
<td>50</td>
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</table>

| **II Food Processing Technology**                  | 200     |
| BMF 2003 Processing of Foods of Plant Origin      | 75      |
| BMF 2004 Processing of Foods of Animal Origin     | 75      |
| BMF 2052 Practicals                               | 50      |

| **III Chemistry (same as for B.Sc. Pass Course Students)** | 200     |
| Paper A Inorganic Chemistry                         | 50      |
| Paper B Organic Chemistry                           | 50      |
| Paper C Physical Chemistry                          | 50      |
| Paper D Practicals                                  | 50      |

| **IV English (same as for B.Sc. Pass Course Students)** | 100     |
| V On – Job Training: Four weeks training in a reputed Industry / Institution after B.Sc. II final exams |        |

Total Marks 700
### B.Sc. PART III

<table>
<thead>
<tr>
<th>C.No</th>
<th>Title</th>
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<tbody>
<tr>
<td>I</td>
<td><strong>Bioinformatics &amp; Environmental Microbiology</strong></td>
<td>200</td>
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<tr>
<td></td>
<td>BMF 3001 Principles of Bioinformatics</td>
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<tr>
<td></td>
<td>BMF 3002 Principles of Environmental Microbiology</td>
<td>75</td>
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<tr>
<td></td>
<td>BMF 3051 Practicals</td>
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<tr>
<td>II</td>
<td><strong>Food Engineering and Quality Control</strong></td>
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<td>BMF 3003 Food Engineering</td>
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<td></td>
<td>BMF 3004 Food Analysis &amp; Quality Control</td>
<td>75</td>
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<tr>
<td></td>
<td>BMF 3052 Practicals</td>
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<tr>
<td>II</td>
<td><strong>Chemistry (same as for B.Sc. Pass Course Students)</strong></td>
<td>200</td>
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<tr>
<td></td>
<td>Paper A Inorganic Chemistry</td>
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<tr>
<td></td>
<td>Paper D Practicals</td>
<td>50</td>
</tr>
<tr>
<td>IV</td>
<td>Project Work-70 +Job Training done after B.Sc I and B.Sc II Examination 30)</td>
<td>100</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 this 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
1. Introduction – Discovery of microbial world, Application of microbiology and its relevance to food technology, species concept and microbial nomenclature; Theories and methods of microbial classification. Bergey’s system of bacterial classification.
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 technique.
3. General information on Sterilization techniques.

SECTION B
4. Microbial Groups –structure and function of Bacteria, a general account of Archaebacteria, Actinomycete, 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.

REFERENCE BOOKS
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 and its applications.
2. Industrially important microbes – Importance of Industrially important microbes, Methods for isolation, selection and Preservation of Industrial microorganisms, 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., inoculum preparation for microbial fermentations, aseptic inoculation of plant fermenters.

SECTION B
4. Industrial fermentation systems– Batch vs continuous culture systems, Submerged and solid state fermentations, aerobic and anaerobic fermentation, Development of Microbial and Food fermentation process at Laboratory, Pilot and Industrial scale.
5. Fermentation Equipment – Design of fermenter, agitation, aeration, pH and temperature controls during fermentation process, use of antifoam agents, sterilization of fermentation media and fermenter, biosensor.

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

SECTION-D
10. Microbial Polysaccharides and Gums: Microbial polysaccharides and their role in nature, Sources of microbial polysaccharides, Bacterial production of polysaccharides

REFERENCE BOOKS
BMF 1051 – PRACTICALS

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

SECTION A (GENERAL AND FOOD MICROBIOLOGY)
1. Introduction and study of microbiological instruments.
2. Media preparation and dispensing for cultivation of different types of microorganisms.
3. To study various culture techniques.
4. Microscopy: study, use and care of compound microscope.
5. To study morphology of bacteria by simple staining, negative staining and gram staining method.
7. Lactophenol cotton blue staining for fungi.
8. Sampling and observation of microorganisms from natural sources.
11. Effect of antimicrobial agents by filter paper disc method.
13. Presumptive coliform test for milk, butter and dahi.
14. Yeast and mold count for butter and dahi.

SECTION B (MICROBIAL TECHNOLOGY & FOOD BIOTECHNOLOGY)
1. Isolation of pure culture of bacteria.
2. Determination of viable counts of bacteria.
3. Maintenance and preservation of pure culture.
4. Identification of microorganism on the basis of morphology and Physiology.
5. Study of bacterial growth cycle.
6. To study the effect of oxygen on the growth of microbes.
7. To study the effect of temperature, pH, aeration and substrate concentration on the growth of microbes.
8. Isolation of LAB in pure culture.
10. To study solid state and submerged fermentation techniques.
11. To study probiotic bacteria.
12. Production of yoghurt.
13. Lab scale preparation of ethanol.
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.
12. **Changes in food constituents during processing**: Changes in carbohydrates on cooking, Browning and Maillard reactions, Effects of heat treatment on proteins, Denaturation of proteins, Oxidative and Hydrolytic Rancidity.

