FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. MICROBIAL & FOOD TECHNOLOGY
1st & 2nd SEMESTER, 3rd & 4th SEMESTER
& 3rd Year

EXAMINATIONS 2015-2016

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OUTLINE OF SEMESTER WISE SYLLABUS FOR B.Sc. (MICROBIAL & FOOD TECHNOLOGY)

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>PAPERS</th>
<th>CODE</th>
<th>SUBJECTS</th>
<th>MARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(B.Sc PART I)</td>
<td>Semester I</td>
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<tr>
<td>PAPER I</td>
<td>BMF 1001</td>
<td>General and Food Microbiology</td>
<td>75 (67+8) 25</td>
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<tr>
<td>PAPER II</td>
<td>BMF 1002</td>
<td>Microbial and Food Biochemistry</td>
<td>75 (67+8) 25</td>
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<td>PAPER III</td>
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<td>Chemistry</td>
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<td></td>
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<td>Paper A Inorganic Chemistry</td>
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<td>Paper B Organic Chemistry</td>
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<td>Paper C Physical Chemistry</td>
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<tr>
<td>PAPER IV</td>
<td></td>
<td>HCP/PUNJABI</td>
<td>50</td>
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<tr>
<td>PAPER V</td>
<td></td>
<td>**Environmental Science (same as for B.Sc. Pass Course Students) (Qualifying)</td>
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</tbody>
</table>

Semester II

| PAPER I | BMF2001 | Industrial Microbiology and Fermentation Technology | 75 25 |
| PAPER II | BMF 2002 | Principles of Food Preservation and Packaging | 75 25 |
| PAPER III |        | Chemistry                                        | 75 25 |
|          |        | Paper A Inorganic Chemistry                     |       |
|          |        | Paper B Organic Chemistry                       |       |
|          |        | Paper C Physical Chemistry                      |       |
| PAPER IV |        | HCP/PUNJABI                                     | 50   |

PAPER VI Job Training: Four weeks training in a reputed Industry / Institution after B.Sc. – IIrd SEMESTER Final exams*.

TOTAL MARKS 700

(B.Sc PART II)                              | Semester III                                    |
| PAPER I | BMF 3001 | Bioanalytical Techniques                         | 75 25 |
| PAPER II | BMF3002 | Processing of Foods of Plant Origin             | 75 25 |
| PAPER III |        | Chemistry                                        | 75 25 |
|          |        | Paper A Inorganic Chemistry                     |       |
|          |        | Paper B Organic Chemistry                       |       |
|          |        | Paper C Physical Chemistry                      |       |
| PAPER IV |        | English                                          | 50   |
### Semester IV

<table>
<thead>
<tr>
<th>PAPER I</th>
<th>BMF 4001</th>
<th>Microbial Genetics and r-DNA Technology</th>
<th>75</th>
<th>25</th>
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<tbody>
<tr>
<td>PAPER II</td>
<td>BMF 4002</td>
<td>Processing of Food of Animal origin</td>
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<td>25</td>
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<tr>
<td>PAPER III</td>
<td></td>
<td>Chemistry</td>
<td>75</td>
<td>25</td>
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<td>Paper A Inorganic Chemistry</td>
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<td>PAPER IV</td>
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<td>English</td>
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PAPER V: Job Training: Four weeks training in a reputed Industry / Institution after B.Sc. – IVth SEMESTER Final exams*.

**TOTAL MARKS** 700

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### B.Sc. PART III

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<tbody>
<tr>
<td><strong>I</strong></td>
<td>Bioinformatics &amp; Environmental Microbiology</td>
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<tr>
<td>BMF 3001</td>
<td>Principles of Bioinformatics</td>
<td>75</td>
</tr>
<tr>
<td>BMF 3002</td>
<td>Principles of Environmental Microbiology</td>
<td>75</td>
</tr>
<tr>
<td>BMF 3051</td>
<td>Practicals</td>
<td>50</td>
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<tr>
<td><strong>II</strong></td>
<td>Food Engineering and Quality Control</td>
<td>200</td>
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<tr>
<td>BMF 3003</td>
<td>Food Engineering</td>
<td>75</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><strong>III</strong></td>
<td>Chemistry (same as for B.Sc. Pass Course Students)</td>
<td>200</td>
</tr>
<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>
<td>50</td>
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<tr>
<td>Paper C</td>
<td>Physical Chemistry</td>
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<tr>
<td>Paper D</td>
<td>Practicals</td>
<td>50</td>
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<tr>
<td><strong>IV</strong></td>
<td>Project Work-70 +Job Training done after B.Sc I and B.Sc II Examination- 30)</td>
<td>100</td>
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</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

**The Environment & Road Safety Education is a compulsory qualifying paper, which the students have to study in the B.Sc. 1st year (2nd Semester). If the student/s failed to qualify the paper during the 2nd Semester, he/she/they be allowed to appear/qualify the same in the 4th or 6th Semester/s.**
ENVIRONMENT AND ROAD SAFETY EDUCATION (SEMESTER – II)

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

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.

