Bachelor of Vocation (B.Voc.)

Bachelor of Vocation (B.Voc.)[Food Processing (Agri)]

Bachelor of Vocation (B.Voc.)[Food Processing and Quality Management]

Bachelor of Vocation (B.Voc.)[Food Processing Technology]

Bachelor of Vocation (B.Voc.)[Herbal Processing Technology]

Bachelor of Vocation (B.Voc.)[MLT/ML&DT]

Bachelor of Vocation (B.Voc.)[Physical Education]

Bachelor of Vocation (B.Voc.)[Acting]

Bachelor of Vocation (B.Voc.)[Food Processing (Agri)]

Syllabus

For

Bachelor of Vocation

2023

Approved by
Gauhati University,
Guwahati, Assam

CCS-Department of Biotechnology, Gauhati University

NEP-2020
CCS-Dept. of Biotechnology, Gauhati University

Detailed Syllabus

Programme: Bachelor of Vocation (B.Voc.)

Trade Name: Food Processing (Agri)

Programme Outcome:

1. To provide a judicious mix of skills relating to the profession and appropriate content of general education
2. To ensure that the students have adequate knowledge and skills so that they are ready to work at each exit point of the program
3. To provide flexibility to the students using predefined entry and multiple exit points
4. To integrate NSQF to enhance the employability of the graduates and meet industry requirements

Eligibility: 10+2 in Arts/science/commerce or 10+2 in vocational subjects related to the trade.

List of core courses

Sl. No	Semester	Course Name
01	I	Food plant sanitation and hygiene management
02		Food Processing –I
03		Bioresources in Food Processing
04	II	Food Quality and Regulation-I
05		Food Processing-II
06		Food plant layout and utilities
07	III	Food Quality and Regulation-II
08		Food Chemistry-I
09		Food Microbiology-I
10	IV	Food Quality and Regulation-III
11		Food Chemistry-II
12		Food Microbiology-II
13		Food Analysis: Tools and techniques
14	V	Food Preservation Technology
15		Fermentation Technology
16		Technology for plant products
17		Food production and operation management
18	VI	Bakery and confectionary technology
19		The technology for animal products
20		Food packaging Technology
21		Internship

Semester I

Qualification Pack: Hygiene Coordinator - Supervisor FIC/Q7606 (NSQF level 4)

Course name: **Food Plant Sanitation and Hygiene Management**

Course level: **100-199**

Semester: **First**

Course objective

- To impart theoretical and practical knowledge of various activities for cleaning and sanitation in food plants
- To enable the student to supervise hygiene practices in food plants
- To enable the application of necessary health and safety practices to ensure workplace health and safety
- To impart the necessary background to work effectively with others
- To train students to use resources at the workplace optimally

Unit 1: Food Safety and Hazards **8 Hours**

Concept of Food Safety, Importance of Guidelines on Prevention of Food Safety Hazards. Concept of food hazards, prevention of food hazards. Importance of identifying and preventing food safety hazards, Food Safety Hazards and Quality Defects: Physical Hazards, Chemical Hazards, Biological Hazards, Allergens

Unit 2: Sanitation and Health **6 Hours**

Definition and importance of sanitation, Application of sanitation in the food industry and food service establishment, Microorganisms and their relationship to sanitation

Unit 3: Hygiene and Sanitation in Food Plant and Food Service Establishments **8 Hours**

Sanitation in Food Plant and Food business operator Establishments: Cleaning Agents, Disinfectants or Sanitizers, Waste Disposal, Pest and

Rodent Control, General Principles of Food Hygiene, Hygiene Requirements for Licensing and Sale, Health Status of Food Handlers, Personal Hygiene, Facilities to Employees

Unit 4: Sanitary aspects of water supply **6 Hours**

Physicochemical properties of water, Source of water, Quality of water, Water supply and its uses in food industries, Purification and disinfection of water

Unit 5: Food Handling **6 Hours**

Receiving and Inspecting Food Deliveries, Storage Space, Dry Storage, Low-Temperature Storage, Store Room Management

Unit 6: Food Plant Waste Management System **6 Hours**

Energy Efficiency and Conservation, Water Conservation, Byproduct Utilization, Treatment of Solid Wastes, Treatment of Liquid Wastes

Practicals

1. Data Collection and Hazard Identification (Physical, Chemical and Biological)
2. Hygienic Requirements for Manufacturing Premises
3. Practice of sanitation inthe workplace
4. GAP analysis
5. Preparation of different checklist
6. Study on different methods of energy conservation
7. Study on CIP and COP
8. Methods of inspection of food at different points in a manufacturing unit
9. Study on utilization of byproducts
10. Study on different methods of waste treatment

Suggested Readings

1. Food Safety and standards Act 2006, Rules 2011, Regulations, 2011, 10th Edition, ILBCO India, Indian Law Book Company, 2013.
2. Principles of Food Sanitation. N. G. Marriott, Springer, 5th Edition, 2006.
3. Hobbs Food Poisoning and Food Hygiene. Jim Mclauchlin and Christine

Little (Eds), 7th Edition, 2007.

4. Food Plant Sanitation: design maintenance, and good manufacturing practices, by Michael M. Cramer,CRC Press
5. Mukundan, M.K. and Balasubramaniam, S. 2007. Seafood Quality Assurance.CIFT Training Manual 1
6. Gopakumar, K. 2002. Textbook on Fish Processing Technology, Indian Councilof Agricultural Research (ICAR), New Delhi
7. http://egyankosh.ac.in//handle/123456789/10012

Graduate attribute

Course Outcome

- Enable the student to be a 'Hygiene Coordinator'
- Increased employability
- Ability to monitor and supervise the cleaning and sanitation tasks.
- Understanding of basic food safety standards.
- Managerial skills to deal with accidents and emergencies.
- Effective work in an organization.
- Thorough understanding of waste management/recycling

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Processing-I**
Course level: **100-199**

Semester: **First**

Course objective

- To enable the need for food processing, understand the challenges faced by the food processing units and know about the various sectors and sub-sectors of food processing.
- To outline the career opportunities in food processing
- To impart the idea of the unit operation in food processing
- To teach the basic industrial mathematics required in a food processing industry
- To understand the basic concept of different types of machinery required in the food industry and the basic line of different food industries
- To acquaint myself with the basics of food quality parameters and understand the concept of HACCP
- To impart the idea of entrepreneurship and motivate self-employability

Unit 1. Basics of Industrial Food Processing **6 Hours**

Food spoilage and causes, food processing, aims of food processing, historical developments in food processing, advantages and disadvantages of food processing, traditional and modern methods of food processing ,various sectors and sub sectors of the food processing industry,the basic problems faced by the food processing industry, relationship with other disciplines, career opportunities, significance of food processing and technology, unit operations and techniques used in unit operations

Unit 2. Basic industrial mathematics **5 Hours**

Ingredient formulation,Chemical concentration, Normality, Molarity, pH calculations, serial dilution, ppm, ppb calculation.

Unit 3. Basics of food safety and quality control **8 Hours**

Definition of food quality, quality attributes of food, subjective and objective

indices for quality, factors affecting quality in the food chain, effects of intrinsic and extrinsic properties on quality, HACCP

Unit 4. Designing of a Food Industry 8 Hours

Introduction to food plant layout and design, location and site selection for food plant, basic production lines of different food industries, bakery industry, dairy industry, fruits and vegetable processing, meat processing

Unit 5. Introduction to Food Processing Machineries 7 Hours

Basics concepts of food processing machinery, mills, ovens, boilers, freezers, mixers and kneaders, size reduction machinery, pasteurizer, packaging equipment

Unit 6 .Concept of Entrepreneurship 6 Hours

Entrepreneurship, nature and characteristics of entrepreneurship, need for entrepreneurship, becoming an entrepreneur, benefits of self-employment

Practicals

1. Basic Laboratory rules
2. Identification of laboratory glasswares and accessories
3. Identification of different instruments and machineries with their working principles
4. Instrument handling procedures.
5. Construction, operation and utility of food processing laboratory equipment.
6. Preparation of standard solutions- normality, molarity, ppm, ppb and percent calculation
7. Identification of entrepreneurial skills
8. Visit to a food service establishment to study its planning and functioning

Suggested Readings

1. Srilakshmi,B, Food Science (3rd edition), New age International (p) limited Publisher, New Delhi, 2003

2. Fellows, Food process technology: Principles and Technology, CRC publications.

3. Pierson, M. D. (2012). HACCP: principles and applications. Springer Science & Business Media.

Graduate attribute

Course Outcome

- Understanding the need for food processing
- Learning about the basic industrial mathematics
- Awareness about food safety and quality control
- Ability to design the basic concept of a processing plant
- Developing technical skills by thorough learning about the different types of machinery used in a food industry
- Motivating to become an entrepreneur

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Course name: **Bio-resources in Food Processing**

Course level: **100-199**

Semester: **First**

Course objective

- To impart the concept of raw materials in a Food Plant, Raw materials may be primary and processed.
- To impart theoretic and practical knowledge of various bioresources which are used as bulk raw materials in food processing plants. These raw materials may be of plant or animal origin.
- To introduce the concept of nutraceuticals and functional foods.
- To ready the student to understand the role of micro-organisms in Food Processing.

Unit 1: Introduction to Bioresources 6 Hours

Bioresources, types of bioresources, bioresources in food processing, the concept of raw materials and ingredients, underutilized bioresources

Unit 2: Plant-Based Bioresources in Food Processing 8 Hours

The concept of primary processing, different plant-based bio resources- raw fruits and vegetables, cereals, grains, pulses, oil seeds, tea, coffee, spices and their quality standards, selection of plant-based raw materials for the preparation of various products and their properties, the concept of nutraceuticals and functional foods.

Unit 3: Animal-Based Bioresources in Food Processing 12 Hours

Different types-meat, fish, poultry, egg, milk and their quality standards, selection of animal-based raw materials for the preparation of various products and their properties

Unit 4: Micro-organisms as Bioresources in Food Processing 6 Hours

Concept of probiotic and prebiotic, Industrially important micro-organisms, beneficial role of micro-organisms

Unit 5: Raw Materials for Food Processing 8 Hours

Raw materials quality inspection in the food industry, quality requirements

of raw materials, the concept of sampling, concept of FIFO and FEFO, management of raw materials in the food industry

Practicals

1. Identification of different plant-based bioresources and their application in Food Processing
2. Identification of different animal-based bioresources and their application in Food Processing
3. Identification of selection criteria of raw materials for food production
4. Study on health benefits imparted by traditional foods
5. Food Sampling
6. Identification of underutilized bioresources

Suggested Readings

1. Potter, N.N. and Hotchkiss, J.H. 2007. Food science. The AVI Pub. Co. Inc., Westport, Connecticut, USA.

2. Bawa. A.S, O.P Chauhan etal. Food Science. New India Publishing agency, 2013

Graduate attribute

Course Outcome

- Understanding of the selection criteria for raw materials to be used in Food Processing
- Awareness of the health benefits of different traditional foods.
- The ability of sampling and management of raw materials at different points in a Food Processing Unit
- Awareness of value-addition in foods and the importance of underutilized bio-resources for its utilization in the near future for product formulation.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Semester II

Qualification Pack: Supervisor-Food Processing Industries FIC/Q9009 (NSQF level 5)

Course name: **Food Quality and Regulation – I**

Course level: **100-199**

Semester: **Second**

Course objective

- To provide students with a comprehensive understanding of the principles and regulations governing food safety and quality maintenance.
- To familiarize students with the different international and national food regulatory agencies and their roles in ensuring food safety and quality.
- To explore the various aspects of food regulations, including labelling, packaging, hygiene practices, and quality control measures.
- To examine the potential hazards in the food supply chain and develop strategies for risk assessment and mitigation.
- To enhance students' knowledge of foodborne illnesses and their prevention, including the identification and control of microbiological, chemical, and physical hazards.
- To develop students' skills in analyzing and interpreting food quality data and applying appropriate quality control measures.
- To foster critical thinking and problem-solving abilities in addressing complex food regulatory challenges and issues.
- To promote ethical considerations and professional responsibility in complying with food regulations and maintaining food quality.
- To encourage students to stay updated with the latest advancements in food regulations and quality maintenance practices.
- To prepare students for careers in the food industry, regulatory agencies, quality assurance departments, and related fields by equipping them with the necessary knowledge and skills.

Unit 1: Basics of Food Quality **8 Hours**

Definition, quality concepts, quality attributes (safety, sensory, shelf life,

convenience, extrinsic attributes), factors affecting food quality; Definition and introduction to general terms-quality, quality control, quality assurance, total quality management in the food industry;Food standards and specifications- compulsory and voluntary standards; Objectives, functions and principles of quality control; Difference between food quality controland quality assurance, assessment of raw materials and finished products

Unit 2: Basics of Food Safety **8 Hours**

Food Safety, Hazards and Risks Meaning, definition, Types of hazards – Biological hazards, physical hazards, chemical hazards, nutrition – related diseases. Risk assessment and management; Natural toxicants in foods, pesticide residues in foods, investigation of food borne disease outbreaks

Unit 3: Pre-requisite Program **8 Hours**

Pre-requisite programs – Good Manufacturing Practices, Personal hygiene, Occupational health and safety specification, differences between PRP and OPRP, Traceability and accountability, recalling procedures, training

Unit 4: HACCP and its Principles **8 Hours**

Introduction to HACCP and its latest developments, Principles-Conducting a hazard analysis, CCP identification, establishing critical limits for each CCP, establishing CCP monitoring procedures, establishing corrective actions procedures, and establishing procedures for HACCP verification and validation, documenting the HACCP Program, Implementation of HACCP.

Unit 5: General Principles for food safety regulation atRegional/National Level **8 Hours**

Structure of Food law, Food regulation, Laws and regulations to prevent adulteration and cross contamination; hygienic practices; Overview of relevant National Bodies-APEDA, BIS, MPEDA, Spice Board, Tea Board, Coffee Board

Practicals:

1. Personal hygiene practices followed in food industries
2. Implementation of HACCP for
    a. Bakery Industry
    b. Fruits and vegetables-based industry
    c. Dairy industry
    d. Meat, fish, and poultry industry
3. Study on identification of natural toxicants in foods
4. Study on pesticide residues in foods
5. Study on assessment procedures for raw materials and finished products in the industry

Suggested Readings

1. Roessler, E. B., Amerine, M. A., Pangborn, R. M. (2013). Principles of Sensory Evaluation of Food. United States: Elsevier Science.
2. Early, R. (2012). Guide to Quality Management Systems for the Food Industry. United Kingdom: Springer US.
3. Furia, T. E. (2017). Regulatory Status of Direct Food Additives. United Kingdom: CRC Press.
4. Jellinek, G. (1985). Sensory Evaluation of Food: Theory and Practice. Germany: E. Horwood.
5. Lawless, H. T., Heymann, H. (2016). Sensory Evaluation of Food: Principles and Practices. United States: Springer New York.
6. Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.
7. Herschdoerfer, S. (2012). Quality Control in the Food Industry V2. United States: Elsevier Science.
8. Encyclopedia of Food Sciences and Nutrition. (2003). Netherlands : Academic Press.
9. Ranganna, S. (2005). Hand Book of Analysis And Quality Control For Fruit And Vegetable Products. India: Tata McGraw-Hill Publishing Company Limited.

10. Export/Import policy by Govt. of India
11. Alli, I. (2004). Food Quality Assurance: Principles and Practices. United Kingdom: Taylor & Francis.

Graduate attribute

Course Outcomes:

- By the end of this course, students should be able to:
- Explain the importance of food safety and quality maintenance in the food industry and society.
- Identify and analyze the roles and responsibilities of various food regulatory agencies at the national and international levels.
- Comprehend and apply the relevant laws, regulations, and standards governing food safety and quality maintenance.
- Evaluate and implement appropriate labelling, packaging, and hygiene practices to ensure compliance with food regulations.
- Conduct risk assessments and develop risk mitigation strategies to prevent and manage potential hazards in the food supply chain.
- Demonstrate an understanding of foodborne illnesses, their causes, and prevention methods, including the identification and control of microbiological, chemical, and physical hazards.
- Interpret food quality data, conduct quality control tests, and implement quality assurance measures to maintain food quality standards.
- Analyze and propose solutions to complex food regulatory challenges and issues, considering ethical considerations and professional responsibility.
- Stay updated with the latest advancements in food regulations, industry best practices, and emerging technologies for quality maintenance.
- Apply the acquired knowledge and skills to pursue careers in the food industry, regulatory agencies, quality assurance departments, or related fields

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Processing –II**

Course level: **100-199**

Semester: **Second**

Course Objectives:

- To provide students with a comprehensive understanding of the principles and concepts of food processing.
- To introduce students to the various unit operations involved in food processing, such as cleaning, sorting, grading, preservation, and packaging.
- To familiarize students with the different techniques and technologies used in food processing, including thermal processing, freezing, drying, fermentation etc
- To develop students' knowledge and skills in selecting appropriate processing methods based on the characteristics of different food commodities.
- To explore the factors that influence food quality during processing, such as ingredient selection, process control, and packaging.
- To examine the impact of food processing on nutritional value, sensory attributes, and shelf life of processed foods.
- To foster an understanding of food safety considerations in processing, including sanitation practices, microbial control, and regulatory requirements.
- To promote critical thinking and problem-solving abilities in addressing challenges related to food processing, such as process optimization, waste reduction, and sustainability.
- To enhance students' awareness of emerging trends and advancements in food processing technologies.
- To prepare students for careers in the food industry, research and development, quality assurance, and related fields by equipping them with the necessary knowledge and skills.