REFERENCE BOOKS –
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.
3. **Refrigeration & Freezing of foods** – Differences between - refrigeration and freezing, CAS & MAS; Effect of refrigerated and frozen storage on food; Immersion freezing.

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
7. **Preservation by Chemicals** - GRAS, Food preservation by preservatives, Food Additives.
8. **Recent Trends in Food Processing** – Overview of Extrusion cooking, Reverse Osmosis, Electrodialysis, Ultrafiltration, High Pressure Processing.
9. **Super critical fluid extraction, Fat mimetics** – Introduction, principle and procedure, application & advantages of super critical fluid extraction. Carbohydrate and protein mimetics, fat substitutes, synthetic fat replacers.

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)

REFERENCE BOOKS –
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 method.
6. Determination of acid value in given oil.
7. Determination of melting points of different types of oils.
8. Estimation of salt content in given food stuff.
10. Determination of Protein by kjeldhal method.
12. Qualitative estimation of sugars.
13. Determination of ash content and different types of ash.
15. Determination of pK and pl values of an amino acid.

SECTION B (FOOD PRESERVATION & 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 effectiveness 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 basic weight of given packaging material.
पत्रकार (लेखक)

‘2009 और 2014 के विभिन्न सालों की’

पेश: दे

मूल अंक: 50

लिखित: 45

डिटेल्स: कॉपी: 5

मात्र: 3 बेटे

पठान

1। अपूर्ण यंगजी रेखा से आर्थिक 10 अंक
2। यंगजी वर्गीय से आर्थिक 10 अंक
3। महीनाकाली से आर्थिक 10 अंक
4। विदेशी बूमवाल रेखा आपाती हुई लघु कृतवाल दाने खुश 15 अंक

वेषं

1। वर्षियमेल, (मेरैपुर) हो चर्चायुक्त निमित्त, पहली रेखाएँ पिपी, यंगजी पूर्वीचरमिश्र, चंद्रीबाँजु
2। वर्ष चर्चायुक्त, (मेरैपुर) हो पत्रिका वेज, पहली रेखाएँ पिपी, यंगजी पूर्वीचरमिश्र, चंद्रीबाँजु
3। इंस्टीट्यूट आगाम, शीर्ष सिख, बांधुबाबू लाल शिक्षा मंत्र, अधिकृत
4। 2 और 3 बूमवाल रेखा आपाती हुई कृतवाल दाने खुश

पुत्रकित अर्थ वीण

1। (अ) बारे संख्याओं रेखाएँ बूमवाल निर्देश विभागीय (देखि रेखा) 5 अंक
(अ) विशेष रेखा से मात्र नाकेर बाबु (देखि रेखा) 5 अंक
2। वर्षियमेल रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ 4+6=10 अंक
(डिटेल रेखा रेखा)
3। महीनाकाली बूमवाल रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ 10 अंक
(डिटेल रेखा रेखा)
4। लघु पूर्वक रेखा से मेधा कृतवाल (कृतवाल रेखा के डिटेल पूर्वक रेखा) (5x1 = 5 अंक)
(न) वर्षियमेल रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ 5x1 = 5 अंक
(अ) वर्षियमेल रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ रेखाएँ 5x1 = 5 अंक
(ए) महीनाकाली रेखाएँ रेखाएँ 5x1 = 5 अंक

फॅक्टोर:

पैटरन मैट्रिक्स: वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे, वर्ष के रेखे। कृतवाल रेखा के डिटेल पूर्वक अंब्र मैट्रिक्स देखि.
पत्रकार

1. लेखक का नाम, उच्चा भाषा पेजिनर
2. लेख उच्चा भाषा
3. मंदिर उच्चा भाषा
4. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
5. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
6. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
7. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)