**Practical**
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.

**Examination Pattern:**
A qualifying paper of 50 marks comprising of fifty multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong answer or un-attempted question), and of 1 hour duration.

The students have to obtain 33% marks to qualify the paper. The marks are not added / included in the final mark sheet.

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
3. Traffic Engineering – Concept & Significance.
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.

**Note : Examination Pattern :**
- The Environment and Road Safety paper is 70 marks.
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted questions).
- The paper shall have two units: **Unit I (Environment) and Unit II (Road Safety).**
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit II is to be covered in 10 hours.
- All the questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
- Duration of examination: 90 minutes.
- The paper setter is 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
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. Examiners 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.

UNIT I

1. Introduction – Discovery of microbial world, Importance of microbiology, Microbial classification and nomenclature, Characteristics of major groups of microorganisms: Archaeabacteria, Eubacteria, Fungi, Protozoa and Viruses and Bacteriophages.

2. Prokaryotic cell structure and function: Cell morphology; the capsule and slime layer; cell wall; cell membrane; ribosome; flagella; fimbriae and pilus; nuclear region and spores.

3. Microbial Nutrition: Nutritional requirements of microbes; Types of culture media; Classification of microbes on the basis of nutritional requirements, Identification of bacteria.

UNIT II

4. Bacterial Growth - Bacterial growth curve, Methods of measurement of growth, Bacterial growth at high and low temperature; Other environmental factors affecting microbial growth, Synchronous and Diauxic growth.

5. Control of microorganisms:- Physical and Chemical methods of sterilization/Disinfection.

6. Human-Microbial Interactions: Normal flora – Gastrointestinal tract; Pathogenic mechanisms of food borne bacteria, Brief account of mechanisms of action of chemotherapeutic agents, Introduction to specific and nonspecific defense mechanisms to infections.

UNIT III

7. Food-borne Pathogens: General characteristics and brief account of food borne diseases caused by- Staphylococcus aureus; Clostridium botulinum; C. perfringens; Listeria monocytogene; Salmonella; Escherichia coli; Yersinia enterocolitica; Vibrio parahaemolyticus, Mycotoxins.


UNIT IV

9. Food Spoilage - Contamination of foods from natural sources, Intrinsic and Extrinsic parameters of food that affect microbial growth, Associations of microorganisms involved in spoilage, Physical and Chemical changes in food caused by micro-organisms.


REFERENCE BOOKS

5. Pelczar, Reid and Chan, 2008, Microbiology, McGraw Hill Ed, ND
BMF 1002 – MICROBIAL 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.

UNIT I
1. Introduction to Biomolecules - Major and minor constituents of food, Bioavailability of nutrients, their functions, sources, Basics of bioenergetics.
2. Enzymes- Enzymes classification and nomenclature; coenzymes, cofactor, kinetics, factors affecting catalytic efficiency of enzymes, allosteric enzymes, feedback inhibition; Competitive and non competitive inhibition.

UNIT II
3. Carbohydrates - Classification, structure & properties, Catabolism of carbohydrates- glycolysis, TCA, electron transport chain, Pentose phosphate pathway, Entner Doudoroff pathway, Fermentation, Anaerobic respiration; artificial sweeteners.
5. Lipids – Classification, Structure and functions- saturated, unsaturated and phopholipids, Catabolism of fatty acids- Alpha and Beta oxidation pathways.

UNIT III
6. Biosynthetic Pathways: Brief account of Biosynthesis of sugars and polysaccharides, amino acids, nucleotides, fatty acids and lipids in prokaryotes, biosynthesis of bacterial cell wall.
8. Vitamins and minerals - Classification, sources and functions.

UNIT IV
10. Flavours - Definition and basic taste factors, chemistry of food flavors from cocoa, coffee, vanilla beans and spices, flavor changes in fats and oil, flavor and aroma’s of food.
11. Changes in food constituents during processing: Changes in carbohydrates on cooking, Browning and Maillard reactions, Effects of physic-chemical conditions on proteins, Denaturation of proteins, Oxidative and Hydrolytic Rancidity.

REFERENCE BOOKS –
5. De, Amit Krishna., 2012, Biochemistry, S.Chand & Co. Ltd., New Delhi, India.
PRACTICALS

BMF 1051 – (GENERAL AND FOOD MICROBIOLOGY)

Max. Marks : 25
Int. Ass. : 2.5
Time : 3 hours

1. Introduction and study of microbiological instruments.
2. Media preparation, aseptic techniques and transfer of microorganisms.
3. To study various culture techniques- pour plating, spread plating and streaking.
4. Microscopy: study, use and care of compound microscope.
5. To study effect of chemical disinfectants on bacterial growth by filter paper disc method.
6. To study morphology of bacteria by simple staining and negative staining.
7. Principle, procedure and use of gram staining method.
8. Staining of bacterial spores.
9. To distinguish the growth characteristics of microorganisms in various differential and selective media.
10. Identification of fungi by Lactophenol cotton blue staining method.
11. Sampling and observation of microorganisms from natural sources.
12. To study serial dilutions of the sample and plate counts.
13. To perform antibacterial testing by Kirby-Bauer method.
15. Presumptive coliform test for milk, butter and ice-cream.
16. Yeast and mold count for butter and dahi.