Unit 1: Unit operation in Food processing **8 Hours**

Introduction to unit operation, techniques used in unit operation-separation, size reduction, mixing and kneading, milling, drying and dehydration,frying, baking, roasting, smoking, freezing and refrigeration

Unit 2: Pre and primary processing –some basic concepts **8 Hours**

Introduction, production, harvesting and handling of fresh foods; production of raw materials for processing; primary processing-cereals, pulses,oilseeds, minimally processed fresh foods

Unit 3: Low temperature processing **12 Hours**

Refrigeration –requirements, storage changes in foods during refrigeration storage, refrigeration load; freezing and frozen storage-freezing curve and methods, changes in foods during freezing, factors determining the freezing rate, dehydro freezing, IQF and frozen fruits and vegetables

Unit 3: Heat processing **12 Hours**

Heat processing –blanching, pasteurization, sterilization, canning, dielectric heating, baking, roasting, frying, thermal processing-thermal death curve, determination of processing time and temperature; effect of heat on microorganisms and enzymes, the effect of heat on nutritional and sensory characteristics of foods

Unit 4: Food Concentration **4 Hours**

Food concentration methods, changes in food during concentration, ultrafiltration and reverse osmosis

Unit 5: Food product development **8 Hours**

Definition and classification, characterization and factors in shaping new product development, the role of ingredients and processing in defining attributes, shelf-life requirements and factors affecting shelf life and product attributes,the process of flow sheet development, concept testing

Practicals:

1. To study the different machineries involved in the unit operation and their working principles
2. study the process of freezing in food samples and prepare the freezing curve
3. Study on various primary processing techniques involved in cereals, pulses and oilseeds
4. Study on different types of freezers used in the food industry
5. Preservation of foods by various food concentration methods
6. To study the various steps involved in food product development and develop a new food product and conduct a shelf-life study of the new product

Suggested Readings

1. Fellows, P.J. (2016). "Food Processing Technology: Principles and Practice" (4th ed.). Woodhead Publishing.
2. Singh, R.P., & Heldman, D.R. (2017). "Introduction to Food Engineering" (5th ed.). Academic Press.
3. Brennan, J.G. (Ed.). (2018). "Food Processing Handbook" (2nd ed.). Wiley-Blackwell.
4. Clark, S., Jung, S., & Lamsal, B. (2019). "Food Processing: Principles and Applications" (2nd ed.). Wiley.
5. Campbell-Platt, G. (Ed.). (2016). "Food Processing Technology: Principles and Practice" (3rd ed.). Wiley-Blackwell.
6. Saravacos, G.D., &Kostaropoulos, A.E. (Eds.). (2015). "Handbook of Food Processing Equipment" (2nd ed.). Springer.

Graduate attribute

Course Outcomes:

- Understand the fundamental principles and concepts of food processing and its significance in the food industry.
- Identify and describe the various unit operations involved in food

processing and their respective roles in transforming raw materials into processed food products.

- Evaluate and select appropriate processing techniques and technologies for different food commodities based on their characteristics and desired outcomes.
- Demonstrate an understanding of the factors influencing food quality during processing and apply appropriate process control measures to maintain quality standards.
- Assess the impact of food processing on the nutritional composition, sensory attributes, and shelf life of processed foods.
- Apply food safety practices and regulatory requirements to ensure the microbiological safety and quality of processed food products.
- Analyze and propose solutions to optimize food processing operations, reduce waste, and improve sustainability in the food industry.
- Stay updated with the latest advancements and emerging trends in food processing technologies.
- Utilize acquired knowledge and skills to contribute effectively to food industry sectors such as research and development, production, and quality assurance.
- Apply critical thinking and problem-solving skills to address challenges and make informed decisions related to food processing.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Course name: **Food Plant Layout and Utilities**

Course Level: **100-199**

Semester: **Second**

Course objective

- To impart the concept of plant layout
- To impart theoretical and practical knowledge of various types of plant layout
- To understand the selection criteria of the location of plant layout.
- To understand the different symbols and flow diagrams in plant layout
- To impart knowledge on food plant sanitation
- To understand different food plant utilities

Unit 1: Plant layout **8 Hours**

Plant layout –Definition, and principles, factors in planning layouts; Methods of layout planning –Unit areas concept, two –dimensional layouts, Principles of plant layout

Unit 2: Types of plant layout **8 Hours**

Types of plant layout –salient features of horticultural, rice, maize, pulses, oil seeds, poultry, fish, meat, milk and milk product plants; experimentation in the pilot layout: size and structure of the pilot plant, minimum and maximum size, types and applications

Unit 3: Location selection criteria **8 Hours**

Location selection criteria –Plant location, factors in selecting a plant, selection of the plant site, preparation of the layout; Selection of processes – Comparison of different processes, batch versus continuous operation. Plant capacity –Equipment design and specifications, scale–up in design, safety factors, specifications, and materials of construction

Unit 4: Flow Diagrams and Symbols **8 Hours**

Flow diagrams-qualitative and quantitative flow diagrams; design; Symbols used for food plant design and layout: introduction, valves, line symbols, fluid handling, heat transfer, mass transfer; symbols used for food plant design and layout: storage vessels, conveyors and feeders, separators, mixing and communication and process control and instrumentation symbols.;

Unit 5: Food plant Sanitation **3 Hours**

Food plant sanitation-Environmental protection, regulations, CIP, COP

Unit 6: Food Plant Utilities **8 Hours**

Food plant utilities: process water, steam, electricity, plant effluents;Selection of equipment material and energy balance, equipment design and selection, Process and controls-Control systems, instrumentation control, maintenance

Practicals:

1. Study of plant layout
2. Preparation of different food plant layout
3. Study of different symbols and flow diagrams used in plant layout
4. Study of food plant utilities
   a. process water
   b. steam,
   c. electricity,
   d. plant effluents

Suggested Readings

1. Moerman, F. (2010). "Food Plant Engineering Systems" (2nd ed.). CRC Press.
2. Lopez-Gomez, A., & Barbosa-Cánovas, G.V. (2016). "Food Plant Design" (1st ed.). CRC Press.
3. Baker, C.G.J., & Stier, R.J. (Eds.). (2018). "Handbook of Food Factory

Design" (1st ed.). Wiley.
4. Cramer, M.M., & Nelson, P.E. (2012). "Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices" (2nd ed.). CRC Press.
5. Berk, Z. (2013). "Food Process Engineering and Technology" (2nd ed.). Academic Press.
6. Maroulis, Z.B., &Saravacos, G.D. (2013). "Food Plant Economics" (1st ed.). CRC Press.

Graduate attribute

Course Outcome

- Understanding of the plant layout and its different types
- Awareness of the selection criteria of plant location
- Awareness of using different symbols and flow diagrams used in plant layout
- Understanding of food plant sanitation and different food plant utilities

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester III

Qualification Pack: Food Microbiologist FIC/Q7603 (NSQF level 6)

Course name: **Food Quality and Regulation – II**

Course Level: **200-299**

Semester: **Third**

Course Objectives:

- To provide students with a comprehensive understanding of the principles, practices, and regulations governing the quality and safety of food
- To equip students with the knowledge and skills necessary to assess, monitor, and maintain food quality standards throughout the food supply chain
- To impart the roles and responsibilities of FSSAI and other national standards, also introduce various initiatives taken by FSSAI
- To understand students about the general principles for food safety regulations at both the national and international level

Unit 1: Basic Concept of Food Laws and Regulations **12 Hours**

Food laws and regulations, concepts of codex Alimentarius, ISO series, GMP, GHP, 5S,4M, AIB, six sigma, PCI, SOP, Checklist, audit system, documentation; FSSAI, the role of various food standards in India- PFA, FPO, AGMARK and BIS.Recent development in food quality regulation, MOFPI and schemes for Establishing food industries in India

Unit 2: FSSAI **12 Hours**

FSSAI:-Introduction to the law, Salient features of Food Safety& Standards Act, 2006, Structure of FSSAI, Administrative set up at the State level and central level, Licensing and registration, Licenses granted by Central Licensing Authority, Documents/ Format required for Registration/ Licensing, Food Laboratories:Accreditation of Food Laboratory, Referral Laboratories, Hierarchy of Food Safety Authorities; Food Labelling;

Promoting safe and wholesome food (Eat Right India, Food Fortification, Clean street food Hub, RUCO, BHOG and various other social and behavioural change initiatives taken by FSSAI)

Unit 3: General Principles for food safety regulation at the internationallevel **12 Hours**

FAO, World Health Organization (WHO), Joint FAO/WHO Food Standards Program -JECFA, JEMRA, JMPR;Codex Alimentarius Commission- Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India, World Trade Organization (WTO), Principles of the trading system. SPS and TBT, differences between SPS & TBT; WTO agreement on the application of SPS

Unit 4: Standard Operating Procedures **12 Hours**

Defining Standard operating procedure: purpose, Format, developing and implementing; effective writing; SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, personal hygiene, facility and equipment. Systems in laboratory accreditation, GRN making, Invoice making and maintenance

Practicals:

1. Identification of Food Logos
2. Study on food Labelling
3. Preparation of SOP for
    i. Receiving raw materials
    ii. Finished products
4. Preparation of GRN, Invoice
5. Preparation of checklist
6. Study on 5S Practices in the food industry
7. Visit a food industry and prepare a report on various quality laws and regulations followed

Suggested Readings

1. Amerine, M.A., Pangborn, R.M., &Rosslos, E.B. (2015). "Principles of Sensory Evaluation of Food." Academic Press.

2. Early, R. (2001). "Guide to Quality Management Systems for Food Industries." Blackie Academic.

3. Jellinek, G. (2019). "Sensory Evaluation of Food - Theory and Practice." Elsevier.

4. Macrae, R., Roloson, R., & Sadler, M.J. (2014). "Encyclopedia of Food Science & Technology & Nutrition." Academic Press.

5. Ranganna, S. (2015). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products." Tata McGraw-Hill.

6. InteazAlli (2018). "Food Quality Assurance: Principles and Practices." CRC Press.

7. Vasconcellos, J.A. (2003). "Quality Assurance for the Food Industry: A Practical Approach." CRC Press.

Graduate attribute

Course Outcome

- Understand the fundamental concepts and principles of food quality and safety.
- Identify and evaluate the factors that affect food quality, including raw materials, processing, storage, and distribution.
- Comprehend the regulatory frameworks and guidelines related to food quality and safety at national and international levels.
- Assess and implement quality control and quality assurance programs in food production, processing, and handling.
- Evaluate the impact of food quality and safety on public health, consumer perception, and the economy.
- Develop effective communication and problem-solving skills to address food quality and safety issues.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Chemistry-I**

Course Level: **200-299**

Semester: **Third**

Course objective

- To demonstrate a sound knowledge of the chemical properties of food components (water, carbohydrates, proteins, enzymes)
- To understand the relationship between the properties and structures of chemical components and ingredients to the functional and chemical properties of foods.
- To understand the physical and chemical interactions between food components and their impact on quality.
- To learn and understand the chemistry concerningthe role and functionality of constituents of the food.

Unit 1: Water **6 Hours**

Structure of water and ice, Physical properties of water, Types of water in food, Water holding capacity and water binding capacity, the concept of Water activity and relation to food stability

Unit 2: Carbohydrates **10 Hours**

Classification, Structure, Properties, sourcesandReactions of Carbohydrates; Reducing & Non-reducing sugar; Glycosidic bonds; Structure of starch, cellulose, glycogen, pectin.; Difference between amylose & amylopectin; Gelatinization and Retrogradationof starch;Chemical Reactions of Carbohydrates, Browning reactions - Enzymatic & Nonenzymatic browning

Unit 3: Proteins **10 Hours**

Classification of amino acid- structure, essential and non-essential amino acids, Peptide bond; biological roles of protein; Classification of protein according to shape; classification of protein according to composition and solubility Structure of protein, chemical bonds involved in protein structure;

Physical-chemical properties of proteins; Denaturation of protein, sources of food proteins

Unit-4: Enzymes **10 Hours**

Introduction, classification of enzyme, enzyme kinetics, enzyme activity, factors affecting enzyme activity. Enzyme inhibitors- reversible (Competitive, Noncompetitive & Uncompetitive), enzyme activity- zymogens inactivation, covalent modification and feedback inhibition; Enzyme immobilization and its application; Enzymes used in the food industry

Practicals:

1. Determination of acidity and pH
2. Determination of moisture by drying method
3. Carbohydrates-qualitative test, estimation of reducing sugar, total sugar
4. Determination of protein by the Kjeldahl method
5. Study on water activity of different foods
6. Study on various techniques of enzyme immobilization

Suggested Readings

1. Belitz, H.-D., Grosch, W., &Schieberle, P. (2016). "Food Chemistry" (4th ed.). Springer.
2. Fennema, O. (2013). "Food Chemistry" (4th ed.). CRC Press.
3. Coultate, T.P. (2009). "Food: The Chemistry of Its Components" (6th ed.). Royal Society of Chemistry.
4. Damodaran, S., Parkin, K.L., & Fennema, O.R. (Eds.). (2017). "Fennema's Food Chemistry" (5th ed.). CRC Press.
5. Hui, Y.H., et al. (Eds.). (2021). "Food Chemistry: Principles and Applications" (2nd ed.). Wiley.
6. Nielsen, S.S. (2020). "Food Analysis" (5th ed.). Springer.
7. Pomeranz, Y., & Meloan, C.E. (2000). "Food Analysis: Theory and Practice" (3rd ed.). Springer.

Graduate Attribute

Course Outcome

- Students will get introduced to Food Chemistry
- Students will be able to understand the basic chemistry of water, carbohydrates, proteins and enzymes
- Students will learn about the classification and properties of carbohydrates, proteins and enzymes
- They will know different tests used for the estimation of carbohydrates, and protein in the food industry

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Microbiology – I**

Course Level: **200-299**

Semester: **Third**

Course objective

- To enable the students to gain an insight into basic aspects of food microbiology.
- To understand the advanced techniques in the microbial analysis of food.

Unit-1: Introduction to food microbiology **8 Hours**

Discovery and History of microbiology, current status, the role of food microbiology, sources of microorganisms in food, Changes caused by microorganisms in food, Growth and survival of microorganisms in foods, biological, chemical and physical changes caused by microorganisms, physical and chemical methods to control microorganisms

Unit 2: Microscope **4 Hours**

Introduction, types of microscopes, parts of a microscope, Maintenance of the Microscope

Unit-3: Characteristics of Microorganisms **8 Hours**

Classification of microorganisms, nomenclature, morphology - yeast and moulds, bacterial cells, viruses; important microbes in food, microbial growth characteristics - Microbial reproduction, nature of growth in food

Unit-4: Culture Media **8 Hours**

Introduction to the microscope, culture media – differential media, selective media, transport media, pure culture, microbial culture techniques, Pure culture techniques – pour, spread and streak plate method; thermal inactivation of microbes; the Basic concept of F, Z and D value

Unit 5: Staining Techniques **5 Hours**

Staining characteristics, Basic principle of simple and grams staining process, mordant and its action, acidic and basic dyes

Unit 6: Microbial Growth in Food **7 Hours**

Microbial growth characteristics, Factors affecting microbial growth – temperature, pH, oxygen concentration, water activity, Psychrophiles, halophiles, mesophiles, Thermophiles; Growth curve – lag, log, the stationary, decline phase

Practicals

1. Introduction to Food Microbiology and Laboratory Safety
2. Operation and use of laboratory equipment
    a. Autoclave
    b. Laminar airflow
    c. Hot air oven
    d. Incubator
    e. Microscope
    f. Colony counter
3. Functioning and use of a compound microscope
4. Cleaning and sterilization of glassware
5. Preparation of cotton plug
6. Preparation and sterilization of Culture media
7. Pure culture techniques-Pour plate spread plate and streak plate
8. Simple staining, Gram Staining, Negative staining
8. Morphological study of bacteria and fungi using permanent slides

Suggested Readings

1. Doyle, M.P., & Buchanan, R.L. (Eds.). (2013). "Food Microbiology: Fundamentals and Frontiers" (4th ed.). ASM Press.
2. Jay, J.M., Loessner, M.J., & Golden, D.A. (Eds.). (2020). "Modern Food Microbiology" (8th ed.). Springer.

3. Adams, M.R., & Moss, M.O. (2019). "Food Microbiology" (4th ed.). Royal Society of Chemistry.

4. Frazier, W.C., Westhoff, D.C., & Vanitha, N.M. (2020). "Food Microbiology" (8th ed.). McGraw-Hill Education.

5. Ray, B., & Bhunia, A.K. (2017). "Fundamentals of Food Microbiology" (5th ed.). CRC Press.

6. Juneja, V.K., &Sofos, J.N. (Eds.). (2019). "Pathogens and Toxins in Foods: Challenges and Interventions" (2nd ed.). ASM Press.

7. Montville, T.J., & Matthews, K.R. (Eds.). (2014). "Food Microbiology: An Introduction" (4th ed.). ASM Press.

Graduate attribute

Course Outcome

- Students will develop knowledge and understanding of different food microorganisms and know different techniques used to detect microorganisms
- Students will develop knowledge and understanding of different food microorganisms and different techniques used in their detection.
- Students will enable to know the basics of microbiology.
- Students will understand the causes of food spoilage of different foods and their type

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):
Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University
Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester IV

Course name: **Food Quality and Regulation – III**

Course Level: **200-299**

Semester: **Fourth**

Course objective

- To explore the various aspects of food regulations, including labelling, packaging, hygiene practices, and quality control measures.
- To familiarize students with the different tools and techniques required for total quality management in a food processing industry
- To introduce students to the concept of audit, and preparation of audit reports for different audit exercises
- To develop students' skills in handling customer-related problems
- To foster critical thinking and problem-solving abilities in addressing complex food regulatory challenges and issues.
- To promote ethical considerations and professional responsibility in complying with food regulations and maintaining food quality

Unit1: Food Labelling **6 Hours**

General concept and importance of labelling; Nutrition Labeling, Health Claims, Nutrition Claims, Nutrient definitions allowed on food labels. Laws related to food labelling and packaging, Indian Institute of Packaging

Unit 2: Total quality management- Tools and Techniques **14 Hours**

Total quality management (TQM)-Definition, features and importance; Total Quality Management (TQM) in Food Industry. Introduction to quality management -Definition, Scope, Significance and Objectives of Quality management;Seven old and new Quality management tools, Kaizen Principle, Statistical process control – Mean & range chart, P chart and C

chart, Seven deadly wastages, PDCA cycle, Quality circle, Continuous improvement of productivity -Six Sigma Concept.

Unit 3: Audit **6 Hours**

Introduction to audit, Types of audit, conducting open meeting and close meetings in auditing, preparation of audit reports for different departments-audit exercise

Unit 4: Country-Specific Standards **6 Hours**

European Committee for Standardization (CEN), PAN American Standards Commission (COPANT), Euro-Asian Council for Standardization, FDA, EPA, EU, ASEAN, EFSA (European Food Safety Authority)

Unit 5: Handling customers and complaints **6 Hours**

Definition- customer, consumer, food chain, types of complaints, handling customer, evaluation and solution of a problem, report making, CAPA.

