FACULTY OF SCIENCE SYLLABI

For B. Sc./ B. Sc. (Honours)/ B. Sc. (Honours) with Research*

in Microbial and Food

4-YEAR UNDERGRADUATE PROGRAMME UNDER NEW EDUCATION POLICY (NEP) 2020

Framework of B.Sc. Microbial and Food Technology 1st Year Programme (2024-2025)

B.Sc (Honours) PART I
(MICROBIAL AND FOOD TECHNOLOGY)
FIRST YEAR EXAMINATION
FIRST SEMESTER
BMF-1001 – PRINCIPLES OF MICROBIOLOGY (THEORY)

(CREDITS - 3)

MAX. MARKS: 75
THEORY: 60
INTERNAL ASSESSMENT: **15**

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.

COURSE OBJECTIVES AND LEARNING OUTCOMES: To give an overview of fundamental aspects of microbiology viz. history, microbial world, prokaryotic structure, cultivation

UNIT II — No. of Hours: 12

Bacteriological techniques Pure culture isolation: Streaking, serial dilution and plating methods; cultivation of anaerobic bacteria, and accessing non-culturable bacteria.

Principles of microbial diagnostics: Conventional and molecular approaches

Microscopic examination: Applications of light microscopy, fluorescent microscopy and electron microscopy in microbial identification

UNIT III — No. of Hours: 11

Bacterial Growth: Bacterial growth curve, Methods of measurement of growth, Synchronous and Diauxic growth, Direct and Indirect methods to measure microbial growth.

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

UNIT IV

PRACTICALS: PRINCIPLES OF MICROBIOLOGY

(CREDITS-01)

MAX. MARKS: 25
PRACTICAL: 22
INTERNAL ASSESSMENT: **03**
TIME: 2 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.

B.SC (Honours) PART I
(MICROBIAL AND FOOD TECHNOLOGY)

UNIT II — No. of Hours: 12

Lipids: Classification, structure and functions of lipids, saturated and unsaturated fatty acids, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash, and fire point. Chemical Properties-Reichert meissel value, polenske value, iodine value, peroxide value, saponification value. Oxidative and Hydrolytic rancidity.
Proteins: Classification and Structure and of amino acids, Essential and non-essential amino acids, structural organization of proteins, physico-chemical properties of proteins, Denaturation of proteins.

UNIT III — No. of Hours : 12

Carbohydrates: Classification of Carbohydrates, structure and properties of Important Mono-, Di- and Polysaccharides, Non-Enzymatic Browning- (Caramelization and Mallard Reaction), Fermentation, Gelatinization and Retrogradation, Dietary Fibres.
Vitamins and Minerals: Classification, sources, and functions.

UNIT IV — No. of Hours: 10

Pigments - Food pigments - Chlorophyll, carotenoids, anthocyanins, flavonoids, betanins.
Flavours Definition and basic taste factors. The smell sensation, Flavour Enhancers and flavourings

PRACTICALS: FOOD BIOMOLECULES

(CREDITS-01)

MAX. MARKS:25
PRACTICAL:22
INTERNAL ASSESSMENT: **03**
TIME: 2 hours

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of Amino acids
3. Determination of Acidity and pH of Food products
4. To perform isoelectric precipitation of proteins.
5. Determination of moisture by Oven drying method.
6. Determination of acid value in given oil.
7. Determination of fat by Soxhlet apparatus.
8. Determination of Melting point of Fats
9. Determination of vitamin C by titration method.
10. Determination of ash content in given food sample.