BMF -1052 (MICROBIAL AND FOOD BIOCHEMISTRY)

Max. Marks : 25
Int. Ass. : 2.5
Time : 3 hours

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of amino acids.
3. Determination of pK and pI values of an amino acid.
4. To perform isoelectric precipitation of proteins.
5. Quantitative estimation of amino acids by ninhydrin.
6. Determination of acidity and pH of food product.
7. Determination of Protein by kjeldhal method.
9. Determination of acid value in given oil.
10. Determination of melting points of different types of oils.
15. Determination of ash content and different types of ash.
B.A. (GENERAL)/B.Sc. (GENERAL) FIRST YEAR SYLLABUS
gzikph (bk+wh)

ची.डी. अंदे डी. शेख. 997 दे दिव्या तिथि 50 पार्सल 2015 दे दिव्या तिथि 50
(ची.डी. अंदे डी. शेख. 997 दे दिव्या तिथि 50 पार्सल 2015)

ग्रेडर विभाग

परिचय

1. अग्निविद्या वैदिक विभाग एवं अभ्यास 20
2. संघ विभाग 20
3. संकेत विभाग 5
4. विभागान्तरण : सिपाह एवं विषय

वेळा

1. काली-समेभ (zgkde) vka eowihs f;zk, gbhe/6B fpT|o', gzikp :{Bhtof;Nh, uzvhrVQ

पुरूषत अंदे वीम

1. (अ) वार्षिक-समेभ पूर्व विभाग पार्श्व विभाग ज्ञान विभाग (दे विचि विभिन्न)
2. ब्यवस्थाविद्या वा विभाग व वेंद्र विभाग (दे विचि विभिन्न)

2. ekft: -zrqlj fту'a :zy/g T[ZsoK tkb/ gqôB (T[Zso fszB :soK s'A tZX Bk j'/u)
(nZm gqôBK fту'A gzi d/ देव विभिन्न)
3. b/y ouBk (500 ðpdK ftu ) ubzs w;fbnK pko/ (uko ffônK fту'A e'Jh fJe eoBk)
4. संकेत विभाग 5
5. विभागान्तरण : सिपाह एवं विषय

(i) ftnkoeB L ftnkoeB dh gfoGkôk, wjsZt s/ sZs (tke gqôpX, o{g gqôpX,
X[Bh gqôpX s/ fbyx gqôpX (zy/g ikD gSkD)
(d' ftu'A fJe gqôB jZb eoBk j?)

(ii) ftjroe gqôB

टेस्ट : प्रायोगिक विभाग वैदिक विभाग एवं वेंद्र विभाग दे उपार्स्य तत्त्वों :zy/g T[ZsoK
tkb/ftjroe gqôB g[ZS// ikD. (uko ftu'A d' gqôB jZb eoB/ jB)

B'NL 1H 3H 33=03=ghohnv.
2H ezg'ihôB bjh 25-30 frfânkehnk dk ro[Zg ns/ jôs/ d/ fshB j'o ghohnv.
3H jôs/ d/ 603 =xghohnv.
OR

HISTORY AND CULTURE OF PUNJAB FROM THE EARLIEST TIMES TO 1849

INSTRUCTIONS FOR THE PAPER –SETTER AND CANDIDATES: (FOR PAPER in semester 1 AND 2)

The syllabus has been divided into four Units.

There shall be 9 questions in all. The first question is compulsory and shall be short answer type containing 10 short questions spread over the whole syllabus to be answered in about 25 to 30 words each. The candidates are required to attempt any 5 short answer type questions carrying 5 marks i.e. 1 mark each. Rest of the paper shall contain 4 units. Each Unit shall have two essay type questions and the candidate shall be given internal choice of attempting one question from each Unit-IV in all. Each question will carry 10 marks.

2. 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 (2) in the question paper.

3. One question from Unit-IV shall be set on the map.

Explanation:

1. Each essay type question would cover about one-third or one-half of a topic detailed in the syllabus.

2. The distribution of marks for the map question would be as under:
   Map : 6 Marks
   Explanatory Note : 4 Marks

   In case a paper setter chooses to set a question of map on important historical places, the paper setter will be required to ask the students to mark 5 places on map of 2 marks each and write explanatory note on any two of 2 marks each.

3. The paper-setter would avoid repetition between different types of question within one question paper.

PAPER:  HISTORY AND CULTURE OF PUNJAB FROM THE EARLIEST TIMES TO 1849

Max. Marks : 50
Theory : 45
Internal Assessment : 05
Time : 3 Hours

Objectives: To introduce the students to the history of Punjab region.
Pedagogy: Lectures, library work and discussions.

UNIT I

2. Vedic Age: socio-economic life; development of caste; position of women.
3. Religion: vedic religion; impact of Buddhism and Jainism on the region.