Practicals:

1. Perform audit and report-making using Excel
2. Study on complaint handling and report making
3. Preparation of SOP for
    a. Receiving raw materials
    b. Finished products
4. Preparation of GRN, Invoice
5. Preparation of checklist
6. Study on 5S Practices in the food industry
7. Visit a food industry and prepare a report on various quality laws and regulations followed

Suggested Readings

1. Roessler, E.B., Amerine, M.A., & Pangborn, R.M. (2013). "Principles of Sensory Evaluation of Food." Elsevier Science.
2. Early, R. (2012). "Guide to Quality Management Systems for the Food Industry." Springer US.
3. Furia, T.E. (2017). "Regulatory Status of Direct Food Additives." CRC Press.

4. Lawless, H.T., & Heymann, H. (2016). "Sensory Evaluation of Food: Principles and Practices." Springer New York.
5. Ranganna, S. (2005). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products." Tata McGraw-Hill Publishing Company Limited.
6. Moss, M.O., & Adams, M.R. (2019). "Food Microbiology" (4th ed.). Royal Society of Chemistry.

Graduate attribute

Course Outcomes:

- Evaluate and implement appropriate labelling, packaging, and hygiene practices to ensure compliance with food regulations
- Familiarizing students with the different tools and techniques required for total quality management in a food processing industry
- Preparation of audit reports for different audit exercises to be performed in a food industry
- To foster critical thinking and problem-solving abilities in dealing with customer-related problems

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Chemistry – II**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

To enable the students to:

- Understand the relationship between nutrition and human well-being.
- Know and understand the functions and chemical structure of the required component in our body.
- To know the major and minor components of foods.
- To know the composition and properties of food.

Unit 1: Lipids **10 Hours**

Classification of lipids according to chemical composition, fatty acids; saturated and unsaturated fatty acids; Fatty acids-essential fatty acids, structure, chemical reactions of lipids; Physical properties – Refractive index, melting point, smoke, flash and fire point, Chemical properties-Saponification value, iodine value, acid value, Peroxide value, Rancidity: Hydrolytic and oxidative rancidity; mechanism of auto-oxidation of fat;Antioxidants- natural and synthetic.

Unit 2: Food Pigments **4 Hours**

Classification of food pigments, Chlorophyll, Myoglobin, anthocyanins, flavonoids, betalains, quinones and xanthones, carotenoids, curcumin

Unit 3: Vitamins **4 Hours**

Classification of Vitamins; sources, functions and Vitamin, deficiency diseases in humans, causesfor losses of vitamins in foods, daily recommended allowance

Unit 4: Minerals **4 Hours**

Classification of Minerals, sources, functions, nutritional aspects of minerals, Bioavailability

Unit 5: Food Additives **8 Hours**

Definition, the difference between food additives and adulterants; Permitted food additives in foods – Antioxidants, natural and chemical antioxidants,

permitted antioxidants in foods, Natural and synthetic colours, application of colours in the food industry, restriction on the use of colours in foods; Flavoring agents:nature identical flavours, artificial flavouring substances; function of emulsifiers and stabilizers in foods, permitted emulsifiers and stabilizers used in foods. Natural and chemical sweeteners,nutritive additives

Unit 6: Aroma Compound **4 Hours**

Properties of Aromatic Compounds, Classification of Aromatic Compounds, Analysis of Aroma of Food

Practical:

1.Determination of ash/mineral in a food sample.

2.Study on crude fat analysis in food samples.

3. Determination of vitamin C content in food samples.

5.Study on the estimation of – Saponification value, iodine value, acid value, peroxide value and iodine number of food sample

7. Study of food pigments present in different foods

8. Study of different food additives

Suggested Readings

1. Gunstone, F.D., John L. Harwood, J.L., & Fred B. Padley, F.B. (2007). "The Lipid Handbook" (3rd ed.). CRC Press.
2. Pokorný, J., &Yanishlieva, N. (Eds.). (2006). "Autoxidation in Food and Biological Systems." CRC Press.
3. Akoh, C.C., & Min, D.B. (2008). "Food Lipids: Chemistry, Nutrition, and Biotechnology" (3rd ed.). CRC Press.
4. Nielsen, S.S. (2017). "Food Analysis" (5th ed.). Springer.
5. Skerrett, P.J., & Willett, W.C. (Eds.). (2014). "Essential Concepts in Food Science." CRC Press.
6. Branen, A.L., Davidson, P.M., & Salminen, S. (Eds.). (2019). "Food Additives" (2nd ed.). CRC Press.
7. Gropper, S.S., Smith, J.L., &Carr, T.P. (2017). "Advanced Nutrition and Human Metabolism" (7th ed.). Cengage Learning.
8. Whitney, E.N., Rolfes, S.R., Crowe, T., & Cameron-Smith, D. (2019). "Understanding Nutrition: Australia and New Zealand Edition" (4th ed.). Cengage Learning.
9. Food Safety and Standards Authority of India (FSSAI). (2016). "Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011." FSSAI.
10. Joint FAO/WHO Expert Committee on Food Additives (JECFA).

(2021). "Compendium of Food Additive Specifications." Food and Agriculture Organization (FAO) of the United Nations.

Graduate attribute

Course outcome:

- They will learn about the classification of lipids, Rancidity, and Autoxidation of fats.
- They will acquire knowledge about the basics of Lipids, vitamins, minerals, pigments and additives
- They will learn about different food additives used in the food industry
- Gain knowledge of the core component of a required nutrient.
- Increased awareness of the diet.
- Know about the permissible limit of food additives.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Microbiology – II**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

- To acquire elementary knowledge about micro-organisms.
- To develop an understanding of the role of microorganisms in the environment, Industry and in the maintenance of health.
- To understand the importance of safe handling of food and disease caused by microorganisms.
- To acquire knowledge about harmful and beneficial microorganisms.

Unit 1: Study of Different Microorganisms **8 Hours**

Cellular, A cellular microorganisms;Morphological and Ultra-structure of a microbial cell (Gram-positive and Gram-negative bacterial membrane, spore, pili, flagella),

Unit 2:Microbial Food Products for human consumption **8 Hours**

Single Cell Protein (SCP), Microbial SCP production by bacteria, algae, mushroom cultivation, the concept of probiotics, prebiotic, symbiotic and bioactive foods; fermented foods

Unit 3: Microbial Agents of Food-Borne Illness **8 Hours**

Foodborne infections and intoxication, food poisoning, microbial toxins, Gram Negative and Gram-positive food-borne pathogens

Unit 5: Spoilage in Different Food Groups **8 Hours**

Food spoilage - Introduction, sources of microorganisms in foods, spoilage in cereals, vegetables and fruits, meat, eggs, poultry, fish, milk and milk products, canned foods, nuts and oil seeds, fats and oil

Unit 6: Beneficial Uses of Microorganisms **8 Hours**

Microorganisms used in food fermentation, intestinal bacteria and probiotics, food bio preservatives of bacterial origin, food ingredients and

enzymes of microbial origin. Economic importance of microorganisms

Practicals:

1. Standard Plate Count of different food samples
2. Estimation of Microbial load in a food sample and plot a growth curve
3. Isolation and Identification of
    i. Escherichia coli
    ii. Yeast and mould
    iii. coliform
4. Estimation of Total plate count of food samples
5. Microbial study of food samples stored at different environmental conditions
6. Assessment of surface sanitation by swab/rinse method
7. Preparation of fermented foods
8. Conduct an industrial visit and prepare a report on the scope of microbiology in the food industry

Suggested Reading:

1. Cappuccino, J.G., & Sherman, N. (2018). "Microbiology: A Laboratory Manual" (12th ed.). Pearson.
2. Harrigan, W.F., & McCance, M.E. (2016). "Laboratory Methods in Food Microbiology" (3rd ed.). Academic Press.
3. Atlas, R.M. (2010). "Handbook of Microbiological Media" (4th ed.). CRC Press.
4. Lee, G. (2016). "Microbiology and Molecular Biology in Foods" (2nd ed.). Wiley-Blackwell.
5. Harrigan, W.F., & Wilkinson, L. (2014). "Food Microbiology: Fundamentals and Frontiers" (5th ed.). ASM Press.
6. Beuchat, L.R., Doyle, M.P., & Montville, T.J. (Eds.). (2013). "Food Microbiology: Fundamentals and Frontiers" (4th ed.). ASM Press.
7. Golden, D.A., & Bishop, P.A. (Eds.). (2018). "Introduction to Laboratory Safety" (3rd ed.). CRC Press.

Graduate attribute

Course Outcome:

- They will learn how to clean equipment and sterilize them.
- They will learn about the handling of a compound microscope.
- They will understand different staining methods for bacteria and their

importance. They will understand the difference between bacteria and fungi.

- They will learn different methods used for the isolation and enumeration of bacteria from food samples.
- Students will learn how to use an instrument like a microscope, autoclave, membrane filters, laminar airflow etc.
- Helps them to acquire jobs in microbiological labs.
- They will know what will cause food-borne illness.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Analysis: Tools and Techniques**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

- To provide conceptual knowledge about sampling and quality of the foods to students.
- To provide Hands-on determination of Moisture content of food, protein content of food etc.
- To provide Hands-on determination of pH and Titratable acidity.
- To provide Hands-on determination of ash content, fat content, pigments, vitamins etc.

Unit 1: Concept of Sampling **8 Hours**

Sampling: - Terminologies in sampling, Selection of sampling procedures, Factors affecting the choice of the sampling plan, Sampling procedures probability and non – probability sampling

Unit 2: Analysis of pH and Acidity **8 Hours**

pH and Titratableacidity: - Acid-base equilibrium, General principles, Reference electrode, Indicator electrode, Buffers, titration, Indicators, standard alkali, standard acid, sample analysis, and the acid content in food.

Unit 3: Analysis of Moisture **8 Hours**

Moisture Assay: - Importance of moisture assay, forms of water in food, Oven drying methods – forced draft oven, vacuum oven, microwave oven. Chemical method – Karl Fischer titration

Unit 4: Analysis of Carbohydrates **10 Hours**

Importance of analysis of carbohydrates, sample preparation, Chemical methods for the analysis of carbohydrates: Nelson- Somogyi method, DNS method, Phenol Sulfuric acid method and Anthronemethod; Importance of dietary fibre, major components of dietary fibre, principle, procedure and application of total soluble and insoluble fibre

Unit 5: Analysis of Fats and Proteins **10 Hours**

Continuous solvent extraction methods: Goldfish method, Semi-continuous solvent extraction methods: Soxhlet method, Discontinuous solvent extraction method: Mojonnier method. Non-Solvent wet extraction method: Gerber method; Analysis of Proteins: - Importance of protein analysis, principle and procedure of Kjeldahl method, Biuret and Lowry method

Unit 6: Analysis of Ash, Vitamins and Pigments **8 Hours**

Importance of ash in food analysis, sample preparation, Dry ashing, wet ashing, Soluble and insoluble ash in water, ash insoluble in acid, Analysis of Minerals: - Importance of analysis of minerals; Analysis of Vitamins - Importance of analysis of vitamins; 2, 6 Dichlorophenol indophenols titrimetric method for vitamin C**;** Pigment analysis- Importance of color and food quality; Presence and distribution of pigments in foods. Analysis of chlorophyll, carotenoids, anthocyanins

Unit 7: Sensory Analysis **3 Hours**

Sensory analysis-definition, methods of sensory evaluation

Unit 8: Food Adulteration **3 Hours**

Adulteration and adulterant, types of adulteration, methods of detecting adulterants in foods

Practical:

1. Determination of pH and acidity of the given sample.
2. Determination of moisture content of different samples
3. Analysis of carbohydrates- nelson-somogyi method, DNS Method, Anthrone method
4. Analysis of dietary fibre
5. Estimation of fat content
6. Detection of adulterants in different foods
7. Estimation of vitamin C from food sample
8. Sensory analysis of foods by different methods

Suggested Readings

1. Nielsen, S.S. (2017). "Food Analysis" (5th ed.). Springer.
2. Belitz, H.-D., Grosch, W., &Schieberle, P. (Eds.). (2013). "Food Chemistry" (4th ed.). Springer.

3. Lees, M. (Ed.). (2019). "Food Analysis: Theory and Practice" (2nd ed.). Springer.

4. Wrolstad, R.E., Acree, T.E., Decker, E.A., Penner, M.H., Reid, D.S., Schwartz, S.J., Shoemaker, C.F., Smith, D., &Sporns, P. (2019). "Handbook of Food Analytical Chemistry" (2nd ed.). Wiley.

5. Downey, G. (Ed.). (2021). "Advances in Food Analysis Techniques" (2nd ed.). CRC Press.

6. Otles, S., &Cagindi, O. (Eds.). (2014). "Handbook of Food Analysis Instruments" (2nd ed.). CRC Press.

7. Paolucci, M., & Liuzzo, G. (2018). "Advanced Methods for Food Analysis" (1st ed.). Elsevier.

Graduate attribute

Course Outcomes:

- On the successful completion of the course, a student will be able to gainhands-on experience and training on the determination of proximate analysis.
- Understand the detection of adulteration in food samples.
- To provide Hands-on qualitative and qualitative evaluation of food samples.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester V

Qualification Pack: **Production Manager FIC/Q9003 (NSQF level 7)**

Course name: **Food Preservation Technology**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To acquaint the students with fundamental principles and various techniques of food preservation.
- To understand the information about food spoilage and why preservation is required.
- To gain knowledge about different techniques such as freezing, sterilization, canning etc.
- To obtain knowledge about the intrinsic factor and extrinsic factors that affect food spoilage.
- To know the emerging technologies in food preservation

Unit 1: Introduction to food preservation **8 Hours**

Definition and significance of food preservation, factors influencing food spoilage and deterioration, traditional food preservation methods, food preservatives: natural and chemical. Perishable, non-perishable food, causes of food spoilage.

Unit 2: Food preservation by low temperature **8 Hours**

Freezing and refrigeration: Introduction to refrigeration- cold storage, freezing. Principle of freezing, changes occurring during freezing, types of freezing- slow and quick. Introduction to thawing, changes during thawing and its effect on food.

Unit 3: Food preservation by high temperature **8 Hours**

Thermal Processing: Commercial heat preservation methods – Sterilization, commercial sterilization. Pasteurization: principles of pasteurization, HTLT, LTLT, Blanching. Canning and bottling: Principles of canning and bottling.

Unit 4: Food preservation by moisture control **8 Hours**

Drying: Definition of drying, preservation, sun drying. Dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve - names of types of driers used in the food industry. Evaporation: Definition, factors affecting evaporation, names of evaporators used in food industry.

Unit 5: Food preservation by irradiation **4 Hours**

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation- mechanism of action, uses of radiation processing in food industry.

Unit 6: Emerging technologies in food preservation **8 Hours**

High pressure processing (HPP), Pulsed electric field (PEF) processing, Ohmic heating, Ultrasound processing, Membrane processing, Microwave, Nanotechnology in Food

Practicals

1. Identification of Class I and Class II preservatives.
2. Study on storage stability of foods under different environmental conditions.
3. Comparison on shelf life study of foods by application of natural and chemical preservatives.
4. Food preservation by low temperature- freezing, refrigeration.
5. Food preservation by high temperature-sterilization, pasteurization.
6. Demonstration of food preservation by canning.
7. Blanching of different fruits and vegetables.
8. Adequacy of blanching.

Suggested Readings

1. Food Processing and Preservation- Subbulaksmi G., and Udipi S.
2. Principles of Food Science, Vol. II- G. Borgstron, Mc. Millan Co. Ltd. London.
3. Principles of food preservation Part I& II- Owen R. Fenemma. 4
4. Food Science- Potter, CBS publishers.
5. The technology of Food Preservation - N.W. Desroiser and N.W. Desrosier
6. Introduction to Food Science & Technology- G.P. Stewart & M.A. Amerine
7. Food Processing Operations Vol. III -M.A. Joslyn and J.J. Heild.
8. Preservation of Fruits and Vegetables- Giridhari Lal, G.S. Siddappa, and G.L. Tondon

Graduate attribute

Course Outcomes:

- Students will enable to understand different food preservation techniques, and processes.
- Students will enable to extend the shelf life of different food products by using the various methods of food preservation
- Students will be able to learn the principles and methods involved in the processing of perishable as well as Non-perishable foods and their effect.
- Acquaint the knowledge of different techniques for food preservation.
- Get knowledge about the various root cause of food spoilage.
- Develop skills in the application of increasing the shelf life of the product.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Fermentation Technology**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To understand the principles of food fermentation technology
- To study the types of starters used in the Food Industry
- To study the production of various fermented foods, alcoholic and non-alcoholicbeverages.

Unit 1: Introduction to Fermentation technology **6 Hours**

History, Scope and Development of Fermentation technology; Isolation and screening of industrially important microorganisms – primary and secondary screening; Maintenance of Strains; Strain improvement.

Unit 2: Fermentation media **8 Hours**

Natural and Synthetic media; Basic components of an medium (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Types of fermentation on the basis of medium used; formulation and process optimization; Role of buffers in media; Process of aeration, and agitation.

Unit 3: Fermenter design **8 Hours**

Types of fermentation on the basis of Fermenter design; Basic design of Fermenter, Types of Fermenters; Scale up study and Product development; Upstream and Down-stream processing and Product recovery.

Unit 4: Production of Microbial Products **8 Hours**

Production of alcohol; Organic acid – Citric acid; Vinegar, Cell immobilization, microbial transformation, sewage treatment, biosensor, bioleaching and effluent treatment.

Unit 5: Fermented foods **8 Hours**

Types of fermentation on the basis of end products; Fermented dairy products, alcoholic beverages; methods of manufacture for sauerkraut, tempeh, miso, soya sauce; traditional fermented foods from North east region of India and their manufacturing methods .

Practicals

1. Demonstration of Fermenters- design, construction and working principle.

2. Study of different types of Fermenters.

3. Preparation of various fermented foods

   a. Alcoholic beverages.
   b. Fermented Dairy products .

4. Preparation of sauerkraut.

5. Preparation of bamboo shoot, fermented fish of north east origin.

Suggested Readings

1. Robert W Hutkins. 2006. Microbiology and technology of fermented foods. WileyBlackwell
2. Y. H. Hui and E. OzgulEvranuz. 2012. Handbook of plant-based fermented foods and beverage technology. CRC press

Graduate attribute

Course Outcome:

- Students will be able to understand the importance of fermentation and different microorganisms associated with foods.
- Students will have an idea about sewage treatment.