SUGGESTED READINGS (latest editions)

1. Lehninger A.L., Nelson, D.L. & Cox, M.M. (2013). Principles of biochemistry. NewYork: Worth Publishers.
2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2011). Molecular biology of the cell. (5th ed.). UK: Garland Science.
3. Stryer, L. (2012). Biochemistry. New York: W H Freeman and Company.
4. Fennema, O.R. (Ed). (2010). Food chemistry (3rd ed.). New York: Marcel Dekker, Inc.
5. DeKrishna, A. (2012). Biochemistry. New Delhi, India: S.Chand & Co. Ltd.
6. Nelson, D.L., & Cox, M.M. (2011). Lehninger Principles of biochemistry (5th ed.). New York: W.H. Freeman & Co.
7. Rao, B.S. (2012). Experimental biochemistry. New Delhi, India: IKI International Pvt. Ltd.
8. Jain, J.L. (2010). Fundamentals of biochemistry. New Delhi, India: S.Chand & Co. Ltd.
9. Boyer, R.D. (2012). Modern experimental biochemistry (3rd ed.). New Delhi, India: Pearson Education Pvt. Ltd.

B.Sc (Honours) PART I
(MICROBIAL AND FOOD TECHNOLOGY)
FIRST YEAR EXAMINATION
(FIRST SEMESTER)
BMF-1003 – FUNDAMENTALS OF MICROBIAL BIOTECHNOLOGY (THEORY)

(CREDITS- 3)

MAX. MARKS:75
THEORY: 60
INTERNAL ASSESSMENT: **15**

INSTRUCTIONS FOR

PRACTICALS: FUNDAMENTALS OF MICROBIAL BIOTECHNOLOGY

(CREDITS-01)

MAX. MARKS: 25
PRACTICAL: 22
INTERNAL ASSESSMENT: 03
TIME: 2 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. Principle, procedure and use of simple staining, negative staining and gram staining method.
5. Fungal and Yeast staining
6. Growth curve of microorganisms.
7. To study solid state and submerged fermentation techniques.
8. To study probiotic bacteria.
9. Isolation of phosphate solubilizing microbes from soil.
10. Analysis of industrial effluent quality.

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SUGGESTED READINGS (latest editions)

MULTI-DISCIPLINARY COURE (MDC-1)

[SEMESTER-I]

SPECIAL FOODS AND MEAL MANAGEMENT

(CREDITS- 3)

MAX. MARKS: 75
THEORY: 60
INTERNAL ASSESSMENT:15

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.

COURSE OBJECTIVES AND LEARNING OUTCOMES: To understand the scope of specialty foods. To classify specialty foods on basis of sources. To familiarize with the concept of therapeutic foods. To gain insights into consumer requirements in area of specialty foods.

UNIT I **No. of Hours: 07**

Need and Scope of Specialty Foods: Need and scope of specialty foods, Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low-cost foods.

Specialty Foods Based on Sources: Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By-product based, Bioactive components, Novel nutraceuticals products, Fast foods. organic, inorganic farming, genetically modified foods.

UNIT II **No. of Hours: 08**

UNIT III **No. of Hours: 08**

Therapeutic Foods: Modification of diets in disorders of digestive tract, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders.

Specific Consumer Oriented Foods: Defence persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, maintenance

UNIT IV **No. of Hours: 07**

Nutrition Management Techniques: Infant nutrition and infant foods, geriatric nutrition, maternal nutrition, Sports Nutrition.

Advances in Nutrition: Effect of processing, preservation, and storage on nutritional quality of foods, food fortification, food enrichment, complementation and supplementation diets, nutritional labelling.

SUGGESTED READINGS (latest editions)

1. Gibson GR & William CM. 2000. Functional Foods - Concept to Product.
2. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
3. Manson P.2001. Dietary Supplements. 2nd Ed. Pharmaceutical Press.
4. Bamji MS, Rao NP & Reddy V. 2003. Textbook of Human Nutrition. Oxford & IBH.
5. B Srilakshmi. 2014. Dietetics 8th ed. New Age Publication.