UNIT II
4. Society and Culture c. 1000 A.D.: Socio-economic life; religious life; education
5. Cultural Reorientation: main features of Bhakti; origin and development of Sufism

UNIT III
9. Institution of Khalsa: new baptism; significance

UNIT IV
11. Society and Culture under Maharaja Ranjit Singh: social mobility; painting and architecture; literature.

Suggested Readings:
1. Joshi, L.M (ed.): History and Culture of the Punjab, Part-I, Publication Bureau, Punjabi University, Patiala, 1989 (3rd edn.)
5. Basham, A.L: The Wonder That was India, Rupa Books, Calcutta (18th rep.), 1992
6. Sharma, B.N: Life in Northern India, MunshiRam Manohar Lal, Delhi, 1966
7. Singh, Kirpal: History and Culture of the Punjab, Part II (Medieval Period), Publication Bureau, Punjabi University, Patiala 1990 (3rd edn.).


Note: The following categories of the students shall be entitled to take 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. Ward of / and Defence Personnel and Central Govt. Employee/Employees who are transferrable on all India basis.
C. Foreigners
第二学期

工业微生物学与发酵技术

BMF 2001

理论：67分

实践：8分

时间：3小时

考官须知：试卷将有四个部分。考官将设置九道题目，包括每单元的两道题目和一道涉及整个课程的必答题。学生将尝试每单元的一道题目和必答题。所有题目可能等值评分，除非特别说明。

目标：提供发酵技术的基本原理以及下游处理的见解，这包括菌株选择，培养基配方，灭菌，接种物发展，生物反应器的设计和产品回收。

纸张也涉及生产以及各种发酵产品的使用。

第一单元

1. 引言：发酵技术的重要性，工业发酵的基本步骤；初级和次级代谢物。
2. 重要工业微生物：重要工业微生物；分离和筛选，改进和保存工业微生物。
3. 发酵培养基和接种物发展：培养基配方和常见用于发酵工业的基质；培养基灭菌方法，微生物发酵的接种物准备。

第二单元

4. 发酵：发酵类型；有氧和无氧发酵，液体和固体发酵，连续和间歇发酵系统。
5. 发酵器设计：发酵器的设计和类型，消泡剂，发酵器的灭菌，基本控制面板（通气，搅拌，pH和温度）。
6. 下游处理工业发酵：一般程序的回收和纯化产物-分离生物质和不溶物；细胞破碎和回收以及纯化。

第三单元

7. 酒精饮料和溶剂：工业啤酒，葡萄酒和乙醇生产。
8. 有机酸：醋酸，柠檬酸，乳酸。
9. 氨基酸：工业生产谷氨酸，赖氨酸和天冬氨酸。

第四单元

10. 微生物生物量：单细胞蛋白生产。
11. 微生物酶：工业生产微生物酶-淀粉酶和蛋白酶；酶的固定化及其应用。
12. 益生菌：生产益生菌，益生菌和食品产品。

参考书目

1. B. D Singh (2013)，生物技术，Kalyani Publishers。
2. Stanbury, Peter.F (1999)，发酵技术，Butterworth Heinemann。
6. Marth, Elmer, H.,ed., 2009，应用乳品微生物学，Marcel Dekker Inc.，NY。
BMF 2002 - 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.

UNIT I
1. **Introduction** - General principles of food preservation, Historical development.
2. **Preservation by Heat** - Heat transfer, Heat treatments – Blanching; Pasteurization; Sterilization; Boiling and Canning; TDT Curve, D value, F value, 12D concept.
3. **Refrigeration & Freezing of foods** – Differences between refrigeration and freezing; Effect of refrigerated and frozen storage on food; Immersion freezing.

UNIT II
4. **Preservation by Drying** - Drying curve, Factors affecting drying, Methods of drying & dehydration - Air convection dryers; Fluidized bed drier; roller drier; vacuum drier; spray drier; Freeze – Drying, Intermediate Moisture foods.
5. **Preservation by Concentration** - Methods of concentration, Types of Evaporators.
6. **Preservation by Radiations** - Types of Radiations, Effects of Radiations, Dose – Determining Factors, Status of Irradiated foods in India, Microwave, Ohmic heating.

UNIT III
7. **Preservation by Chemicals** - GRAS, Chemical food preservatives, Food Additives.
8. **Recent Trends in Food Processing** – Overview of Extrusion cooking, Reverse Osmosis, Electro dialysis, Ultrafiltration, High Pressure Processing, Pulse electric field preservation.
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.

UNIT IV
11. **Packaging Methods** - Form fill seal packaging, Hermetic closures, Retortable pouches, Aseptic packaging, Inert gas packaging, Active & Intelligent Packaging, vacuum packaging, CAP and MAP.
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 and bakery
   f) Fruit juices
   g) Heat processed foods
   h) Fresh produce (Eggs, Meat, Fruits and Vegetables)

REFERENCE BOOKS –
1. Jood, Sudesh, 2009, Food Preservation, Agrotech Publisher Academy, Udaipur.