- Students will gain knowledge about regional and international fermented foods and their benefits.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Technology for Plant Products**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To teach the importance of horticultural crops, fruits & vegetables, tea, coffee and spices etc.
- To understand the basic composition and structure of fruits & vegetables, oil seeds, cereals and legumes
- To impart technical knowledge on processing into value-added products.
- To teach the importance of preservation techniques and increase self-life.

Unit 1: Industrial Processing of Fruits and Vegetables **12 Hours**

Chemical composition and nutritive value of fruits and vegetables, preparing fruits and vegetables for processing; preparation and maintenance of work area and process machineries; Post harvest losses of fruits and vegetables and causal factors; maturity indices of fruits and vegetables; climacteric and non-climacteric fruits; packaging of whole fruits and vegetables; post harvest physical and chemical treatment to enhance the shelf life of fruits and vegetables; microbiological spoilage of fruits and vegetables and analysis of products.; FPO Specifications and processing for jam, jelly ketchup, Juice, Squash, cordial, nectar, RTS, Crush , puree, paste, etc.

Unit 2: Cereals and cereals product **12 Hours**

Structure and nutritional composition of different types of cereals; Importance of cereals for nutrition; Technologies for cereal processing; Rice types, Physical properties of rice, cooking properties, parboiling, milling, rice products and byproducts; wheat – types, milling of wheat, wheat flour, wheat based products; millet and millet based products

Unit 3: Pulses, Legumes and Oil-seeds processing **8 Hours**

Present status and future prospects of legumes and oilseeds; Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds Chemical composition, nutritional value and anti-nutritional compounds in legumes and oilseeds; Methods of removal of anti- nutritional compounds; Pulse and legumes processing; Factors affecting milling quality and quantity; Oil seed milling; Refining of oils; Hydrogenation of oils, rancidity in oil

Unit 4: Industrial Processing of Tea, Coffee and Spices **12 Hours**

Tea plant, types of tea, green tea, black tea, white tea, oolong tea, yellow tea, instant tea, CTC Tea, orthodox tea flavored tea, industrial processing techniques, tea fermentation and compounds, quality of tea, health effects, Assam tea, storage of tea, innovative tea-based products, tea-wine, kombucha, etc.; Coffee plant, different types, processing, quality analysis; Major international quality specifications of spices. Spice processing, Value-added spice products: Spice volatile oils, spice oleoresins.

Practicals

1. Estimation of total soluble solids (TSS).

2. Preparation of fruit jam/ fruit jelly/marmalade.

4. Preparation of fruit juice/squash/cordial/nectar.

5. Preparation of pickle/mixed pickle.

6. Preparation of tomato products-sauce, puree, ketchup.

7. Physical characteristics of rice- bulk density, true density, porosity, 1000 kernel length and weight.

8. Cooking quality of rice- minimum cooking time, elongation ratio, water uptake ratio.

9. Processing of tea leaves.

10. Quality analysis of different spices.

11. Demonstration of coffee processing.

Suggested Readings

1. Post-harvest physiology, handling and utilization of tropical and subtropical fruits and vegetables by E. B. Pantastico, AVI Publishing company, INC

2. Post-harvest technology of fruits and vegetables: handling, processing, fermentation and waste management. Vol I and II. Verma L. R. and Joshi V.K.

3. Preservation of fruits and vegetables- Girdharilal, G. S. Siddapa and G. L. Tandon.

4. Fruits and vegetables preservation principles and practices- Srivastava R. P and Sanjeev Kumar.

5. Essentials of food science

6. David Dendy A.V. Cereals and cereal products: technology and chemistry- 2000

7. Association of Operative Millers Cereal Millers Hand Book, Burgess Publishing company, USA, 1963.

8. Pomeranz Y, "Modern Cereal science and Technology" MVCH Publications, NY, 1987.

Graduate attribute

Course Outcome:

- Develop proficiency skills in producing different types of processed fruits & vegetables products.
- Operating & maintenance of the modern processing equipment&types of machinery

- To make different processed fruit &vegetable-based products with quality assurance and safety.
- Students will be able to understand the importance of processing and preservation of horticultural crops, fruits & vegetables, cereals, legumes and oil seed
- They also understand different technology used in different milling industries, refineries etc.
- They will have an idea about new product development using plant-based food.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Production and Operation Management**

Course Level: **300-399**

Semester: **Fifth**

Course objective:

- To understand the basic concept of food production and operation management
- To understand managing the production and operations of food processing unit through production planning and control, directing and controlling finance, human resources, and ensuring product and process quality.
- To understand basic work in a food production plant: Planning, Products Planning, Line Balancing, Scheduling, Inventory Management, Forecasting etc.
- To know the importance of the production system in an organization.
- To understand the link between various activities of the production system.
- Direct and control human resources for the operation of the food processing unit.
- Ensure product and process quality in the food processing unit.

Unit 1: Introduction to Production and Operation Management

8 Hours

Nature and scope of production/operation management –objectives, introduction, concept of production, production system, types of production, production management, operation management, scope of production and operation management, benefits of production management, responsibility of a production manager, decisions of production managements.

Unit 2: Productivity **4 Hours**

Productivity-introduction, meaning of productivity, definitions, importance of productivity, how to improve productivity, methods of measurement of productivity

Unit 3: Production Planning **8 Hours**

Production planning and controlling-objectives, introduction, production planning and control meaning, importance of production planning and control, challenges in production planning and control, factors affecting production planning and control, types of production system, types of manufacturing process, steps of production planning and control.

Unit 4: Inventory and Maintenance Management **8 Hours**

Inventory management-objectives, introduction, definition, different types of inventory, need for inventory management, Good Inventory Management Practices, inventory management techniques; Introduction and meaning, objectives of maintenance, types of maintenance, maintenance planning, maintenance scheduling

Unit 5: Scheduling **4 Hours**

Scheduling– introduction and meaning of scheduling, objectives, selection criteria for the type of scheduling.

Unit 6: Waste management **4 Hours**

Waste–introduction and meaning, reasons for generation and accumulation, identification and control of waste, disposal of scrap.

Practicals

1. Measurement of productivity
2. Demonstration of production system
3. Demonstration of inventory management
4. Demonstration of maintenance management
5. Demonstration on industrial waste management system

6. Conduct an industrial visit and prepare a report on the production management system

Suggested Readings

1. Production and Operation Management Paperback – 2015 by K.ASWATHAPPA (Author, Contributor), K. Shridhara Bhat. Himalaya Publishing House Pvt. Ltd,
2. Principles of Food Production operation by Yogesh Singh, I K International Publishing Pvt. Ltd.
3. Production and operation management: concepts, models and behaviors, 5th edition. Prentice hall of India, Adam and Ebert. 2006
4. Modern production/operation management, Wiley India, Buff ES 2008
5. Panneerselvam, ―Production and Operations Management‖ PHI. Ajay K Garg, Production and Operations Management, TMH.
6. Prof. L.C. Jhamb: Production Operations Management, 18th edition, Everest Publishing House.
7. Dipak Kumar Bhattacharyya, Production and Operations Management, Universities Press.
8. B. Mahadevan, Operations Management: Theory and Practice, Pearson.
9. Kenneth K. Boyer, Rohit Verma, Operations Management, Cengage Learning.

Graduate outcome

Course Outcome:

- Students will have basic ideas about production and operations in food industries.
- They will learn to be disciplined in inventory management, maintenance management quality management etc.
- Understand the importance of the location of the food production plant.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

SEMESTER VI

Course name: **Baking and Confectionery Technology**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

- To teach about the raw material, and their function for making different bakery and confectionery products.
- To impart technical knowledge on processing bakery and confectionery products.
- To teach about leavening agents, shortening agents etc.
- To understand different equipment used in bakery and confectionery industries.

Unit 1: Introduction to bakery science and technology **8 Hours**

Overview on bakery and bakery products; list the various types of industries within the bakery sub sector; scope, present status and future perspective; Classification of bakery products; Bakery ingredients and their functions- Essential ingredients: Flour, yeast and sour dough, water, salt- Other ingredients: Sugar, color, flavor, fat, milk, milk powder and bread improvers; Leavening agents, Shortenings, emulsifiers and antioxidants; Problems of baking.

Unit 2: Equipments **8 Hours**

Introduction to utensils and equipments used in bakery industry with their purpose; Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, and laminating; Fermentation enclosures and brew equipment - Ovens and Slicers

Unit 3: Bread making process **12 Hours**

The Chemistry of Dough Development; process and stages of mixing , Bread making methods- Straight dough/bulk fermentation, Sponge and dough, Activated dough development, Chorley wood bread process; Advantages and disadvantages of various methods of bread-making; Characteristics of good bread: Internal characters; external characters; Bread defects/faults and remedies; Spoilage of bread-Causes, detection and prevention.

Unit 4: Other bakery products **12 Hours**

Production of cakes and cookies/biscuits; Types of biscuit dough – Developed dough, short dough, semi-sweet, enzyme modified dough and batters; Cake making: Ingredients and their function, Structure builders, Tenderizers, moisteners and flavor enhancers; cake faults and remedies ;Production process for Wafers- type of flour, raising agents and maturing; Other miscellaneous products- puff pastry

Unit 5: Confectionery Products **8 Hours**

Definition, importance of sugar confectionery; General technical aspects of industrial sugar confectionery manufacture ,Types of confectionery - Caramel, Toffee and Fudge and other confections-:- ingredients - Formulation - Processing method- Quality control- Aerated confectionery- Methods of aeration- Manufacturing process-product quality parameters, faults and corrective measures, Spoilage of confectionery products

Practicals

1. Determination of moisture content and comparison of different raw ingredients, finished goods
2. Determination of sedimentation value, ash, acid insoluble ash, grittiness, alcoholic acidity, gluten content of wheat flour.
3. Determination of yeast activity.
4. Demonstration of different equipments used in bakery industry.
7. Preparation of different bakery products-bread, cake, biscuit/cookies, bun, pastries.

8. Microbial analysis of bakery products.

Suggested Readings

1. Matz, Samuel A., ―Bakery Technology and Engineering□, Third Edition, Chapman & Hall, London.

   2. Cauvain, Stanley P, and Young, Linda S., ―Technology of Bread Making□, Second Edition Aspen publication. Maryland, 1999
2. Zhou. W, HuiY, H; (2014), "Bakery Products Science and Technology", 2nd Edition, Wiley Blackwell Publishers,
3. 4.Pyler, E. J. and Gorton, L.A. (2009), "Baking Science & Technology" Vol.1 Fourth Edition,Sosland Publications.
4. Stanley P. Cauvain, Linda S. Young, (2008), "Baked Products: Science Technology and Practice". John Wiley & Sons Publishers
5. Edwards W.P. ― Science of bakery products□, Published by The Royal Society of Chemistry, UK,2007

   7. Samuel A. Matz., ―Equipment for Bakers□, Pan Tech International Publication. 1988.

Graduate attribute

Course Outcome:

- Students will get practical knowledge about different bakery and confectionery products.
- They will understand the importance of moisture content, pH, emulsifiers etc.
- They will have an idea about new product development in the field of bakery and confectionery.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Technology for Animal Products**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

- To study the processing of different dairy products, meat, fish and poultry products.
- To study the different products of animal-based products.
- To study the nutritional aspect of the animal-based product

Unit 1: Compositional and Nutritional aspect of Animal foods

12 Hours

Fish - fresh water and marine, composition, spoilage of fish microbiological, physiological, biochemical. Meat – Definition of carcass, red meat and white meat, composition of meat, meat products, abattoir, slaughter methods, marbling in meat, post mortem changes in meat-rigor mortis, tenderization of meat, ageing of meat. Egg-composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality

Unit 2: Fish Processing **8 Hours**

Marine and fresh water fish, popular fishes, Preservation of fish-Chilling, Freezing, curing, drying, salting – salting methods: brining, pickling, curing and canning of fish. Smoking - smoke production, smoke components, quality, safety and nutritive value of smoked fish, pre - smoking processes, smoking process control. Fishery products: Surimi - Process, traditional and modern production lines, quality of surimi products. Fish protein concentrates (FPC), fish protein extracts (FPE), natural causes of rapid spoilage, fish glazing, other preservation techniques, fermented and non-fermented fish products, fish drying and dried fish products of Assam, storage.

Unit 3: Meat processing **10 Hours**

Meat Quality - colour, flavor, texture, Water Holding Capacity (WHC), Emulsification capacity of meat, Preservation of meat –Refrigeration and freezing, thermal processing - canning of meat, dehydration, meat curing and smoking, Meat products: Sausages - processing, RTE meat products.

Unit 4: Egg processing **8 Hours**

Egg- Structure and Composition of egg and nutritive value; Factors affecting egg quality, egg quality evaluation, primary processing, egg white and egg yolk, egg as natural emulsifier, storage; Preservation of eggs - Refrigeration and freezing, thermal processing, dehydration, coating. Egg products- Egg powder, frozen egg pulp, designer eggs.

Unit 5: Dairy processing **12 Hours**

Co-operative dairy schemes, milk composition and properties, milk micro-flora, , Platform tests, Milk Processing- collection of milk, homogenization, pasteurization techniques, aseptic packaging, toned and double-toned milk, recombined and reconstituted milk, lactose intolerance, flavored milks, dahi and yoghurt, paneer, chana, butter, ghee, lassi, toffee, milk powder, ice cream- processing and quality, microbiology and storage, recent developments in dairy industry.

Practicals

1. Estimation of moisture content of meat.
2. Preservation of meat.
3. Demonstration of microbial spoilage in meat and meat products.
4. Milk reception operation.
6. To perform different platform tests in milk.
7. Demonstration of Standardization of milk.
8. To estimate milk fat by Gerber method.
11. Demonstration of cream separator.
12. Demonstration of can washer.

13. Demonstration of batch pasteurizer and HTST pasteurizer.

14. Preparation of different dairy products.

Suggested Readings

1. R.A. Lawrie, 1988 Meat Science, Pergamon Press.

2. G.J. Mountney.1995. Poultry Products Technology by Taylor & Francis

3. Parkhurst& Mountney.2012. Poultry Meat and Egg Production.Springer London, Limited, 05-Jul- 2012

4. Food Facts & Principles by Shakuntla Manay N &Shadoksharaswamy N, 1996, New Age World publisher, CA.

5. Egg Science & Technology by Stadelman WJ, & Cotterill OJ, 2002, CBS Publisher, New Delhi.

6. Fish Processing & preservations by Charles L, Cutting

7. Sukumar de; Outlines of dairy technology -oxford university press.

8. Indian dairy products, K.T.Acharya publication

9. Milk hygiene in milk production processing and distribution, FAO Publication.

10. Fliud milk industry, J.S Handerson, A.V.I Publishing Company, USA

11. Milk Hygiene in milk production processing and distribution, F.A.O Publication

Graduate attribute

Course Outcome:

- Students will be able to understand the importance of meat, preservation and processing into different products.
- They will have practical knowledge of animal-based products.
- They will learn about quality testing, spoilage etc.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Packaging Technology**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

The objectives of this course are to

- Establish the different functions performed by packaging material.
- To inform about the health implications of food-package interactions.
- To inform about packaging requirements for fresh and processed food for local and international markets

Unit 1: Introduction to food packaging **8 Hours**

Definition, functions and requirements for effective packaging, packaging criteria, classification of packaging-primary, secondary and tertiary packaging, Flexible and rigid packaging, Importance of packaging

Unit 2 Materials for food packaging **8 Hours**

Paper, glass, tin, aluminium-polymer coated, tin free steel cans, cellophane, plastics- different types of plastics including bioplastics and edible films, active/intelligent films.

Unit 3: Different forms of food containers **8 Hours**

Boxes, jar, cans, bottle; Interaction of package with foods; Packaging requirements for various products-fruits and vegetables, meat, fish, milk and dairy products, canned foods, dehydrated foods.

Unit 4: Modern concepts of packaging technology **8 Hours**

Aseptic packaging, form-fill seal packaging, edible films, retort pouch packaging, Gas flushing, tetra pack, vacuum packaging, MAP & CAP, active packaging, intelligent packaging.

Unit 5: Food packaging laws and specifications **8 Hours**

Quality testing of packaging materials; Paper and paper board-thickness, bursting strength, tensile strength, puncture resistance; Flexible packaging materials (plastics)-density, tensile strength, WVTR, GTR, seal strength.

Practicals

1. Demonstration of different packaging materials

2. Determination of water vapor transmission rate of various packaging materials.

3. Demonstration of measurement of carton's dimension as per organizational standard.

4. To determine the thickness of paper and paper board.

5. Demonstration on biodegradable packaging materials

Suggested Readings

1. Coles,r; dowel, d.m; kirwan,j. food packaging technology. Black well publishing ltd
2. Niir board; food packaging technol;ogy handbook national institute of industrial research , New Delhi
3. PirengerO.G.andA.L.Baver: Plastic Packaging Materials for Food Wiley VCH, GmbH,

Graduate attribute

Course Outcome:

- Students will be able to understand the need for packaging food.
- Understand the various functions of food packages as influenced by their characteristics
- Understand the health implications of food-package interactions

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Internship**

Course Level: **300-399**

Semester: **Sixth**

Duration: 40 Hours

Conduct in workplace

A student will undergo an industrial internship in the field of their specialization during the semester break (winter) of the academic year.

Evaluation will be done by the department based on the feedback received from the industrial management on the student's performance during the tenure

Report making and verbal presentation

After completion of the internship, the student will prepare a report on his/her work and experience

Evaluation will be based on the quality of the report and presentation

Project report+ presentation +viva

Bachelor of Vocation (B.Voc.)[Food Processing and Quality Management]

Syllabus

For

Bachelor of Vocation

2023

Approved by
Gauhati University,
Guwahati, Assam

CCS-Department of Biotechnology, Gauhati University

NEP-2020
CCS-Dept. of Biotechnology, Gauhati University

Detailed Syllabus

Programme: Bachelor of Vocation (B.Voc.)

Trade Name: Food Processing and Quality Management

Programme Outcome:

1. To provide a judicious mix of skills relating to the profession and appropriate content of general education
2. To ensure that the students have adequate knowledge and skills so that they are ready to work at each exit point of the program
3. To provide flexibility to the students using predefined entry and multiple exit points
4. To integrate NSQF to enhance the employability of the graduates and meet industry requirements

Eligibility: 10+2 in Arts/science/commerce or 10+2 in vocational subjects related to the trade.