SKILL ENHANCEMENT COURSE (SEC-1)
SEMESTER I

ENTREPRENEURSHIP IN MILLET PROCESSING (PRACTICAL)

[CREDITS-03]

MAX. MARKS: 75
PRACTICAL: 60
INTERNAL ASSESSMENT: 15
TIME : 3 Hours

COURSE OBJECTIVES AND LEARNING OUTCOMES:

The purpose of this course is to provide comprehensive information about millets, which are ancient and forgotten golden grains, and the commercial potential associated with this emerging topic. In this course, one will also be able to learn about nutritious and delicious dishes of millet in detail to incorporate into our regular diet and about the environmental benefits of millets. This course serves as the complete guide for understanding millets, from their fundamentals right up to launching a business in the millet industry.

UNIT I

Introduction to Millets: Types & Nutritional Benefits

Definition of millets.
Types & Varieties
Positive & Neutral Millets
Why include millet in our diet?
Identifying polished & unpolished millets?
How to store millets?
Health benefits of Indian millets
Environmental benefits of millets

UNIT II

Traditional Foods Based on Major Millets:

Sorghum

Pearl Millet

Value addition from by-products:

Sorghum bran peda (sweet),

Sorghum based energy bars.

Sorghum bran fryums.

UNIT III

Traditional Foods Based on Minor Millets:

Finger Millet

Proso Millet

Kodo Millet

Barnyard Millet

Foxtail Millet

UNIT IV

Business opportunities in various segments:

Market analysis, demand for millet-based products

Millets in food industries, farmer producer company

Millet Primary Processing Unit

Millets Value Addition

Packaging and Labelling requirements for millets based products.

B.Sc (Honours) PART I
(MICROBIAL AND FOOD TECHNOLOGY)
FIRST YEAR EXAMINATION
SECOND SEMESTER
BMF-2001 – MICROBIAL DIVERSITY & METABOLISM (THEORY)

(CREDITS- 3)

MAX. MARKS:75
THEORY:60
INTERNAL ASSESSMENT:15

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.

UNIT II **No. of**

B.Sc (Honours) PART I

UNIT III — No. of Hours : 12

Preservation by Concentration: Methods of concentration, factors affecting evaporation; Types of Evaporators: Batch/Pan evaporator, rising film evaporator, falling film evaporator, natural circulation and forced circulation evaporator, scraped surface evaporator
Preservation by Radiations: Types of Radiations used for foods, units of radiation, concept of cold sterilization, Dose determining Factors. Applications of Food Irradiation, Microwave heating.

UNIT IV — No. of Hours : 11

Preservation by Chemicals: Class I & Class II preservatives, Factors affecting Chemical preservation, Types of common preservatives
Recent Trends in Food Processing: Extrusion cooking, Hurdle Technology, Electro dialysis, Roasting and Smoking of foods, High Pressure Processing. Pulse electric field preservation, Ohmic Heating.

PRACTICALS: FOOD PRESERVATION

[CREDITS-01]

MAX. MARKS: 25
PRACTICAL: 22
INTERNAL ASSESSMENT: **03**
TIME: 2 hours

1. To blanch a seasonal fruit or vegetable & assess quality of blanching process.
2. To study the effect of various anti-browning agents on raw fruits & vegetables.
3. Preparation of drying curve.
4. Effect of thermal processing on microbial activity of various food samples.
5. To study the effectiveness of pasteurization by phosphatase test.
6. To study pasteurization of milk using microwave technique.
7. Rehydration tests for the dried samples.
8. Concept of shelf life of different foods preserved by low temperature techniques.
9. To study the effect of addition of different chemical preservatives on food quality.
10. To study preservation of milk by sterilization.

SUGGESTED READINGS (latest editions)

1. Jood, Sudesh (2009). Food preservation. Udaipur: Agrotech Publisher Academy.
2. Potter, N.N. (2007). Food science. New Delhi: CBS Publishers.
3. Mohini (2001). Food science. New Delhi: CBS Publishers.
4. Srilakshmi, B. (2012). Food science. New Delhi: New Age International Pvt. Ltd.
5. Manay, N.S. (2005). Foods: Facts & principles. New Delhi: Wiley Eastern Ltd.
6. Ranganna, S. (2008). Handbook of Analysis and quality control for fruit and vegetable products. Tata McGraw Hills.
8. Smith J.S., & Hui Y.H. (2009). Food processing: Principles & applications. Wiley – Blackwell.
10. NIIR Board (2010). Modern technology on food preservation.
11. Khetarpaul, N.& Daya, (2011). Food processing & preservation. Woodhead Publishing Ltd.