PRACTICALS

BMF 2051 – (INDUSTRIAL MICROBIOLOGY & FERMENTATION TECHNOLOGY)
1. Screening of microbes producing industrially important enzyme.
2. Maintenance and preservation of pure culture.
3. Determination of cell biomass.
5. To study the effect of energy source and role of buffers on the growth of microbes.
6. To study the effect of temperature and pH on the growth of microbes.
7. To study the effect of aeration and substrate concentration on the growth of bacteria.
8. Isolation of LAB in pure culture.
11. To study solid state and submerged fermentation techniques.
12. To study probiotic bacteria.
13. Lab scale production of an enzyme.
14. Lab scale preparation of ethanol.
15. Study of Cell/enzyme immobilization techniques.

BMF 2052 – PRINCIPLES OF FOOD PRESERVATION AND 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.
13. Determination of uniformity of tin coating and tin crystal size on given tin plate.
14. To study the effect of addition of different chemical preservatives on food quality.
15. To study the synergistic / antagonistic combination of GRAS additives.
B.A.(GENERAL)/B.Sc. (GENERAL) FIRST YEAR SYLLABUS

gzikph (bk÷wh)

(2016 के विभाग के लिए)

(2016 के विभाग के लिए)

कोटा 2016

लघु भाषा: 50

विधवारी भाषा: 45

दिवसीय अनुपात: 5

भाषा: 3 घंटे

पाठ्यक्रम

1. भौगोलिक वर्गीकरण एवं अपििमोत

2. मुख्य लिंग तंत्र

3. भौगोलिक

4. विभागीय शिक्षाओं: नियंत्रण से विचार

वेक्टर

1. (zgkde) vka XBtzs e"o, gbph/oB fpT{o', gzikp :{Bhtof;Nh, uzvhrVQ

पुष्टि न्याय वर्ण

1. (T) ÆEk ejkJdhO g[se ftu'A f'e/ fJe ejkJdh dk ftök dZ; e/ ;ko fbyDk (fSZB ftu'A fJe)

(आ) दर्पण-संग्राम विषय मिश्रित वर्गीकरण विषय पर उत्तर विराम बदलर

(फिल सिस्टर विषय)

2. ejkJdh:-zrQfj ftu'A :zy/g T[Zso ktb/ qgôB (T) [zso [fSZB s'A tZx Bk j'u/. (nZm ftu'A gzi qgôB ebB/ )

3 मुख्य लिंग तंत्र विधिमत (मंडलिक, मण्डलिक स्तर के बंध तंत्र तथा मण्डल,)

4 भूगोल : अर्थ तह वे वर्ग निरूपित (मंडल सिस्टर वेधी वेधी वेड़ी वेंड़ी)

5 विभागीय शिक्षाओं: नियंत्रण से विचार

(1) X[Bh s/ X[Bh rôkw L X[Bh dh gfoGkô, yzvh s/ nyzvh X[BhnK (:zy/g ikD gSKD)

2H nBhj'soh, t/d, gfoukfJe Gkô ffrnkB, dhge gpfO÷o, ibzXo, 1981H

3H [jytzdo f'x: :zxk ns/ j'o, gzikph Gkô ffrnkB, Gkr-gljbk, d'ik s/ shik, gzikph Gkô ne'pô, nardpô , 1997.

4H joehos f'x (vkH), Æekki gzikph ftnkeoBØ, gzikp :N:N ;{Bhtof;Nh N'?e: N p[Zp p'ov, uzvhrVQ, 1999

5H XkhkDk, g/qw gqekô f'x (vkH) Ôf:XXs Gkô ffrnkBO, wdkB gpfbe/oB÷, gfnabk, 2002H

6H pokV, p[Nk f'xz (vkH), Ægzikph ftnkeoB, f'Xks ns/ ftiuko, u/sBk gqekôB b[fXnkDk, 2008H

7H iz:h etbi, Ægzikph ftnkeoB d/ e'jM gZyÔ, oth ;kfjs gqekôB, jkb pk÷ko, nzfwhs;ö, 2012H

8. मात्री वेढ़, gzikph Gkô L tos'A s/ pDso, b'erhs gqekôB, uzvhrVQ.

B'NL 1H N'?e:N bjh jös/ d/ S/ ghohnv.

2. ezg'iôhôB Bjh 25-30 ffrDnkEhnK dk ro[Zg ns/ jös/ d/ fszB j'o ghohnv.

3H jös/ d/ 6O3 =xghohnv.
HISTORY AND CULTURE OF PUNJAB

INSTRUCTIONS FOR THE PAPER –SETTER AND CANDIDATES: (FOR PAPER in Semester 1 and 2) (6 credit course)

1. The syllabus has been divided into four Units. There shall be 9 questions in all. The first question is compulsory and shall be short answer type containing 10 short questions spread over the whole syllabus to be answered in about 25 to 30 words each. The candidates are required to attempt any 5 short answer type questions carrying 5 marks i.e. 1 mark each. Rest of the paper shall contain 4 units. Each Unit shall have two essay type questions and the candidate shall be given internal choice of attempting one question from each Unit-IV in all. Each question will carry 10 marks.

2. 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 (2) in the question paper.