List of core courses

Sl. No	Semester	Course Name
01	I	Food plant sanitation and hygiene management
02		Food Processing –I
03		Bioresources in Food Processing
04	II	Food Quality and Regulation-I
05		Food Processing-II
06		Food plant layout and utilities
07	III	Food Quality and Regulation-II
08		Food Chemistry-I
09		Food Microbiology-I
10	IV	Food Quality and Regulation-III
11		Food Chemistry-II
12		Food Microbiology-II
13		Food Analysis: Tools and techniques
14	V	Food Preservation Technology
15		Fermentation Technology
16		Technology for plant products
17		Food production and operation management
18	VI	Bakery and confectionary technology
19		The technology for animal products
20		Food packaging Technology
21		Internship

Semester I

Qualification Pack: Hygiene Coordinator - Supervisor FIC/Q7606 (NSQF level 4)

Course name: **Food Plant Sanitation and Hygiene Management**

Course level: **100-199**

Semester: **First**

Course objective

- To impart theoretical and practical knowledge of various activities for cleaning and sanitation in food plants
- To enable the student to supervise hygiene practices in food plants
- To enable the application of necessary health and safety practices to ensure workplace health and safety
- To impart the necessary background to work effectively with others
- To train students to use resources at the workplace optimally

Unit 1: Food Safety and Hazards **8 Hours**

Concept of Food Safety, Importance of Guidelines on Prevention of Food Safety Hazards. Concept of food hazards, prevention of food hazards. Importance of identifying and preventing food safety hazards, Food Safety Hazards and Quality Defects: Physical Hazards, Chemical Hazards, Biological Hazards, Allergens

Unit 2: Sanitation and Health **6 Hours**

Definition and importance of sanitation, Application of sanitation in the food industry and food service establishment, Microorganisms and their relationship to sanitation

Unit 3: Hygiene and Sanitation in Food Plant and Food Service Establishments **8 Hours**

Sanitation in Food Plant and Food business operator Establishments: Cleaning Agents, Disinfectants or Sanitizers, Waste Disposal, Pest and

Rodent Control, General Principles of Food Hygiene, Hygiene Requirements for Licensing and Sale, Health Status of Food Handlers, Personal Hygiene, Facilities to Employees

Unit 4: Sanitary aspects of water supply **6 Hours**

Physicochemical properties of water, Source of water, Quality of water, Water supply and its uses in food industries, Purification and disinfection of water

Unit 5: Food Handling **6 Hours**

Receiving and Inspecting Food Deliveries, Storage Space, Dry Storage, Low-Temperature Storage, Store Room Management

Unit 6: Food Plant Waste Management System **6 Hours**

Energy Efficiency and Conservation, Water Conservation, Byproduct Utilization, Treatment of Solid Wastes, Treatment of Liquid Wastes

Practicals

1. Data Collection and Hazard Identification (Physical, Chemical and Biological)
2. Hygienic Requirements for Manufacturing Premises
3. Practice of sanitation inthe workplace
4. GAP analysis
5. Preparation of different checklist
6. Study on different methods of energy conservation
7. Study on CIP and COP
8. Methods of inspection of food at different points in a manufacturing unit
9. Study on utilization of byproducts
10. Study on different methods of waste treatment

Suggested Readings

1. Food Safety and standards Act 2006, Rules 2011, Regulations, 2011, 10th Edition, ILBCO India, Indian Law Book Company, 2013.
2. Principles of Food Sanitation. N. G. Marriott, Springer, 5th Edition, 2006.
3. Hobbs Food Poisoning and Food Hygiene. Jim Mclauchlin and Christine

Little (Eds), 7th Edition, 2007.

4. Food Plant Sanitation: design maintenance, and good manufacturing practices, by Michael M. Cramer,CRC Press
5. Mukundan, M.K. and Balasubramaniam, S. 2007. Seafood Quality Assurance.CIFT Training Manual 1
6. Gopakumar, K. 2002. Textbook on Fish Processing Technology, Indian Councilof Agricultural Research (ICAR), New Delhi
7. http://egyankosh.ac.in//handle/123456789/10012

Graduate attribute

Course Outcome

- Enable the student to be a 'Hygiene Coordinator'
- Increased employability
- Ability to monitor and supervise the cleaning and sanitation tasks.
- Understanding of basic food safety standards.
- Managerial skills to deal with accidents and emergencies.
- Effective work in an organization.
- Thorough understanding of waste management/recycling

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Processing-I**
Course level: **100-199**

Semester: **First**

Course objective

- To enable the need for food processing, understand the challenges faced by the food processing units and know about the various sectors and sub-sectors of food processing.
- To outline the career opportunities in food processing
- To impart the idea of the unit operation in food processing
- To teach the basic industrial mathematics required in a food processing industry
- To understand the basic concept of different types of machinery required in the food industry and the basic line of different food industries
- To acquaint myself with the basics of food quality parameters and understand the concept of HACCP
- To impart the idea of entrepreneurship and motivate self-employability

Unit 1. Basics of Industrial Food Processing **6 Hours**

Food spoilage and causes, food processing, aims of food processing, historical developments in food processing, advantages and disadvantages of food processing, traditional and modern methods of food processing ,various sectors and sub sectors of the food processing industry,the basic problems faced by the food processing industry, relationship with other disciplines, career opportunities, significance of food processing and technology, unit operations and techniques used in unit operations

Unit 2. Basic industrial mathematics **5 Hours**

Ingredient formulation,Chemical concentration, Normality, Molarity, pH calculations, serial dilution, ppm, ppb calculation.

Unit 3. Basics of food safety and quality control **8 Hours**

Definition of food quality, quality attributes of food, subjective and objective

indices for quality, factors affecting quality in the food chain, effects of intrinsic and extrinsic properties on quality, HACCP

Unit 4. Designing of a Food Industry 8 Hours

Introduction to food plant layout and design, location and site selection for food plant, basic production lines of different food industries, bakery industry, dairy industry, fruits and vegetable processing, meat processing

Unit 5. Introduction to Food Processing Machineries 7 Hours

Basics concepts of food processing machinery, mills, ovens, boilers, freezers, mixers and kneaders, size reduction machinery, pasteurizer, packaging equipment

Unit 6 .Concept of Entrepreneurship 6 Hours

Entrepreneurship, nature and characteristics of entrepreneurship, need for entrepreneurship, becoming an entrepreneur, benefits of self-employment

Practicals

1. Basic Laboratory rules
2. Identification of laboratory glasswares and accessories
3. Identification of different instruments and machineries with their working principles
4. Instrument handling procedures.
5. Construction, operation and utility of food processing laboratory equipment.
6. Preparation of standard solutions- normality, molarity, ppm, ppb and percent calculation
7. Identification of entrepreneurial skills
8. Visit to a food service establishment to study its planning and functioning

Suggested Readings

1. Srilakshmi,B, Food Science (3rd edition), New age International (p) limited Publisher, New Delhi, 2003

2. Fellows, Food process technology: Principles and Technology, CRC publications.

3. Pierson, M. D. (2012). HACCP: principles and applications. Springer Science & Business Media.

Graduate attribute

Course Outcome

- Understanding the need for food processing
- Learning about the basic industrial mathematics
- Awareness about food safety and quality control
- Ability to design the basic concept of a processing plant
- Developing technical skills by thorough learning about the different types of machinery used in a food industry
- Motivating to become an entrepreneur

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Course name: **Bio-resources in Food Processing**

Course level: **100-199**

Semester: **First**

Course objective

- To impart the concept of raw materials in a Food Plant, Raw materials may be primary and processed.
- To impart theoretic and practical knowledge of various bioresources which are used as bulk raw materials in food processing plants. These raw materials may be of plant or animal origin.
- To introduce the concept of nutraceuticals and functional foods.
- To ready the student to understand the role of micro-organisms in Food Processing.

Unit 1: Introduction to Bioresources 6 Hours

Bioresources, types of bioresources, bioresources in food processing, the concept of raw materials and ingredients, underutilized bioresources

Unit 2: Plant-Based Bioresources in Food Processing 8 Hours

The concept of primary processing, different plant-based bio resources- raw fruits and vegetables, cereals, grains, pulses, oil seeds, tea, coffee, spices and their quality standards, selection of plant-based raw materials for the preparation of various products and their properties, the concept of nutraceuticals and functional foods.

Unit 3: Animal-Based Bioresources in Food Processing 12 Hours

Different types-meat, fish, poultry, egg, milk and their quality standards, selection of animal-based raw materials for the preparation of various products and their properties

Unit 4: Micro-organisms as Bioresources in Food Processing 6 Hours

Concept of probiotic and prebiotic, Industrially important micro-organisms, beneficial role of micro-organisms

Unit 5: Raw Materials for Food Processing 8 Hours

Raw materials quality inspection in the food industry, quality requirements

of raw materials, the concept of sampling, concept of FIFO and FEFO, management of raw materials in the food industry

Practicals

1. Identification of different plant-based bioresources and their application in Food Processing
2. Identification of different animal-based bioresources and their application in Food Processing
3. Identification of selection criteria of raw materials for food production
4. Study on health benefits imparted by traditional foods
5. Food Sampling
6. Identification of underutilized bioresources

Suggested Readings

1. Potter, N.N. and Hotchkiss, J.H. 2007. Food science. The AVI Pub. Co. Inc., Westport, Connecticut, USA.

2. Bawa. A.S, O.P Chauhan etal. Food Science. New India Publishing agency, 2013

Graduate attribute

Course Outcome

- Understanding of the selection criteria for raw materials to be used in Food Processing
- Awareness of the health benefits of different traditional foods.
- The ability of sampling and management of raw materials at different points in a Food Processing Unit
- Awareness of value-addition in foods and the importance of underutilized bio-resources for its utilization in the near future for product formulation.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Semester II

Qualification Pack: Supervisor-Food Processing Industries FIC/Q9009 (NSQF level 5)

Course name: **Food Quality and Regulation – I**

Course level: **100-199**

Semester: **Second**

Course objective

- To provide students with a comprehensive understanding of the principles and regulations governing food safety and quality maintenance.
- To familiarize students with the different international and national food regulatory agencies and their roles in ensuring food safety and quality.
- To explore the various aspects of food regulations, including labelling, packaging, hygiene practices, and quality control measures.
- To examine the potential hazards in the food supply chain and develop strategies for risk assessment and mitigation.
- To enhance students' knowledge of foodborne illnesses and their prevention, including the identification and control of microbiological, chemical, and physical hazards.
- To develop students' skills in analyzing and interpreting food quality data and applying appropriate quality control measures.
- To foster critical thinking and problem-solving abilities in addressing complex food regulatory challenges and issues.
- To promote ethical considerations and professional responsibility in complying with food regulations and maintaining food quality.
- To encourage students to stay updated with the latest advancements in food regulations and quality maintenance practices.
- To prepare students for careers in the food industry, regulatory agencies, quality assurance departments, and related fields by equipping them with the necessary knowledge and skills.

Unit 1: Basics of Food Quality **8 Hours**

Definition, quality concepts, quality attributes (safety, sensory, shelf life,

convenience, extrinsic attributes), factors affecting food quality; Definition and introduction to general terms-quality, quality control, quality assurance, total quality management in the food industry;Food standards and specifications- compulsory and voluntary standards; Objectives, functions and principles of quality control; Difference between food quality controland quality assurance, assessment of raw materials and finished products

Unit 2: Basics of Food Safety **8 Hours**

Food Safety, Hazards and Risks Meaning, definition, Types of hazards – Biological hazards, physical hazards, chemical hazards, nutrition – related diseases. Risk assessment and management; Natural toxicants in foods, pesticide residues in foods, investigation of food borne disease outbreaks

Unit 3: Pre-requisite Program **8 Hours**

Pre-requisite programs – Good Manufacturing Practices, Personal hygiene, Occupational health and safety specification, differences between PRP and OPRP, Traceability and accountability, recalling procedures, training

Unit 4: HACCP and its Principles **8 Hours**

Introduction to HACCP and its latest developments, Principles-Conducting a hazard analysis, CCP identification, establishing critical limits for each CCP, establishing CCP monitoring procedures, establishing corrective actions procedures, and establishing procedures for HACCP verification and validation, documenting the HACCP Program, Implementation of HACCP.

Unit 5: General Principles for food safety regulation atRegional/National Level **8 Hours**

Structure of Food law, Food regulation, Laws and regulations to prevent adulteration and cross contamination; hygienic practices; Overview of relevant National Bodies-APEDA, BIS, MPEDA, Spice Board, Tea Board, Coffee Board

Practicals:

1. Personal hygiene practices followed in food industries
2. Implementation of HACCP for
    a. Bakery Industry
    b. Fruits and vegetables-based industry
    c. Dairy industry
    d. Meat, fish, and poultry industry
3. Study on identification of natural toxicants in foods
4. Study on pesticide residues in foods
5. Study on assessment procedures for raw materials and finished products in the industry

Suggested Readings

1. Roessler, E. B., Amerine, M. A., Pangborn, R. M. (2013). Principles of Sensory Evaluation of Food. United States: Elsevier Science.
2. Early, R. (2012). Guide to Quality Management Systems for the Food Industry. United Kingdom: Springer US.
3. Furia, T. E. (2017). Regulatory Status of Direct Food Additives. United Kingdom: CRC Press.
4. Jellinek, G. (1985). Sensory Evaluation of Food: Theory and Practice. Germany: E. Horwood.
5. Lawless, H. T., Heymann, H. (2016). Sensory Evaluation of Food: Principles and Practices. United States: Springer New York.
6. Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.
7. Herschdoerfer, S. (2012). Quality Control in the Food Industry V2. United States: Elsevier Science.
8. Encyclopedia of Food Sciences and Nutrition. (2003). Netherlands : Academic Press.
9. Ranganna, S. (2005). Hand Book of Analysis And Quality Control For Fruit And Vegetable Products. India: Tata McGraw-Hill Publishing Company Limited.

10. Export/Import policy by Govt. of India
11. Alli, I. (2004). Food Quality Assurance: Principles and Practices. United Kingdom: Taylor & Francis.

Graduate attribute

Course Outcomes:

- By the end of this course, students should be able to:
- Explain the importance of food safety and quality maintenance in the food industry and society.
- Identify and analyze the roles and responsibilities of various food regulatory agencies at the national and international levels.
- Comprehend and apply the relevant laws, regulations, and standards governing food safety and quality maintenance.
- Evaluate and implement appropriate labelling, packaging, and hygiene practices to ensure compliance with food regulations.
- Conduct risk assessments and develop risk mitigation strategies to prevent and manage potential hazards in the food supply chain.
- Demonstrate an understanding of foodborne illnesses, their causes, and prevention methods, including the identification and control of microbiological, chemical, and physical hazards.
- Interpret food quality data, conduct quality control tests, and implement quality assurance measures to maintain food quality standards.
- Analyze and propose solutions to complex food regulatory challenges and issues, considering ethical considerations and professional responsibility.
- Stay updated with the latest advancements in food regulations, industry best practices, and emerging technologies for quality maintenance.
- Apply the acquired knowledge and skills to pursue careers in the food industry, regulatory agencies, quality assurance departments, or related fields

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Processing –II**

Course level: **100-199**

Semester: **Second**

Course Objectives:

- To provide students with a comprehensive understanding of the principles and concepts of food processing.
- To introduce students to the various unit operations involved in food processing, such as cleaning, sorting, grading, preservation, and packaging.
- To familiarize students with the different techniques and technologies used in food processing, including thermal processing, freezing, drying, fermentation etc
- To develop students' knowledge and skills in selecting appropriate processing methods based on the characteristics of different food commodities.
- To explore the factors that influence food quality during processing, such as ingredient selection, process control, and packaging.
- To examine the impact of food processing on nutritional value, sensory attributes, and shelf life of processed foods.
- To foster an understanding of food safety considerations in processing, including sanitation practices, microbial control, and regulatory requirements.
- To promote critical thinking and problem-solving abilities in addressing challenges related to food processing, such as process optimization, waste reduction, and sustainability.
- To enhance students' awareness of emerging trends and advancements in food processing technologies.
- To prepare students for careers in the food industry, research and development, quality assurance, and related fields by equipping them with the necessary knowledge and skills.

Unit 1: Unit operation in Food processing **8 Hours**

Introduction to unit operation, techniques used in unit operation-separation, size reduction, mixing and kneading, milling, drying and dehydration,frying, baking, roasting, smoking, freezing and refrigeration

Unit 2: Pre and primary processing –some basic concepts **8 Hours**

Introduction, production, harvesting and handling of fresh foods; production of raw materials for processing; primary processing-cereals, pulses,oilseeds, minimally processed fresh foods

Unit 3: Low temperature processing **12 Hours**

Refrigeration –requirements, storage changes in foods during refrigeration storage, refrigeration load; freezing and frozen storage-freezing curve and methods, changes in foods during freezing, factors determining the freezing rate, dehydro freezing, IQF and frozen fruits and vegetables

Unit 3: Heat processing **12 Hours**

Heat processing –blanching, pasteurization, sterilization, canning, dielectric heating, baking, roasting, frying, thermal processing-thermal death curve, determination of processing time and temperature; effect of heat on microorganisms and enzymes, the effect of heat on nutritional and sensory characteristics of foods

Unit 4: Food Concentration **4 Hours**

Food concentration methods, changes in food during concentration, ultrafiltration and reverse osmosis

Unit 5: Food product development **8 Hours**

Definition and classification, characterization and factors in shaping new product development, the role of ingredients and processing in defining attributes, shelf-life requirements and factors affecting shelf life and product attributes,the process of flow sheet development, concept testing

Practicals:

1. To study the different machineries involved in the unit operation and their working principles
2. study the process of freezing in food samples and prepare the freezing curve
3. Study on various primary processing techniques involved in cereals, pulses and oilseeds
4. Study on different types of freezers used in the food industry
5. Preservation of foods by various food concentration methods
6. To study the various steps involved in food product development and develop a new food product and conduct a shelf-life study of the new product

Suggested Readings

1. Fellows, P.J. (2016). "Food Processing Technology: Principles and Practice" (4th ed.). Woodhead Publishing.
2. Singh, R.P., & Heldman, D.R. (2017). "Introduction to Food Engineering" (5th ed.). Academic Press.
3. Brennan, J.G. (Ed.). (2018). "Food Processing Handbook" (2nd ed.). Wiley-Blackwell.
4. Clark, S., Jung, S., & Lamsal, B. (2019). "Food Processing: Principles and Applications" (2nd ed.). Wiley.
5. Campbell-Platt, G. (Ed.). (2016). "Food Processing Technology: Principles and Practice" (3rd ed.). Wiley-Blackwell.
6. Saravacos, G.D., &Kostaropoulos, A.E. (Eds.). (2015). "Handbook of Food Processing Equipment" (2nd ed.). Springer.