पूर्वबोध

1. फाइनल पत्रकार फिरिया धर्म दिने में धर्म दिने नींदट, उच्छा भाषा में फाइनल पेजिनर
2. फाइनल पत्रकार फिरिया धर्म दिने में धर्म दिने नींदट (फाइनल फैक्ट्री वा फाइनल पेजिनर)
3. फाइनल पत्रकार फिरिया धर्म दिने में धर्म दिने नींदट (फाइनल फैक्ट्री वा फाइनल पेजिनर)
4. फाइनल पत्रकार फिरिया धर्म दिने में धर्म दिने नींदट (फाइनल फैक्ट्री वा फाइनल पेजिनर)
5. फाइनल पत्रकार फिरिया धर्म दिने में धर्म दिने नींदट (फाइनल फैक्ट्री वा फाइनल पेजिनर)
6. फाइनल पत्रकार फिरिया धर्म दिने में धर्म दिने नींदट (फाइनल फैक्ट्री वा फाइनल पेजिनर)
7. फाइनल पत्रकार फिरिया धर्म दिने में धर्म दिने नींदट (फाइनल फैक्ट्री वा फाइनल पेजिनर)

पूर्वबोध:

1. लेखक का नाम, उच्चा भाषा पेजिनर
2. लेख उच्चा भाषा
3. मंदिर उच्चा भाषा
4. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
5. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
6. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
7. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)

पूर्वबोध:

1. लेखक का नाम, उच्चा भाषा पेजिनर
2. लेख उच्चा भाषा
3. मंदिर उच्चा भाषा
4. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
5. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
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7. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
8. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)

पूर्वबोध:

1. लेखक का नाम, उच्चा भाषा पेजिनर
2. लेख उच्चा भाषा
3. मंदिर उच्चा भाषा
4. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
5. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
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7. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
8. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
9. फाइनल पत्रकार (फाइनल फैक्ट्री वा फाइनल पेजिनर)
PAPER IV: HISTORY AND CULTURE OF PUNJAB

Theory : 90 marks
Internal Assessment : 10 marks
Total : 100 marks
Time : 3 hours

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.- 1849 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).


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

   (a) That the students who have not studied Punjabi up to 10th.

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

   (c) Foreigners.
UNIT I (ENVIRONMENT)

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.*

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
4. Traffic Signs.
5. How to obtain Driving License.
7. Common Driving mistakes.
8. Significance of First-aid in Road Safety.
9. Role of Civil Society in Road Safety.

**Examination Pattern:**

- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted question).
- The paper shall have two units: Unit I (Environment) and Unit II (Road Safety).
- Unit I shall comprise of 50 questions with minimum of 2 questions from each topics 1, and 12 to 15 and minimum of 4 questions from topics 2 to 11.
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
• The entire syllabus of Unit I is to be covered in 25 hours and that of Unit II is to be covered in 10 hours.
• All questions are to be attempted.
• Qualifying Marks 33 per cent i.e. 23 marks out of 70.
• Duration of examination: 90 minutes.
• The paper setters are requested to set the questions strictly according to the syllabus.

Suggested Readings

2. Road Safety Signage and Signs (2011), Ministry of Road Transport and Highways, Government of India.

Websites:

   (a) www.chandigarhpolice.nic.in
   (b) www.punjabpolice.gov.in
   (c) www.haryanapolice.gov.in
   (d) www.hppolice.nic.in
B.Sc. PART II

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

1. Genetics of bacteria and its application to health and agriculture.
3. Genome organization – Composition and structure of prokaryotic DNA and RNA.
4. DNA Replication- DNA replication mechanism in prokaryotes, enzymes involved in DNA replication, theta and sigma modes of replication.

SECTION-B

5. Gene Expression – Transcription in bacteria, nature of the genetic code and translation.
8. DNA Transferring Mechanisms - CaCl₂ method, biolistic gun, Electroporation, phage transfection.

SECTION-C

7. Tools in Recombinant DNA Technology- Restriction endonuclease, DNA ligase, Alkaline phosphatase, DNA polymerase, DNA cloning vectors- plasmids, cosmids, phagemids, shuttle vectors, expression vectors, BAC/YAC vectors.
8. Genes to clones – Basic techniques used to identify, amplify and clone genes; construction of genomic and cDNA libraries and screening of DNA libraries.
9. DNA amplification- PCR, its types and applications.

SECTION-D

11. Gene Regulations - Operon concept, the Lactose and the Tryptophan operon.
12. Site directed mutagenesis and its applications.

REFERENCE BOOKS -
Malacinski, George M., 2005, Freifelder’s. Essentials of Molecular Biology, Narosa Publishing House, ND.
Karp, Gerald, 2005, Cell and Molecular Biology, Wiley International, USA.
BMF 2002 – BIOANALYTICAL TECHNIQUES

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 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 for protein, Nucleic acid and Capillary Electrophoresis.

SECTION B

3. Refractometry - Basic Principle, specific and molar refractions, Refractometers- Components working and its Applications.