3. One question from Unit-IV shall be set on the map.

Explanation:

1. Each essay type question would cover about one-third or one-half of a topic detailed in the syllabus.

2. The distribution of marks for the map question would be as under:

   Map : 6 Marks
   Explanatory Note : 4 Marks

   In case a paper setter chooses to set a question of map on important historical places, the paper setter will be required to ask the students to mark 5 places on map of 2 marks each and write explanatory note on any two of 2 marks each.

3. The paper-setter would avoid repetition between different types of question within one question paper.

PAPER: HISTORY AND CULTURE OF PUNJAB FROM THE EARLIEST TIMES TO 1849

Max. Marks : 50

Theory : 45
Internal Assessment : 05
Time : 3 Hours

Objectives: To introduce the students to the history of Punjab region in Modern times.

Pedagogy: Lectures, library work and discussions.

UNIT I

1. Introduction of Colonial Rule: administrative changes; means of communication; western education.
2. Agrarian Development: Commercialization of agriculture; canalization and colonization.
3. Social Classes: agrarian groups; new middle classes

UNIT II
5. Socio Religious Reform Movements: activities of Arya Samaj; Singh sabhas; Ahmadiyas.
6. Development of Press & literature: growth of press; development in literature

UNIT III
7. Emergence Of Political Consciousness: Agrarian uprising 1907; Ghadar.
8. Gurudwara Reform Movement: Jallianwala Bagh; foundation of SGPC and Akali Dal; Morchas.
9. Struggle for Freedom: activities of revolutionaries - Babbar Akalis, Naujawan Bharat Sabha; participation in mass movements – non co-operation, civil disobedience, Quit India.

UNIT IV
10. Partition and its Aftermath: resettlement; rehabilitation
12. MAP: Major Historical places: Delhi, Kurukshetra, Jaito, Ferozepur, Ambala, Amritsar, Lahore, Ludhiana, Qadian, Jalandhar, Lyallpur, Montgomery.

Suggested Readings:
1. Singh,Kirpal :History and Culture os the Punjab, Part II(Medieval Period), Publication Bureau, Punjabi University, Patiala 1990(3rd edn.).
B.Sc. PART II
(MICROBIAL AND FOOD TECHNOLOGY)
SECOND YEAR EXAMINATION 2015-16, 2016-17
THIRD SEMESTER

BMF 3001– 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.

UNIT I
1. **Microscopy** - Principle and applications of Bright field, Fluorescence, Dark field and Electron microscopy, Direct Epifluorescent Filter Technique, Fixation and Staining.
2. **Chromatography** - Principles and applications of: Gel permeation, Ion-Exchange, Affinity, Paper, Thin-Layer Chromatography, HPLC and Gas Chromatography.
3. **Centrifugation**: Principles and applications of Density gradient and Differential centrifugation; Ultracentrifugation.

UNIT II
4. **Electrophoresis** - Types of electrophoresis; Principles and application of Agarose Gel Electrophoresis; SDS-Page electrophoresis; Immunoelectrophoresis and 2-D Electrophoresis.
5. **Refractometry** - Basic Principle; specific and molar refractions; Refractometers-Principle and its Applications.
6. **Polarimetry** - Basic principle of Polarimeter and its applications

UNIT III
7. **Spectroscopy** - Basic principle of absorption of light, Principle and applications of UV and Visible; Atomic absorption; Nuclear magnetic resonance and Mass spectroscopy.
8. **Fluorescence spectroscopy** - Fluorescence methods; filter fluorometers; Fluorosence Spectrophotometer

UNIT IV
9. **Immuoassays**: Principle and applications of Radioimmunoassy, Immunofluorescent assay, Enzyme linked Immunosorbent assay and Flow cytometry in food industry.
10. **Biosensors**: Principle; types and applications of biosensors.
11. **Tracer techniques**: Use of radioisotope, detection and measurement of radioactivity; specific activity; applications in food sector.

REFERENCE BOOKS -
B.Sc. PART II  
(MICROBIAL AND FOOD TECHNOLOGY)  
SECOND YEAR EXAMINATION 2015-16, 2016-17  
THIRD SEMESTER  

BMF 3002- 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.

UNIT I  
1. Physiology of ripening, Effect of physical and chemical treatments on post harvest life of fruits and vegetables, Storage and handling of fresh fruits and vegetables, Preparation of fruits and vegetables for processing, Preparation of fruit juices and pectin.  
2. FSSAI/FPO Standards and preparation of jam, jellies, marmalades, tomato products, preserves and pickles.  
3. By–product utilization of fruits and vegetable processing industry.

UNIT II  
4. Structure and composition of different grains like wheat, rice, etc. Milling of wheat. Flour quality, Technology of baking bread, biscuit and cereal based infant foods.  
5. Milling and parboiling of rice, Rice bran oil, Wet and dry milling of corn.  
6. Breakfast cereals – Porridge and flakes

UNIT III  
7. Nutritional value of pulses.  
9. Anti nutritinal component of pulses, Application of enzymes in processing of cereals and pulses.  