Graduate attribute

Course Outcomes:

- Understand the fundamental principles and concepts of food processing and its significance in the food industry.
- Identify and describe the various unit operations involved in food

processing and their respective roles in transforming raw materials into processed food products.

- Evaluate and select appropriate processing techniques and technologies for different food commodities based on their characteristics and desired outcomes.
- Demonstrate an understanding of the factors influencing food quality during processing and apply appropriate process control measures to maintain quality standards.
- Assess the impact of food processing on the nutritional composition, sensory attributes, and shelf life of processed foods.
- Apply food safety practices and regulatory requirements to ensure the microbiological safety and quality of processed food products.
- Analyze and propose solutions to optimize food processing operations, reduce waste, and improve sustainability in the food industry.
- Stay updated with the latest advancements and emerging trends in food processing technologies.
- Utilize acquired knowledge and skills to contribute effectively to food industry sectors such as research and development, production, and quality assurance.
- Apply critical thinking and problem-solving skills to address challenges and make informed decisions related to food processing.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Course name: **Food Plant Layout and Utilities**

Course Level: **100-199**

Semester: **Second**

Course objective

- To impart the concept of plant layout
- To impart theoretical and practical knowledge of various types of plant layout
- To understand the selection criteria of the location of plant layout.
- To understand the different symbols and flow diagrams in plant layout
- To impart knowledge on food plant sanitation
- To understand different food plant utilities

Unit 1: Plant layout **8 Hours**

Plant layout –Definition, and principles, factors in planning layouts; Methods of layout planning –Unit areas concept, two –dimensional layouts, Principles of plant layout

Unit 2: Types of plant layout **8 Hours**

Types of plant layout –salient features of horticultural, rice, maize, pulses, oil seeds, poultry, fish, meat, milk and milk product plants; experimentation in the pilot layout: size and structure of the pilot plant, minimum and maximum size, types and applications

Unit 3: Location selection criteria **8 Hours**

Location selection criteria –Plant location, factors in selecting a plant, selection of the plant site, preparation of the layout; Selection of processes – Comparison of different processes, batch versus continuous operation. Plant capacity –Equipment design and specifications, scale–up in design, safety factors, specifications, and materials of construction

Unit 4: Flow Diagrams and Symbols **8 Hours**

Flow diagrams-qualitative and quantitative flow diagrams; design; Symbols used for food plant design and layout: introduction, valves, line symbols, fluid handling, heat transfer, mass transfer; symbols used for food plant design and layout: storage vessels, conveyors and feeders, separators, mixing and communication and process control and instrumentation symbols.;

Unit 5: Food plant Sanitation **3 Hours**

Food plant sanitation-Environmental protection, regulations, CIP, COP

Unit 6: Food Plant Utilities **8 Hours**

Food plant utilities: process water, steam, electricity, plant effluents;Selection of equipment material and energy balance, equipment design and selection, Process and controls-Control systems, instrumentation control, maintenance

Practicals:

1. Study of plant layout
2. Preparation of different food plant layout
3. Study of different symbols and flow diagrams used in plant layout
4. Study of food plant utilities
   a. process water
   b. steam,
   c. electricity,
   d. plant effluents

Suggested Readings

1. Moerman, F. (2010). "Food Plant Engineering Systems" (2nd ed.). CRC Press.
2. Lopez-Gomez, A., & Barbosa-Cánovas, G.V. (2016). "Food Plant Design" (1st ed.). CRC Press.
3. Baker, C.G.J., & Stier, R.J. (Eds.). (2018). "Handbook of Food Factory

Design" (1st ed.). Wiley.
4. Cramer, M.M., & Nelson, P.E. (2012). "Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices" (2nd ed.). CRC Press.
5. Berk, Z. (2013). "Food Process Engineering and Technology" (2nd ed.). Academic Press.
6. Maroulis, Z.B., &Saravacos, G.D. (2013). "Food Plant Economics" (1st ed.). CRC Press.

Graduate attribute

Course Outcome

- Understanding of the plant layout and its different types
- Awareness of the selection criteria of plant location
- Awareness of using different symbols and flow diagrams used in plant layout
- Understanding of food plant sanitation and different food plant utilities

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester III

Qualification Pack: Food Microbiologist FIC/Q7603 (NSQF level 6)

Course name: **Food Quality and Regulation – II**

Course Level: **200-299**

Semester: **Third**

Course Objectives:

- To provide students with a comprehensive understanding of the principles, practices, and regulations governing the quality and safety of food
- To equip students with the knowledge and skills necessary to assess, monitor, and maintain food quality standards throughout the food supply chain
- To impart the roles and responsibilities of FSSAI and other national standards, also introduce various initiatives taken by FSSAI
- To understand students about the general principles for food safety regulations at both the national and international level

Unit 1: Basic Concept of Food Laws and Regulations **12 Hours**

Food laws and regulations, concepts of codex Alimentarius, ISO series, GMP, GHP, 5S,4M, AIB, six sigma, PCI, SOP, Checklist, audit system, documentation; FSSAI, the role of various food standards in India- PFA, FPO, AGMARK and BIS.Recent development in food quality regulation, MOFPI and schemes for Establishing food industries in India

Unit 2: FSSAI **12 Hours**

FSSAI:-Introduction to the law, Salient features of Food Safety& Standards Act, 2006, Structure of FSSAI, Administrative set up at the State level and central level, Licensing and registration, Licenses granted by Central Licensing Authority, Documents/ Format required for Registration/ Licensing, Food Laboratories:Accreditation of Food Laboratory, Referral Laboratories, Hierarchy of Food Safety Authorities; Food Labelling;

Promoting safe and wholesome food (Eat Right India, Food Fortification, Clean street food Hub, RUCO, BHOG and various other social and behavioural change initiatives taken by FSSAI)

Unit 3: General Principles for food safety regulation at the internationallevel **12 Hours**

FAO, World Health Organization (WHO), Joint FAO/WHO Food Standards Program -JECFA, JEMRA, JMPR;Codex Alimentarius Commission- Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India, World Trade Organization (WTO), Principles of the trading system. SPS and TBT, differences between SPS & TBT; WTO agreement on the application of SPS

Unit 4: Standard Operating Procedures **12 Hours**

Defining Standard operating procedure: purpose, Format, developing and implementing; effective writing; SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, personal hygiene, facility and equipment. Systems in laboratory accreditation, GRN making, Invoice making and maintenance

Practicals:

1. Identification of Food Logos
2. Study on food Labelling
3. Preparation of SOP for
    i. Receiving raw materials
    ii. Finished products
4. Preparation of GRN, Invoice
5. Preparation of checklist
6. Study on 5S Practices in the food industry
7. Visit a food industry and prepare a report on various quality laws and regulations followed

Suggested Readings

1. Amerine, M.A., Pangborn, R.M., &Rosslos, E.B. (2015). "Principles of Sensory Evaluation of Food." Academic Press.

2. Early, R. (2001). "Guide to Quality Management Systems for Food Industries." Blackie Academic.

3. Jellinek, G. (2019). "Sensory Evaluation of Food - Theory and Practice." Elsevier.

4. Macrae, R., Roloson, R., & Sadler, M.J. (2014). "Encyclopedia of Food Science & Technology & Nutrition." Academic Press.

5. Ranganna, S. (2015). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products." Tata McGraw-Hill.

6. InteazAlli (2018). "Food Quality Assurance: Principles and Practices." CRC Press.

7. Vasconcellos, J.A. (2003). "Quality Assurance for the Food Industry: A Practical Approach." CRC Press.

Graduate attribute

Course Outcome

- Understand the fundamental concepts and principles of food quality and safety.
- Identify and evaluate the factors that affect food quality, including raw materials, processing, storage, and distribution.
- Comprehend the regulatory frameworks and guidelines related to food quality and safety at national and international levels.
- Assess and implement quality control and quality assurance programs in food production, processing, and handling.
- Evaluate the impact of food quality and safety on public health, consumer perception, and the economy.
- Develop effective communication and problem-solving skills to address food quality and safety issues.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Chemistry-I**

Course Level: **200-299**

Semester: **Third**

Course objective

- To demonstrate a sound knowledge of the chemical properties of food components (water, carbohydrates, proteins, enzymes)
- To understand the relationship between the properties and structures of chemical components and ingredients to the functional and chemical properties of foods.
- To understand the physical and chemical interactions between food components and their impact on quality.
- To learn and understand the chemistry concerningthe role and functionality of constituents of the food.

Unit 1: Water **6 Hours**

Structure of water and ice, Physical properties of water, Types of water in food, Water holding capacity and water binding capacity, the concept of Water activity and relation to food stability

Unit 2: Carbohydrates **10 Hours**

Classification, Structure, Properties, sourcesandReactions of Carbohydrates; Reducing & Non-reducing sugar; Glycosidic bonds; Structure of starch, cellulose, glycogen, pectin.; Difference between amylose & amylopectin; Gelatinization and Retrogradationof starch;Chemical Reactions of Carbohydrates, Browning reactions - Enzymatic & Nonenzymatic browning

Unit 3: Proteins **10 Hours**

Classification of amino acid- structure, essential and non-essential amino acids, Peptide bond; biological roles of protein; Classification of protein according to shape; classification of protein according to composition and solubility Structure of protein, chemical bonds involved in protein structure;

Physical-chemical properties of proteins; Denaturation of protein, sources of food proteins

Unit-4: Enzymes **10 Hours**

Introduction, classification of enzyme, enzyme kinetics, enzyme activity, factors affecting enzyme activity. Enzyme inhibitors- reversible (Competitive, Noncompetitive & Uncompetitive), enzyme activity- zymogens inactivation, covalent modification and feedback inhibition; Enzyme immobilization and its application; Enzymes used in the food industry

Practicals:

1. Determination of acidity and pH
2. Determination of moisture by drying method
3. Carbohydrates-qualitative test, estimation of reducing sugar, total sugar
4. Determination of protein by the Kjeldahl method
5. Study on water activity of different foods
6. Study on various techniques of enzyme immobilization

Suggested Readings

1. Belitz, H.-D., Grosch, W., &Schieberle, P. (2016). "Food Chemistry" (4th ed.). Springer.
2. Fennema, O. (2013). "Food Chemistry" (4th ed.). CRC Press.
3. Coultate, T.P. (2009). "Food: The Chemistry of Its Components" (6th ed.). Royal Society of Chemistry.
4. Damodaran, S., Parkin, K.L., & Fennema, O.R. (Eds.). (2017). "Fennema's Food Chemistry" (5th ed.). CRC Press.
5. Hui, Y.H., et al. (Eds.). (2021). "Food Chemistry: Principles and Applications" (2nd ed.). Wiley.
6. Nielsen, S.S. (2020). "Food Analysis" (5th ed.). Springer.
7. Pomeranz, Y., & Meloan, C.E. (2000). "Food Analysis: Theory and Practice" (3rd ed.). Springer.

Graduate Attribute

Course Outcome

- Students will get introduced to Food Chemistry
- Students will be able to understand the basic chemistry of water, carbohydrates, proteins and enzymes
- Students will learn about the classification and properties of carbohydrates, proteins and enzymes
- They will know different tests used for the estimation of carbohydrates, and protein in the food industry

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Microbiology – I**

Course Level: **200-299**

Semester: **Third**

Course objective

- To enable the students to gain an insight into basic aspects of food microbiology.
- To understand the advanced techniques in the microbial analysis of food.

Unit-1: Introduction to food microbiology **8 Hours**

Discovery and History of microbiology, current status, the role of food microbiology, sources of microorganisms in food, Changes caused by microorganisms in food, Growth and survival of microorganisms in foods, biological, chemical and physical changes caused by microorganisms, physical and chemical methods to control microorganisms

Unit 2: Microscope **4 Hours**

Introduction, types of microscopes, parts of a microscope, Maintenance of the Microscope

Unit-3: Characteristics of Microorganisms **8 Hours**

Classification of microorganisms, nomenclature, morphology - yeast and moulds, bacterial cells, viruses; important microbes in food, microbial growth characteristics - Microbial reproduction, nature of growth in food

Unit-4: Culture Media **8 Hours**

Introduction to the microscope, culture media – differential media, selective media, transport media, pure culture, microbial culture techniques, Pure culture techniques – pour, spread and streak plate method; thermal inactivation of microbes; the Basic concept of F, Z and D value

Unit 5: Staining Techniques **5 Hours**

Staining characteristics, Basic principle of simple and grams staining process, mordant and its action, acidic and basic dyes

Unit 6: Microbial Growth in Food **7 Hours**

Microbial growth characteristics, Factors affecting microbial growth – temperature, pH, oxygen concentration, water activity, Psychrophiles, halophiles, mesophiles, Thermophiles; Growth curve – lag, log, the stationary, decline phase

Practicals

1. Introduction to Food Microbiology and Laboratory Safety
2. Operation and use of laboratory equipment
    a. Autoclave
    b. Laminar airflow
    c. Hot air oven
    d. Incubator
    e. Microscope
    f. Colony counter
3. Functioning and use of a compound microscope
4. Cleaning and sterilization of glassware
5. Preparation of cotton plug
6. Preparation and sterilization of Culture media
7. Pure culture techniques-Pour plate spread plate and streak plate
8. Simple staining, Gram Staining, Negative staining
8. Morphological study of bacteria and fungi using permanent slides

Suggested Readings

1. Doyle, M.P., & Buchanan, R.L. (Eds.). (2013). "Food Microbiology: Fundamentals and Frontiers" (4th ed.). ASM Press.
2. Jay, J.M., Loessner, M.J., & Golden, D.A. (Eds.). (2020). "Modern Food Microbiology" (8th ed.). Springer.

3. Adams, M.R., & Moss, M.O. (2019). "Food Microbiology" (4th ed.). Royal Society of Chemistry.

4. Frazier, W.C., Westhoff, D.C., & Vanitha, N.M. (2020). "Food Microbiology" (8th ed.). McGraw-Hill Education.

5. Ray, B., & Bhunia, A.K. (2017). "Fundamentals of Food Microbiology" (5th ed.). CRC Press.

6. Juneja, V.K., &Sofos, J.N. (Eds.). (2019). "Pathogens and Toxins in Foods: Challenges and Interventions" (2nd ed.). ASM Press.

7. Montville, T.J., & Matthews, K.R. (Eds.). (2014). "Food Microbiology: An Introduction" (4th ed.). ASM Press.

Graduate attribute

Course Outcome

- Students will develop knowledge and understanding of different food microorganisms and know different techniques used to detect microorganisms
- Students will develop knowledge and understanding of different food microorganisms and different techniques used in their detection.
- Students will enable to know the basics of microbiology.
- Students will understand the causes of food spoilage of different foods and their type

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):
Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University
Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester IV

Course name: **Food Quality and Regulation – III**

Course Level: **200-299**

Semester: **Fourth**

Course objective

- To explore the various aspects of food regulations, including labelling, packaging, hygiene practices, and quality control measures.
- To familiarize students with the different tools and techniques required for total quality management in a food processing industry
- To introduce students to the concept of audit, and preparation of audit reports for different audit exercises
- To develop students' skills in handling customer-related problems
- To foster critical thinking and problem-solving abilities in addressing complex food regulatory challenges and issues.
- To promote ethical considerations and professional responsibility in complying with food regulations and maintaining food quality

Unit1: Food Labelling **6 Hours**

General concept and importance of labelling; Nutrition Labeling, Health Claims, Nutrition Claims, Nutrient definitions allowed on food labels. Laws related to food labelling and packaging, Indian Institute of Packaging

Unit 2: Total quality management- Tools and Techniques **14 Hours**

Total quality management (TQM)-Definition, features and importance; Total Quality Management (TQM) in Food Industry. Introduction to quality management -Definition, Scope, Significance and Objectives of Quality management;Seven old and new Quality management tools, Kaizen Principle, Statistical process control – Mean & range chart, P chart and C

chart, Seven deadly wastages, PDCA cycle, Quality circle, Continuous improvement of productivity -Six Sigma Concept.

Unit 3: Audit **6 Hours**

Introduction to audit, Types of audit, conducting open meeting and close meetings in auditing, preparation of audit reports for different departments-audit exercise

Unit 4: Country-Specific Standards **6 Hours**

European Committee for Standardization (CEN), PAN American Standards Commission (COPANT), Euro-Asian Council for Standardization, FDA, EPA, EU, ASEAN, EFSA (European Food Safety Authority)

Unit 5: Handling customers and complaints **6 Hours**

Definition- customer, consumer, food chain, types of complaints, handling customer, evaluation and solution of a problem, report making, CAPA.

Practicals:

1. Perform audit and report-making using Excel
2. Study on complaint handling and report making
3. Preparation of SOP for
    a. Receiving raw materials
    b. Finished products
4. Preparation of GRN, Invoice
5. Preparation of checklist
6. Study on 5S Practices in the food industry
7. Visit a food industry and prepare a report on various quality laws and regulations followed

Suggested Readings

1. Roessler, E.B., Amerine, M.A., & Pangborn, R.M. (2013). "Principles of Sensory Evaluation of Food." Elsevier Science.
2. Early, R. (2012). "Guide to Quality Management Systems for the Food Industry." Springer US.
3. Furia, T.E. (2017). "Regulatory Status of Direct Food Additives." CRC Press.

4. Lawless, H.T., & Heymann, H. (2016). "Sensory Evaluation of Food: Principles and Practices." Springer New York.
5. Ranganna, S. (2005). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products." Tata McGraw-Hill Publishing Company Limited.
6. Moss, M.O., & Adams, M.R. (2019). "Food Microbiology" (4th ed.). Royal Society of Chemistry.

Graduate attribute

Course Outcomes:

- Evaluate and implement appropriate labelling, packaging, and hygiene practices to ensure compliance with food regulations
- Familiarizing students with the different tools and techniques required for total quality management in a food processing industry
- Preparation of audit reports for different audit exercises to be performed in a food industry
- To foster critical thinking and problem-solving abilities in dealing with customer-related problems

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Chemistry – II**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

To enable the students to:

- Understand the relationship between nutrition and human well-being.
- Know and understand the functions and chemical structure of the required component in our body.
- To know the major and minor components of foods.
- To know the composition and properties of food.