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

10. Radio-active tracer techniques - Radioactive isotopes, Types of Radioactive decay: Decay by Negatron, positron, alpha particles emission, Radioactive Decay energy, Rate of Radioactive Decay, Units of radioactivity, Types and its Instrumentation of Detection and measurement of Radioactivity and applications of Radioisotopes in Biological sciences.

REFERENCE BOOKS -
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. Isolation of nutritional mutants.
7. Preparation of competent cells.
8. CaCl₂ transformation of plasmid and screening for positive transformants.
9. Isolation of mutant by U.V. or a chemical mutagen.
10. Quantitative estimation of DNA and RNA.

SECTION B (BIOANALYTICAL TECHNIQUES)

1. Determination of molar absorption coefficient of L-tyrosine
2. Estimation of proteins by biuret method.
3. Estimation of total sugars by anthrone method.
4. Estimation of reducing sugars by DNSA method.
5. Separation of amino acids by paper electrophoresis.
7. Separation of plant pigments by TLC.
8. Separation of lipids by TLC.
12. Estimation of total serum cholesterol by Zak & Henley’s method
15. 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.

REFERENCE BOOKS –

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.

REFERENCE BOOKS –
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
PAPER I BIOINFORMATICS & ENVIRONMENTAL MICROBIOLOGY

BMF 3001: PRINCIPLES OF BIOINFORMATICS

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: addition, substraction, multiplication, simplification; 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.

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. **Introduction to bioinformatics**
6. **Sequence analysis**: Introduction to sequence alignment and its applications. Pair wise sequence alignment: Concept of global and local alignment, Dot Plot, algorithm for pair wise sequence alignment (Needleman and Wunsch, Smith watterman methods)
8. **BLAST**: Introduction to BLAST, types of BLAST, algorithm of BLAST and interpretation of its result.

SECTION D
9. **Phylogenetic Analysis**
10. Introduction to phylogenetic analysis and its application, phylogenetic tree topologies, methods of phylogenetic tree construction and tools.
11. **Primary Databases**: Nucleotide sequence database (GenBank, EMBL), protein sequence database.
12. **Structural Databases**: Pdb, PDBsum
13. **Motifs and Pattern Databases**: PROSITE, Pfam.

REFERENCE BOOKS:
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.
REFERENCE BOOKS -

BMF 3051 – PRACTICALS

SECTION A (BIOINFORMATICS)
1. Retrieving amino acid and nucleotide sequence from sequence databases using Entrez.
2. Performing BLASTp/n and interpreting its results.
4. Finding ORF in nucleotide sequence using NCBI ORF FINDER
5. Download protein structure form PDB and visualize it using RasMol.
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. Isolation of phosphate solublizing microbes from soil.
6. Demonstration of rhizosphere effect.
7. Determination of TS, TDS, TSS in industrial effluent.
8. Determination of dissolved oxygen of water.
10. Determination of COD of industrial effluent.
11. Isolation of ammonifying bacteria.
12. Detection of Coliforms for determination of purity of potable water.
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

REFERENCE BOOKS -
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
2. Physico chemical methods for food analysis
   Moisture & Total solids
   Carbohydrates
   Proteins
   Fats
   Fiber
   Ash & its types
   Minerals
   Vitamins
   Enzymatic methods
3. 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 – Size, Shape & Colour.
   Flavor of food – Taste & Smell, Subjective & Objective analysis.
   Texture of food – Concept of Rheology & Viscosity, Subjective & Objective Analysis.
6. Sensory Tests –
   Difference, Rating & Sensitivity tests.
   Types of panels
   Testing area & schedule.

SECTION C
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
8. Adulterants and Preservatives – Common adulterants present in milk, tea, coffee, cereals, spices, oils & fats. Their analysis and analysis of common preservatives used in processed foods. Permissible limits of Preservatives.
SECTION D


**REFERENCE BOOKS**


**PAPER 3052 – PRACTICALS**

**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
14. To study different components of refrigeration system.
15. To study thermal properties of foods.

**SECTION-B (Food analysis and Quality Control)**

1. Detection of different type of sugars in fruit juices by TLC
2. Testing of given canned product
3. Shelf life testing of packaged product by HVP method
4. Proximate analysis of Butter
5. Determination of Fructose by Roe’s Resorcinol Method.
6. Colorimetric determination of Crude Protein (Kjeldahl Nitrogen).
10. Determination of Fat by Majonnier method.
11. Determination of preservatives in milk.
12. Determination of adulterants in milk, oils & fats, spices, Tea and Coffee
14. To prepare a chart of specifications for different Food products as specified by BIS
15. Determine the Critical Control Points for production line of Milk, Fruits & Vegetables and Meat industry as per HACCP system.

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