UNIT IV  
11. Extraction and purification of oils, preparation of various products including margarine, salad dressing & mayonnaise.  
12. Nutritional food mixes from oilseeds – Oilseeds for food use

REFERENCE BOOKS –  

PRACTICAL
B.Sc. PART II
(MICROBIAL AND FOOD TECHNOLOGY)
SECOND YEAR EXAMINATION 2015-16, 2016-17
SEMESTER III

Max. Marks : 25
Int. Ass. : 2.5
Time : 3 hours

BMF 3051 – BIOANALYTICAL TECHNIQUES

1. Determination of molar absorption coefficient of L-tyrosine
3. Quantitative estimation of total sugars by anthrone method.
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. Separation of lipids by TLC.
12. Estimation of total serum cholesterol by Zak & Henly’s method
15. To study the effect of ultraviolet light on Vitamin A.
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 free fatty acid value of a given oil sample.
9. Qualitative and Quantitative determination of oil rancidity.
10. Determination of Sulphur Dioxide in processed fruits and vegetables
11. Estimation of total aldehydes by hydroxylamine titration in citrus oils.
12. Preparation of jellies and marmalades.
13. Quality evaluation of wheat flour
14. Determination of starch gelatinization from different plant sources.
15. Estimation of Trypsin Inhibitor / cyanogenic glucosides in pulses.
BMF 4001 – MICROBIAL GENETICS & r-DNA TECHNOLOGY

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.

UNIT I
1. **Genome organization in prokaryotes** – Molecular nature of the genetic material, Composition and structure of prokaryotic DNA and RNA, Types of RNA.
2. **DNA Replication** – DNA replication mechanism in prokaryotes, Enzymes involved in DNA replication, theta and sigma modes of replication.
3. **Gene Expression** – Prokaryotic transcription process- Initiation, Elongation and Termination; General characteristics of the genetic code, Charging of tRNA, Prokaryotic translation process- Initiation, Elongation and Termination.

UNIT II
4. **Mutations** – Spontaneous and induced mutations, types of mutations, Physical and chemical mutagenic agents, repair of DNA damage, Replicating, Transposable elements in bacteria, drug resistance.
5. **Genetic Exchange** – Gene transfer by Transformation; Generalized and Specialized transduction; Conjugation processes.
6. **Gene Regulations** – Operon concept- Lactose operon and Tryptophan operon in *E.coli*.

UNIT III
7. **Recombinant DNA Technology** – Tools of genetic engineering- DNA cloning vectors- Plasmids, Cosmids, Phage vectors, Shuttle vectors, Expression vectors, BAC/YAC vectors; Restriction endonuclease, DNA ligase, Alkaline phosphatase, DNA polymerase, Exonuclease.
8. **Gene cloning** – Basic techniques used to identify, amplify and clone genes; Construction of genomic and cDNA libraries and Screening of DNA libraries.
9. **Applications** of Recombinant DNA Technology in health and food sector.

UNIT IV
10. **DNA Transferring Mechanisms** – Chemical methods, biolistic gun, Electroporation, Liposome mediated gene transfer and phage transfection.
11. **DNA amplification** – PCR, Types and Applications.
12. **Techniques of molecular biology** – Dot Blot, Southern blotting, Northern blotting and Western blotting techniques, DNA sequencing by Maxam-Gilbert, Dideoxy chain termination and Automated dideoxy method, Oligonucleotide mediated site directed mutagenesis.

REFERENCE BOOKS -
2. Karp, Gerald, 2005, Cell and Molecular Biology, Wiley International, USA.
3. Snusted and Simmons, 2012, Principles of genetics, John Wiley and Sons, Inc
BMF 4002- PROCESSING OF FOODS OF ANIMAL ORIGIN

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.

UNIT I
1. FSSAI/PFA Definition of milk; Chemical composition of milk of different species i.e. Buffalo, Cow (foreign), Cow (sindhi), Goat, Murrah, Jersey.
2. Diagrammatic representation of milk constituents; Factors affecting milk composition. Physico-chemical properties of milk, Production, distribution and storage of liquid milk
3. Processing of different types of market milk – Pasteurized, Sterilized, Homogenized, Flavored, Toned and Double Toned milk.

UNIT II
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; Cheddar cheese, Cottage cheese, Blue cheese, Mozzarella cheese and Processed cheese.

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

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

REFERENCE BOOKS –
1. De, Sukumar, 2012, Outlines of Dairy Technology, Oxford Univ. Press, ND
PRACTICAL
B.Sc. PART II
(MICROBIAL AND FOOD TECHNOLOGY)
SECOND YEAR EXAMINATION 2015-16, 2016-17
SEMESTER IV

Max. Marks : 25
Int. Ass. : 2.5
Time : 3 hours

BMF 4051 (MICROBIAL GENETICS & R- DNA TECHNOLOGY)
1. Preparation of reagents involved in DNA work.
2. Isolation of genomic DNA from bacteria.
3. Estimation of DNA by Diphenylamine method.
4. Isolation of plasmid DNA.
5. Preparation and running of agarose gel and detection of DNA on the gels.
6. Estimation of RNA content by the Orcinol method.
8. Demonstration of photoreactivation repair mechanism in bacteria.
9. Isolation of nutritional mutants.
11. Selection of Antibiotic resistant variants by gradient plate method.
12. Spectrophotometric quantitative estimation of DNA.
**BMF 4052- (PROCESSING OF FOODS OF ANIMAL ORIGIN)**