9. Vikas Nanda: Meat, Egg and Poultry Science & Technology. Wiley Press.
10. Chadha, R. and Mathur, P. eds. (2015). Nutrition: A Lifecycle Approach. Hyderabad: Orient BlackSwan,
11. Byrd-Bredbenner, C., Moe, G., Beshgetoor, D. & Berning, J. (2013). Wardlaw's Perspectives in Nutrition, International Edition, 9th edition, New York: McGraw- Hill,
12. Seth, V., Singh, K. & Mathur, P. (2018). Diet Planning Through the Lifecycle Part I: Normal Nutrition- A Practical Manual. 6th Edition. Delhi: Elite Publishing House.

MULTI-DISCIPLINARY COURE (MDC-2)

[SEMESTER-II]

Functional Foods for Sustainable Health

(CREDITS- 3)

MAX. MARKS:75
THEORY: 60
INTERNAL ASSESSMENT: **15**

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

UNIT III **No. of Hours : 07**

Functional foods and their types: Conventional functional foods (e.g Millets); Modified functional foods (Fortification, Enrichment and supplementation); Foods for special dietary use (Weight loss foods, Gluten free foods, Lactose free foods)

UNIT IV **No. of Hours : 08**

Bioactive Components in Foods and Health effects: Introduction to bioactive compounds: description, health effects, and food examples; Polyphenols, flavonoids, carotenoids; Anti-nutritional Factors, Phytates; Vitamins, Minerals; Special reference to Resveratrol, Quercetin, Cinnamaldehyde, Capsaicin, Piperine, Gingerol, Eugenol, Diosgenin

SUGGESTED READINGS (latest editions):

1. Wildman, R. E. (2016). Handbook of Nutraceuticals and Functional Foods. CRC Press
2. Gibson, G. R. and Williams, M. C. (2001). Functional Foods Concept to Product. CRC Press.
3. Vattem, D.A. and Maitin V.(2016). Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications. DEStech Publications, Inc
4. Gupta, R. C. (2016). Nutraceuticals: Efficacy, Safety and Toxicity. Academic Press.
5. Robert E.C. Wildman; Handbook of Nutraceuticals and Functional Foods, Second Edition; CRC Press
6. Giuseppe Mazza; Functional Foods: Biochemical and Processing Aspects, Volume 1; CRC Press

SKILL ENHANCEMENT COURSE (SEC-2)
SEMESTER II

ENTREPRENEURIAL SKILLS IN MICROBIOLOGY (PRACTICAL)

[CREDITS-03]

MAX. MARKS: 75
PRACTICAL: 60
INTERNAL ASSESSMENT:15
TIME : 3 Hours

COURSE OBJECTIVES AND LEARNING OUTCOMES: The course is designed to inculcate and strengthen the entrepreneurial skills of students in the field of microbiology. The course lays emphasis on hands on training to be imparted to students to strengthen the various microbiology-based skills that can be taken up as future entrepreneurial career options.

UNIT I

Microbial testing of soil, air and water
Microbiological testing of food products
Testing of food adulteration and microbial toxins

UNIT II

Isolation and quantification of antibiotic producing microbes from soil
Isolation and identification of pathogenic bacteria from spoiled food and contaminated water samples.
Production of novel fermented food products.

UNIT III

Project Formulation, Identification and selection criterion
Technological assessment, Project cost and feasibility assesment
Process of Spawn production and mushroom cultivation
Process of bioethanol production from waste substrates
Process of biofertilizer production and use

UNIT IV

Technical feasibility report writing with commercial viability
Sources of funding and market analysis
Study of Biogas plant setup and biofuel production
Process of composting and manure production
Process of production of organic disinfectants from plants.