Unit 1: Lipids **10 Hours**

Classification of lipids according to chemical composition, fatty acids; saturated and unsaturated fatty acids; Fatty acids-essential fatty acids, structure, chemical reactions of lipids; Physical properties – Refractive index, melting point, smoke, flash and fire point, Chemical properties-Saponification value, iodine value, acid value, Peroxide value, Rancidity: Hydrolytic and oxidative rancidity; mechanism of auto-oxidation of fat;Antioxidants- natural and synthetic.

Unit 2: Food Pigments **4 Hours**

Classification of food pigments, Chlorophyll, Myoglobin, anthocyanins, flavonoids, betalains, quinones and xanthones, carotenoids, curcumin

Unit 3: Vitamins **4 Hours**

Classification of Vitamins; sources, functions and Vitamin, deficiency diseases in humans, causesfor losses of vitamins in foods, daily recommended allowance

Unit 4: Minerals **4 Hours**

Classification of Minerals, sources, functions, nutritional aspects of minerals, Bioavailability

Unit 5: Food Additives **8 Hours**

Definition, the difference between food additives and adulterants; Permitted food additives in foods – Antioxidants, natural and chemical antioxidants,

permitted antioxidants in foods, Natural and synthetic colours, application of colours in the food industry, restriction on the use of colours in foods; Flavoring agents:nature identical flavours, artificial flavouring substances; function of emulsifiers and stabilizers in foods, permitted emulsifiers and stabilizers used in foods. Natural and chemical sweeteners,nutritive additives

Unit 6: Aroma Compound **4 Hours**

Properties of Aromatic Compounds, Classification of Aromatic Compounds, Analysis of Aroma of Food

Practical:

1.Determination of ash/mineral in a food sample.

2.Study on crude fat analysis in food samples.

3. Determination of vitamin C content in food samples.

5.Study on the estimation of – Saponification value, iodine value, acid value, peroxide value and iodine number of food sample

7. Study of food pigments present in different foods

8. Study of different food additives

Suggested Readings

1. Gunstone, F.D., John L. Harwood, J.L., & Fred B. Padley, F.B. (2007). "The Lipid Handbook" (3rd ed.). CRC Press.
2. Pokorný, J., &Yanishlieva, N. (Eds.). (2006). "Autoxidation in Food and Biological Systems." CRC Press.
3. Akoh, C.C., & Min, D.B. (2008). "Food Lipids: Chemistry, Nutrition, and Biotechnology" (3rd ed.). CRC Press.
4. Nielsen, S.S. (2017). "Food Analysis" (5th ed.). Springer.
5. Skerrett, P.J., & Willett, W.C. (Eds.). (2014). "Essential Concepts in Food Science." CRC Press.
6. Branen, A.L., Davidson, P.M., & Salminen, S. (Eds.). (2019). "Food Additives" (2nd ed.). CRC Press.
7. Gropper, S.S., Smith, J.L., &Carr, T.P. (2017). "Advanced Nutrition and Human Metabolism" (7th ed.). Cengage Learning.
8. Whitney, E.N., Rolfes, S.R., Crowe, T., & Cameron-Smith, D. (2019). "Understanding Nutrition: Australia and New Zealand Edition" (4th ed.). Cengage Learning.
9. Food Safety and Standards Authority of India (FSSAI). (2016). "Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011." FSSAI.
10. Joint FAO/WHO Expert Committee on Food Additives (JECFA).

(2021). "Compendium of Food Additive Specifications." Food and Agriculture Organization (FAO) of the United Nations.

Graduate attribute

Course outcome:

- They will learn about the classification of lipids, Rancidity, and Autoxidation of fats.
- They will acquire knowledge about the basics of Lipids, vitamins, minerals, pigments and additives
- They will learn about different food additives used in the food industry
- Gain knowledge of the core component of a required nutrient.
- Increased awareness of the diet.
- Know about the permissible limit of food additives.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Microbiology – II**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

- To acquire elementary knowledge about micro-organisms.
- To develop an understanding of the role of microorganisms in the environment, Industry and in the maintenance of health.
- To understand the importance of safe handling of food and disease caused by microorganisms.
- To acquire knowledge about harmful and beneficial microorganisms.

Unit 1: Study of Different Microorganisms **8 Hours**

Cellular, A cellular microorganisms;Morphological and Ultra-structure of a microbial cell (Gram-positive and Gram-negative bacterial membrane, spore, pili, flagella),

Unit 2:Microbial Food Products for human consumption **8 Hours**

Single Cell Protein (SCP), Microbial SCP production by bacteria, algae, mushroom cultivation, the concept of probiotics, prebiotic, symbiotic and bioactive foods; fermented foods

Unit 3: Microbial Agents of Food-Borne Illness **8 Hours**

Foodborne infections and intoxication, food poisoning, microbial toxins, Gram Negative and Gram-positive food-borne pathogens

Unit 5: Spoilage in Different Food Groups **8 Hours**

Food spoilage - Introduction, sources of microorganisms in foods, spoilage in cereals, vegetables and fruits, meat, eggs, poultry, fish, milk and milk products, canned foods, nuts and oil seeds, fats and oil

Unit 6: Beneficial Uses of Microorganisms **8 Hours**

Microorganisms used in food fermentation, intestinal bacteria and probiotics, food bio preservatives of bacterial origin, food ingredients and

enzymes of microbial origin. Economic importance of microorganisms

Practicals:

1. Standard Plate Count of different food samples
2. Estimation of Microbial load in a food sample and plot a growth curve
3. Isolation and Identification of
    i. Escherichia coli
    ii. Yeast and mould
    iii. coliform
4. Estimation of Total plate count of food samples
5. Microbial study of food samples stored at different environmental conditions
6. Assessment of surface sanitation by swab/rinse method
7. Preparation of fermented foods
8. Conduct an industrial visit and prepare a report on the scope of microbiology in the food industry

Suggested Reading:

1. Cappuccino, J.G., & Sherman, N. (2018). "Microbiology: A Laboratory Manual" (12th ed.). Pearson.
2. Harrigan, W.F., & McCance, M.E. (2016). "Laboratory Methods in Food Microbiology" (3rd ed.). Academic Press.
3. Atlas, R.M. (2010). "Handbook of Microbiological Media" (4th ed.). CRC Press.
4. Lee, G. (2016). "Microbiology and Molecular Biology in Foods" (2nd ed.). Wiley-Blackwell.
5. Harrigan, W.F., & Wilkinson, L. (2014). "Food Microbiology: Fundamentals and Frontiers" (5th ed.). ASM Press.
6. Beuchat, L.R., Doyle, M.P., & Montville, T.J. (Eds.). (2013). "Food Microbiology: Fundamentals and Frontiers" (4th ed.). ASM Press.
7. Golden, D.A., & Bishop, P.A. (Eds.). (2018). "Introduction to Laboratory Safety" (3rd ed.). CRC Press.

Graduate attribute

Course Outcome:

- They will learn how to clean equipment and sterilize them.
- They will learn about the handling of a compound microscope.
- They will understand different staining methods for bacteria and their

importance. They will understand the difference between bacteria and fungi.

- They will learn different methods used for the isolation and enumeration of bacteria from food samples.
- Students will learn how to use an instrument like a microscope, autoclave, membrane filters, laminar airflow etc.
- Helps them to acquire jobs in microbiological labs.
- They will know what will cause food-borne illness.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Analysis: Tools and Techniques**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

- To provide conceptual knowledge about sampling and quality of the foods to students.
- To provide Hands-on determination of Moisture content of food, protein content of food etc.
- To provide Hands-on determination of pH and Titratable acidity.
- To provide Hands-on determination of ash content, fat content, pigments, vitamins etc.

Unit 1: Concept of Sampling **8 Hours**

Sampling: - Terminologies in sampling, Selection of sampling procedures, Factors affecting the choice of the sampling plan, Sampling procedures probability and non – probability sampling

Unit 2: Analysis of pH and Acidity **8 Hours**

pH and Titratableacidity: - Acid-base equilibrium, General principles, Reference electrode, Indicator electrode, Buffers, titration, Indicators, standard alkali, standard acid, sample analysis, and the acid content in food.

Unit 3: Analysis of Moisture **8 Hours**

Moisture Assay: - Importance of moisture assay, forms of water in food, Oven drying methods – forced draft oven, vacuum oven, microwave oven. Chemical method – Karl Fischer titration

Unit 4: Analysis of Carbohydrates **10 Hours**

Importance of analysis of carbohydrates, sample preparation, Chemical methods for the analysis of carbohydrates: Nelson- Somogyi method, DNS method, Phenol Sulfuric acid method and Anthronemethod; Importance of dietary fibre, major components of dietary fibre, principle, procedure and application of total soluble and insoluble fibre

Unit 5: Analysis of Fats and Proteins **10 Hours**

Continuous solvent extraction methods: Goldfish method, Semi-continuous solvent extraction methods: Soxhlet method, Discontinuous solvent extraction method: Mojonnier method. Non-Solvent wet extraction method: Gerber method; Analysis of Proteins: - Importance of protein analysis, principle and procedure of Kjeldahl method, Biuret and Lowry method

Unit 6: Analysis of Ash, Vitamins and Pigments **8 Hours**

Importance of ash in food analysis, sample preparation, Dry ashing, wet ashing, Soluble and insoluble ash in water, ash insoluble in acid, Analysis of Minerals: - Importance of analysis of minerals; Analysis of Vitamins - Importance of analysis of vitamins; 2, 6 Dichlorophenol indophenols titrimetric method for vitamin C**;** Pigment analysis- Importance of color and food quality; Presence and distribution of pigments in foods. Analysis of chlorophyll, carotenoids, anthocyanins

Unit 7: Sensory Analysis **3 Hours**

Sensory analysis-definition, methods of sensory evaluation

Unit 8: Food Adulteration **3 Hours**

Adulteration and adulterant, types of adulteration, methods of detecting adulterants in foods

Practical:

1. Determination of pH and acidity of the given sample.
2. Determination of moisture content of different samples
3. Analysis of carbohydrates- nelson-somogyi method, DNS Method, Anthrone method
4. Analysis of dietary fibre
5. Estimation of fat content
6. Detection of adulterants in different foods
7. Estimation of vitamin C from food sample
8. Sensory analysis of foods by different methods

Suggested Readings

1. Nielsen, S.S. (2017). "Food Analysis" (5th ed.). Springer.
2. Belitz, H.-D., Grosch, W., &Schieberle, P. (Eds.). (2013). "Food Chemistry" (4th ed.). Springer.

3. Lees, M. (Ed.). (2019). "Food Analysis: Theory and Practice" (2nd ed.). Springer.

4. Wrolstad, R.E., Acree, T.E., Decker, E.A., Penner, M.H., Reid, D.S., Schwartz, S.J., Shoemaker, C.F., Smith, D., &Sporns, P. (2019). "Handbook of Food Analytical Chemistry" (2nd ed.). Wiley.

5. Downey, G. (Ed.). (2021). "Advances in Food Analysis Techniques" (2nd ed.). CRC Press.

6. Otles, S., &Cagindi, O. (Eds.). (2014). "Handbook of Food Analysis Instruments" (2nd ed.). CRC Press.

7. Paolucci, M., & Liuzzo, G. (2018). "Advanced Methods for Food Analysis" (1st ed.). Elsevier.

Graduate attribute

Course Outcomes:

- On the successful completion of the course, a student will be able to gainhands-on experience and training on the determination of proximate analysis.
- Understand the detection of adulteration in food samples.
- To provide Hands-on qualitative and qualitative evaluation of food samples.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester V

Qualification Pack: **Production Manager FIC/Q9003 (NSQF level 7)**

Course name: **Food Preservation Technology**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To acquaint the students with fundamental principles and various techniques of food preservation.
- To understand the information about food spoilage and why preservation is required.
- To gain knowledge about different techniques such as freezing, sterilization, canning etc.
- To obtain knowledge about the intrinsic factor and extrinsic factors that affect food spoilage.
- To know the emerging technologies in food preservation

Unit 1: Introduction to food preservation **8 Hours**

Definition and significance of food preservation, factors influencing food spoilage and deterioration, traditional food preservation methods, food preservatives: natural and chemical. Perishable, non-perishable food, causes of food spoilage.

Unit 2: Food preservation by low temperature **8 Hours**

Freezing and refrigeration: Introduction to refrigeration- cold storage, freezing. Principle of freezing, changes occurring during freezing, types of freezing- slow and quick. Introduction to thawing, changes during thawing and its effect on food.

Unit 3: Food preservation by high temperature **8 Hours**

Thermal Processing: Commercial heat preservation methods – Sterilization, commercial sterilization. Pasteurization: principles of pasteurization, HTLT, LTLT, Blanching. Canning and bottling: Principles of canning and bottling.

Unit 4: Food preservation by moisture control **8 Hours**

Drying: Definition of drying, preservation, sun drying. Dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve - names of types of driers used in the food industry. Evaporation: Definition, factors affecting evaporation, names of evaporators used in food industry.

Unit 5: Food preservation by irradiation **4 Hours**

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation- mechanism of action, uses of radiation processing in food industry.

Unit 6: Emerging technologies in food preservation **8 Hours**

High pressure processing (HPP), Pulsed electric field (PEF) processing, Ohmic heating, Ultrasound processing, Membrane processing, Microwave, Nanotechnology in Food

Practicals

1. Identification of Class I and Class II preservatives.
2. Study on storage stability of foods under different environmental conditions.
3. Comparison on shelf life study of foods by application of natural and chemical preservatives.
4. Food preservation by low temperature- freezing, refrigeration.
5. Food preservation by high temperature-sterilization, pasteurization.
6. Demonstration of food preservation by canning.
7. Blanching of different fruits and vegetables.
8. Adequacy of blanching.

Suggested Readings

1. Food Processing and Preservation- Subbulaksmi G., and Udipi S.
2. Principles of Food Science, Vol. II- G. Borgstron, Mc. Millan Co. Ltd. London.
3. Principles of food preservation Part I& II- Owen R. Fenemma. 4
4. Food Science- Potter, CBS publishers.
5. The technology of Food Preservation - N.W. Desroiser and N.W. Desrosier
6. Introduction to Food Science & Technology- G.P. Stewart & M.A. Amerine
7. Food Processing Operations Vol. III -M.A. Joslyn and J.J. Heild.
8. Preservation of Fruits and Vegetables- Giridhari Lal, G.S. Siddappa, and G.L. Tondon

Graduate attribute

Course Outcomes:

- Students will enable to understand different food preservation techniques, and processes.
- Students will enable to extend the shelf life of different food products by using the various methods of food preservation
- Students will be able to learn the principles and methods involved in the processing of perishable as well as Non-perishable foods and their effect.
- Acquaint the knowledge of different techniques for food preservation.
- Get knowledge about the various root cause of food spoilage.
- Develop skills in the application of increasing the shelf life of the product.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Fermentation Technology**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To understand the principles of food fermentation technology
- To study the types of starters used in the Food Industry
- To study the production of various fermented foods, alcoholic and non-alcoholicbeverages.

Unit 1: Introduction to Fermentation technology **6 Hours**

History, Scope and Development of Fermentation technology; Isolation and screening of industrially important microorganisms – primary and secondary screening; Maintenance of Strains; Strain improvement.

Unit 2: Fermentation media **8 Hours**

Natural and Synthetic media; Basic components of an medium (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Types of fermentation on the basis of medium used; formulation and process optimization; Role of buffers in media; Process of aeration, and agitation.

Unit 3: Fermenter design **8 Hours**

Types of fermentation on the basis of Fermenter design; Basic design of Fermenter, Types of Fermenters; Scale up study and Product development; Upstream and Down-stream processing and Product recovery.

Unit 4: Production of Microbial Products **8 Hours**

Production of alcohol; Organic acid – Citric acid; Vinegar, Cell immobilization, microbial transformation, sewage treatment, biosensor, bioleaching and effluent treatment.

Unit 5: Fermented foods **8 Hours**

Types of fermentation on the basis of end products; Fermented dairy products, alcoholic beverages; methods of manufacture for sauerkraut, tempeh, miso, soya sauce; traditional fermented foods from North east region of India and their manufacturing methods .

Practicals

1. Demonstration of Fermenters- design, construction and working principle.

2. Study of different types of Fermenters.

3. Preparation of various fermented foods

   a. Alcoholic beverages.
   b. Fermented Dairy products .

4. Preparation of sauerkraut.

5. Preparation of bamboo shoot, fermented fish of north east origin.

Suggested Readings

1. Robert W Hutkins. 2006. Microbiology and technology of fermented foods. WileyBlackwell
2. Y. H. Hui and E. OzgulEvranuz. 2012. Handbook of plant-based fermented foods and beverage technology. CRC press

Graduate attribute

Course Outcome:

- Students will be able to understand the importance of fermentation and different microorganisms associated with foods.
- Students will have an idea about sewage treatment.

- Students will gain knowledge about regional and international fermented foods and their benefits.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Technology for Plant Products**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To teach the importance of horticultural crops, fruits & vegetables, tea, coffee and spices etc.
- To understand the basic composition and structure of fruits & vegetables, oil seeds, cereals and legumes
- To impart technical knowledge on processing into value-added products.
- To teach the importance of preservation techniques and increase self-life.

Unit 1: Industrial Processing of Fruits and Vegetables **12 Hours**

Chemical composition and nutritive value of fruits and vegetables, preparing fruits and vegetables for processing; preparation and maintenance of work area and process machineries; Post harvest losses of fruits and vegetables and causal factors; maturity indices of fruits and vegetables; climacteric and non-climacteric fruits; packaging of whole fruits and vegetables; post harvest physical and chemical treatment to enhance the shelf life of fruits and vegetables; microbiological spoilage of fruits and vegetables and analysis of products.; FPO Specifications and processing for jam, jelly ketchup, Juice, Squash, cordial, nectar, RTS, Crush , puree, paste, etc.