Max. Marks : 25  
Int. Ass. : 2.5  
Time : 3 hours

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. Physical and chemical analysis of milk & milk products  
9. To estimate the salt content in butter.  
11. To estimate the purity of ghee by Baudouin test.  
12. Testing the adulteration in milk & milk products  
13. Preparation of Ghee by different methods.  
14. Quality of egg & egg powder, egg preservation.  
15. Evaluation of quality of meat, fish & poultry

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**B.Sc. 3rd Year (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 units. 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.
UNIT-I
1. **Gene prediction methods**: hidden markov model method, neural network method, homology based methods.
2. **Protein Structure classification**: SCOP, CATH; Protein secondary structure prediction methods: Ab-initio prediction methods, homology based methods, prediction using neural networks; Protein tertiary structure prediction methods: Ab initio, homology modeling, threading & fold recognition.

UNIT-II
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.

UNIT-III
5. **Introduction to bioinformatics**: Introduction, overview and needs of bioinformatics technology.
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)
7. **BLAST**: Introduction to BLAST, types of BLAST, algorithm of BLAST and interpretation of its result.

UNIT-IV
8. **Phylogenetic Analysis**: Introduction to phylogenetic analysis and its application, phylogenetic tree topologies, methods of phylogenetic tree construction and tools.
9. **Primary Databases**: Nucleotide sequence database (GenBank, EMBL), protein sequence database.
10. **Structural Databases**: Pdb, PDBsum
11. **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 units. 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

UNIT-I
1. **Microbial Ecology**: Introduction, scope, history and applications of environment microbiology.
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.

   **UNIT-II**

4. **Microbial Interactions**: Microbe- Microbe Interactions- Neutralism, Synergism, Mutualism, Commensalism Competition, Parasitism, Predation.

5. **Microbiology of Extremophiles**: Ecology of Acidophiles, Alkalophiles, Halophiles, Barophiles, Psychrophiles, Thermophiles and Radioresistant microorganisms.


   **UNIT-III**

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

8. **Microorganisms as geochemical agents**: Recycling of nitrogen, carbon, water, oxygen, sulphur and phosphorus.

9. **Bioconversions and Bioremediation**: Role of microorganisms in Biomining and Bioleaching of ores, Biogas Production, Composting and Vermicomposting, Biodegradation of hydrocarbons.

   **UNIT-IV**

10. **Microorganisms in Waste Management**: Treatment of Industrial and Municipal waste-primary,secondary and tertiary treatment, Microbial indicators of environmental pollution.

11. **Microorganisms in Biological Control**: Microbial control of insects, pests, weeds and other disease causing organisms.

12. **Biosensors**: Development of Biosensors for heavy metal ions, BOD biosensor, Construction of biosensors and kits for detection of pathogens, insecticides and pesticides.

**REFERENCE BOOKS**


**BMF 3051 – PRACTICALS**

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

**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 cellulose producer from soil.
6. Isolation of phosphate solubilizing microbes from soil.
7. Demonstration of rhizosphere effect.
8. Determination of TS, TDS, TSS in industrial effluent.
10. Determination of BOD of industrial effluent.
11. Determination of COD of industrial effluent.
12. Isolation of ammonifying bacteria.
15. Demonstration of Biogas production.

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**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 units. 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.
UNIT-I

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, HUMIDITY & RELATIVE HUMIDITY, adiabatic saturation temperature, Dew point, Information about psychrometric 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

UNIT-II

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

UNIT-III

7. **Flow of fluids**: Types of fluids and fluid flows, viscosity, Bernoullie’s equation and its application for measurement of flow rate Different types of pumps (Reciprocating, rotary and centrifugal pumps).
8. **Evaporation**: Mechanisms of vaporization, Boiling Point elevation, Different types of evaporators, Evaporation of heat sensitive materials

UNIT-IV

10. **Mixing**: Theory of mixing, mixing of liquids & solids, types of mixers, power calculation in mixing. Homogenization
11. **Separation processes**: Principles and methods of gas absorption, Distillation, Extraction and washing, Filtration, sedimentation, sieving, centrifugation
12. **Membrane Separation Processes**: Separation by Sieving, Screen effectiveness; Theory of filtration, Reverse Osmosis, Nano filtration and Ultra filtration

REFERENCE BOOKS -

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 units. 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

UNIT-I

1. **Sampling**: Sampling techniques and preparation of food samples. Sampling of Milk, Eggs, Dried & Frozen...
2. **Physico chemical methods for food analysis:**
   - Moisture & Total solids
   - Carbohydrates
   - Proteins
   - Fats
   - Fiber
   - Ash & its types
   - Minerals
   - Vitamins

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*.

**UNIT-II**

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.

**UNIT-III**

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.

**UNIT-IV**


**REFERENCE BOOKS**

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
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
13. Estimation of Vitamin C spectrophotometrically
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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