Unit 2: Cereals and cereals product **12 Hours**

Structure and nutritional composition of different types of cereals; Importance of cereals for nutrition; Technologies for cereal processing; Rice types, Physical properties of rice, cooking properties, parboiling, milling, rice products and byproducts; wheat – types, milling of wheat, wheat flour, wheat based products; millet and millet based products

Unit 3: Pulses, Legumes and Oil-seeds processing **8 Hours**

Present status and future prospects of legumes and oilseeds; Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds Chemical composition, nutritional value and anti-nutritional compounds in legumes and oilseeds; Methods of removal of anti- nutritional compounds; Pulse and legumes processing; Factors affecting milling quality and quantity; Oil seed milling; Refining of oils; Hydrogenation of oils, rancidity in oil

Unit 4: Industrial Processing of Tea, Coffee and Spices **12 Hours**

Tea plant, types of tea, green tea, black tea, white tea, oolong tea, yellow tea, instant tea, CTC Tea, orthodox tea flavored tea, industrial processing techniques, tea fermentation and compounds, quality of tea, health effects, Assam tea, storage of tea, innovative tea-based products, tea-wine, kombucha, etc.; Coffee plant, different types, processing, quality analysis; Major international quality specifications of spices. Spice processing, Value-added spice products: Spice volatile oils, spice oleoresins.

Practicals

1. Estimation of total soluble solids (TSS).

2. Preparation of fruit jam/ fruit jelly/marmalade.

4. Preparation of fruit juice/squash/cordial/nectar.

5. Preparation of pickle/mixed pickle.

6. Preparation of tomato products-sauce, puree, ketchup.

7. Physical characteristics of rice- bulk density, true density, porosity, 1000 kernel length and weight.

8. Cooking quality of rice- minimum cooking time, elongation ratio, water uptake ratio.

9. Processing of tea leaves.

10. Quality analysis of different spices.

11. Demonstration of coffee processing.

Suggested Readings

1. Post-harvest physiology, handling and utilization of tropical and subtropical fruits and vegetables by E. B. Pantastico, AVI Publishing company, INC

2. Post-harvest technology of fruits and vegetables: handling, processing, fermentation and waste management. Vol I and II. Verma L. R. and Joshi V.K.

3. Preservation of fruits and vegetables- Girdharilal, G. S. Siddapa and G. L. Tandon.

4. Fruits and vegetables preservation principles and practices- Srivastava R. P and Sanjeev Kumar.

5. Essentials of food science

6. David Dendy A.V. Cereals and cereal products: technology and chemistry- 2000

7. Association of Operative Millers Cereal Millers Hand Book, Burgess Publishing company, USA, 1963.

8. Pomeranz Y, "Modern Cereal science and Technology" MVCH Publications, NY, 1987.

Graduate attribute

Course Outcome:

- Develop proficiency skills in producing different types of processed fruits & vegetables products.
- Operating & maintenance of the modern processing equipment&types of machinery

- To make different processed fruit &vegetable-based products with quality assurance and safety.
- Students will be able to understand the importance of processing and preservation of horticultural crops, fruits & vegetables, cereals, legumes and oil seed
- They also understand different technology used in different milling industries, refineries etc.
- They will have an idea about new product development using plant-based food.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Production and Operation Management**

Course Level: **300-399**

Semester: **Fifth**

Course objective:

- To understand the basic concept of food production and operation management
- To understand managing the production and operations of food processing unit through production planning and control, directing and controlling finance, human resources, and ensuring product and process quality.
- To understand basic work in a food production plant: Planning, Products Planning, Line Balancing, Scheduling, Inventory Management, Forecasting etc.
- To know the importance of the production system in an organization.
- To understand the link between various activities of the production system.
- Direct and control human resources for the operation of the food processing unit.
- Ensure product and process quality in the food processing unit.

Unit 1: Introduction to Production and Operation Management

8 Hours

Nature and scope of production/operation management –objectives, introduction, concept of production, production system, types of production, production management, operation management, scope of production and operation management, benefits of production management, responsibility of a production manager, decisions of production managements.

Unit 2: Productivity **4 Hours**

Productivity-introduction, meaning of productivity, definitions, importance of productivity, how to improve productivity, methods of measurement of productivity

Unit 3: Production Planning **8 Hours**

Production planning and controlling-objectives, introduction, production planning and control meaning, importance of production planning and control, challenges in production planning and control, factors affecting production planning and control, types of production system, types of manufacturing process, steps of production planning and control.

Unit 4: Inventory and Maintenance Management **8 Hours**

Inventory management-objectives, introduction, definition, different types of inventory, need for inventory management, Good Inventory Management Practices, inventory management techniques; Introduction and meaning, objectives of maintenance, types of maintenance, maintenance planning, maintenance scheduling

Unit 5: Scheduling **4 Hours**

Scheduling– introduction and meaning of scheduling, objectives, selection criteria for the type of scheduling.

Unit 6: Waste management **4 Hours**

Waste–introduction and meaning, reasons for generation and accumulation, identification and control of waste, disposal of scrap.

Practicals

1. Measurement of productivity
2. Demonstration of production system
3. Demonstration of inventory management
4. Demonstration of maintenance management
5. Demonstration on industrial waste management system

6. Conduct an industrial visit and prepare a report on the production management system

Suggested Readings

1. Production and Operation Management Paperback – 2015 by K.ASWATHAPPA (Author, Contributor), K. Shridhara Bhat. Himalaya Publishing House Pvt. Ltd,
2. Principles of Food Production operation by Yogesh Singh, I K International Publishing Pvt. Ltd.
3. Production and operation management: concepts, models and behaviors, 5th edition. Prentice hall of India, Adam and Ebert. 2006
4. Modern production/operation management, Wiley India, Buff ES 2008
5. Panneerselvam, ―Production and Operations Management‖ PHI. Ajay K Garg, Production and Operations Management, TMH.
6. Prof. L.C. Jhamb: Production Operations Management, 18th edition, Everest Publishing House.
7. Dipak Kumar Bhattacharyya, Production and Operations Management, Universities Press.
8. B. Mahadevan, Operations Management: Theory and Practice, Pearson.
9. Kenneth K. Boyer, Rohit Verma, Operations Management, Cengage Learning.

Graduate outcome

Course Outcome:

- Students will have basic ideas about production and operations in food industries.
- They will learn to be disciplined in inventory management, maintenance management quality management etc.
- Understand the importance of the location of the food production plant.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

SEMESTER VI

Course name: **Baking and Confectionery Technology**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

- To teach about the raw material, and their function for making different bakery and confectionery products.
- To impart technical knowledge on processing bakery and confectionery products.
- To teach about leavening agents, shortening agents etc.
- To understand different equipment used in bakery and confectionery industries.

Unit 1: Introduction to bakery science and technology **8 Hours**

Overview on bakery and bakery products; list the various types of industries within the bakery sub sector; scope, present status and future perspective; Classification of bakery products; Bakery ingredients and their functions- Essential ingredients: Flour, yeast and sour dough, water, salt- Other ingredients: Sugar, color, flavor, fat, milk, milk powder and bread improvers; Leavening agents, Shortenings, emulsifiers and antioxidants; Problems of baking.

Unit 2: Equipments **8 Hours**

Introduction to utensils and equipments used in bakery industry with their purpose; Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, and laminating; Fermentation enclosures and brew equipment - Ovens and Slicers

Unit 3: Bread making process **12 Hours**

The Chemistry of Dough Development; process and stages of mixing , Bread making methods- Straight dough/bulk fermentation, Sponge and dough, Activated dough development, Chorley wood bread process; Advantages and disadvantages of various methods of bread-making; Characteristics of good bread: Internal characters; external characters; Bread defects/faults and remedies; Spoilage of bread-Causes, detection and prevention.

Unit 4: Other bakery products **12 Hours**

Production of cakes and cookies/biscuits; Types of biscuit dough – Developed dough, short dough, semi-sweet, enzyme modified dough and batters; Cake making: Ingredients and their function, Structure builders, Tenderizers, moisteners and flavor enhancers; cake faults and remedies ;Production process for Wafers- type of flour, raising agents and maturing; Other miscellaneous products- puff pastry

Unit 5: Confectionery Products **8 Hours**

Definition, importance of sugar confectionery; General technical aspects of industrial sugar confectionery manufacture ,Types of confectionery - Caramel, Toffee and Fudge and other confections-:- ingredients - Formulation - Processing method- Quality control- Aerated confectionery- Methods of aeration- Manufacturing process-product quality parameters, faults and corrective measures, Spoilage of confectionery products

Practicals

1. Determination of moisture content and comparison of different raw ingredients, finished goods
2. Determination of sedimentation value, ash, acid insoluble ash, grittiness, alcoholic acidity, gluten content of wheat flour.
3. Determination of yeast activity.
4. Demonstration of different equipments used in bakery industry.
7. Preparation of different bakery products-bread, cake, biscuit/cookies, bun, pastries.

8. Microbial analysis of bakery products.

Suggested Readings

1. Matz, Samuel A., ―Bakery Technology and Engineering□, Third Edition, Chapman & Hall, London.

   2. Cauvain, Stanley P, and Young, Linda S., ―Technology of Bread Making□, Second Edition Aspen publication. Maryland, 1999
2. Zhou. W, HuiY, H; (2014), "Bakery Products Science and Technology", 2nd Edition, Wiley Blackwell Publishers,
3. 4.Pyler, E. J. and Gorton, L.A. (2009), "Baking Science & Technology" Vol.1 Fourth Edition,Sosland Publications.
4. Stanley P. Cauvain, Linda S. Young, (2008), "Baked Products: Science Technology and Practice". John Wiley & Sons Publishers
5. Edwards W.P. ― Science of bakery products□, Published by The Royal Society of Chemistry, UK,2007

   7. Samuel A. Matz., ―Equipment for Bakers□, Pan Tech International Publication. 1988.

Graduate attribute

Course Outcome:

- Students will get practical knowledge about different bakery and confectionery products.
- They will understand the importance of moisture content, pH, emulsifiers etc.
- They will have an idea about new product development in the field of bakery and confectionery.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Technology for Animal Products**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

- To study the processing of different dairy products, meat, fish and poultry products.
- To study the different products of animal-based products.
- To study the nutritional aspect of the animal-based product

Unit 1: Compositional and Nutritional aspect of Animal foods

12 Hours

Fish - fresh water and marine, composition, spoilage of fish microbiological, physiological, biochemical. Meat – Definition of carcass, red meat and white meat, composition of meat, meat products, abattoir, slaughter methods, marbling in meat, post mortem changes in meat-rigor mortis, tenderization of meat, ageing of meat. Egg-composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality

Unit 2: Fish Processing **8 Hours**

Marine and fresh water fish, popular fishes, Preservation of fish-Chilling, Freezing, curing, drying, salting – salting methods: brining, pickling, curing and canning of fish. Smoking - smoke production, smoke components, quality, safety and nutritive value of smoked fish, pre - smoking processes, smoking process control. Fishery products: Surimi - Process, traditional and modern production lines, quality of surimi products. Fish protein concentrates (FPC), fish protein extracts (FPE), natural causes of rapid spoilage, fish glazing, other preservation techniques, fermented and non-fermented fish products, fish drying and dried fish products of Assam, storage.

Unit 3: Meat processing **10 Hours**

Meat Quality - colour, flavor, texture, Water Holding Capacity (WHC), Emulsification capacity of meat, Preservation of meat –Refrigeration and freezing, thermal processing - canning of meat, dehydration, meat curing and smoking, Meat products: Sausages - processing, RTE meat products.

Unit 4: Egg processing **8 Hours**

Egg- Structure and Composition of egg and nutritive value; Factors affecting egg quality, egg quality evaluation, primary processing, egg white and egg yolk, egg as natural emulsifier, storage; Preservation of eggs - Refrigeration and freezing, thermal processing, dehydration, coating. Egg products- Egg powder, frozen egg pulp, designer eggs.

Unit 5: Dairy processing **12 Hours**

Co-operative dairy schemes, milk composition and properties, milk micro-flora, , Platform tests, Milk Processing- collection of milk, homogenization, pasteurization techniques, aseptic packaging, toned and double-toned milk, recombined and reconstituted milk, lactose intolerance, flavored milks, dahi and yoghurt, paneer, chana, butter, ghee, lassi, toffee, milk powder, ice cream- processing and quality, microbiology and storage, recent developments in dairy industry.

Practicals

1. Estimation of moisture content of meat.
2. Preservation of meat.
3. Demonstration of microbial spoilage in meat and meat products.
4. Milk reception operation.
6. To perform different platform tests in milk.
7. Demonstration of Standardization of milk.
8. To estimate milk fat by Gerber method.
11. Demonstration of cream separator.
12. Demonstration of can washer.

13. Demonstration of batch pasteurizer and HTST pasteurizer.

14. Preparation of different dairy products.

Suggested Readings

1. R.A. Lawrie, 1988 Meat Science, Pergamon Press.

2. G.J. Mountney.1995. Poultry Products Technology by Taylor & Francis

3. Parkhurst& Mountney.2012. Poultry Meat and Egg Production.Springer London, Limited, 05-Jul- 2012

4. Food Facts & Principles by Shakuntla Manay N &Shadoksharaswamy N, 1996, New Age World publisher, CA.

5. Egg Science & Technology by Stadelman WJ, & Cotterill OJ, 2002, CBS Publisher, New Delhi.

6. Fish Processing & preservations by Charles L, Cutting

7. Sukumar de; Outlines of dairy technology -oxford university press.

8. Indian dairy products, K.T.Acharya publication

9. Milk hygiene in milk production processing and distribution, FAO Publication.

10. Fliud milk industry, J.S Handerson, A.V.I Publishing Company, USA

11. Milk Hygiene in milk production processing and distribution, F.A.O Publication

Graduate attribute

Course Outcome:

- Students will be able to understand the importance of meat, preservation and processing into different products.
- They will have practical knowledge of animal-based products.
- They will learn about quality testing, spoilage etc.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Packaging Technology**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

The objectives of this course are to

- Establish the different functions performed by packaging material.
- To inform about the health implications of food-package interactions.
- To inform about packaging requirements for fresh and processed food for local and international markets

Unit 1: Introduction to food packaging **8 Hours**

Definition, functions and requirements for effective packaging, packaging criteria, classification of packaging-primary, secondary and tertiary packaging, Flexible and rigid packaging, Importance of packaging

Unit 2 Materials for food packaging **8 Hours**

Paper, glass, tin, aluminium-polymer coated, tin free steel cans, cellophane, plastics- different types of plastics including bioplastics and edible films, active/intelligent films.

Unit 3: Different forms of food containers **8 Hours**

Boxes, jar, cans, bottle; Interaction of package with foods; Packaging requirements for various products-fruits and vegetables, meat, fish, milk and dairy products, canned foods, dehydrated foods.

Unit 4: Modern concepts of packaging technology **8 Hours**

Aseptic packaging, form-fill seal packaging, edible films, retort pouch packaging, Gas flushing, tetra pack, vacuum packaging, MAP & CAP, active packaging, intelligent packaging.

Unit 5: Food packaging laws and specifications **8 Hours**

Quality testing of packaging materials; Paper and paper board-thickness, bursting strength, tensile strength, puncture resistance; Flexible packaging materials (plastics)-density, tensile strength, WVTR, GTR, seal strength.

Practicals

1. Demonstration of different packaging materials

2. Determination of water vapor transmission rate of various packaging materials.

3. Demonstration of measurement of carton's dimension as per organizational standard.

4. To determine the thickness of paper and paper board.

5. Demonstration on biodegradable packaging materials

Suggested Readings

1. Coles,r; dowel, d.m; kirwan,j. food packaging technology. Black well publishing ltd
2. Niir board; food packaging technol;ogy handbook national institute of industrial research , New Delhi
3. PirengerO.G.andA.L.Baver: Plastic Packaging Materials for Food Wiley VCH, GmbH,

Graduate attribute

Course Outcome:

- Students will be able to understand the need for packaging food.
- Understand the various functions of food packages as influenced by their characteristics
- Understand the health implications of food-package interactions

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Internship**

Course Level: **300-399**

Semester: **Sixth**

Duration: 40 Hours

Conduct in workplace

A student will undergo an industrial internship in the field of their specialization during the semester break (winter) of the academic year.

Evaluation will be done by the department based on the feedback received from the industrial management on the student's performance during the tenure

Report making and verbal presentation

After completion of the internship, the student will prepare a report on his/her work and experience

Evaluation will be based on the quality of the report and presentation

Project report+ presentation +viva

Bachelor of Vocation (B.Voc.)[Food Processing Technology]

Syllabus

For

Bachelor of Vocation

2023

Approved by
Gauhati University,
Guwahati, Assam

CCS-Department of Biotechnology, Gauhati University

NEP-2020
CCS-Dept. of Biotechnology, Gauhati University

Detailed Syllabus

Programme: Bachelor of Vocation (B.Voc.)

Trade Name: Food Processing Technology

Programme Outcome:

1. To provide a judicious mix of skills relating to the profession and appropriate content of general education
2. To ensure that the students have adequate knowledge and skills so that they are ready to work at each exit point of the program
3. To provide flexibility to the students using predefined entry and multiple exit points
4. To integrate NSQF to enhance the employability of the graduates and meet industry requirements

Eligibility: 10+2 in Arts/science/commerce or 10+2 in vocational subjects related to the trade.

List of core courses

Sl. No	Semester	Course Name
01	I	Food plant sanitation and hygiene management
02		Food Processing –I
03		Bioresources in Food Processing
04	II	Food Quality and Regulation-I
05		Food Processing-II
06		Food plant layout and utilities
07	III	Food Quality and Regulation-II
08		Food Chemistry-I
09		Food Microbiology-I
10	IV	Food Quality and Regulation-III
11		Food Chemistry-II
12		Food Microbiology-II
13		Food Analysis: Tools and techniques
14	V	Food Preservation Technology
15		Fermentation Technology
16		Technology for plant products
17		Food production and operation management
18	VI	Bakery and confectionary technology
19		The technology for animal products
20		Food packaging Technology
21		Internship

Semester I

Qualification Pack: Hygiene Coordinator - Supervisor FIC/Q7606 (NSQF level 4)

Course name: **Food Plant Sanitation and Hygiene Management**

Course level: **100-199**

Semester: **First**

Course objective

- To impart theoretical and practical knowledge of various activities for cleaning and sanitation in food plants
- To enable the student to supervise hygiene practices in food plants
- To enable the application of necessary health and safety practices to ensure workplace health and safety
- To impart the necessary background to work effectively with others
- To train students to use resources at the workplace optimally

Unit 1: Food Safety and Hazards **8 Hours**

Concept of Food Safety, Importance of Guidelines on Prevention of Food Safety Hazards. Concept of food hazards, prevention of food hazards. Importance of identifying and preventing food safety hazards, Food Safety Hazards and Quality Defects: Physical Hazards, Chemical Hazards, Biological Hazards, Allergens

Unit 2: Sanitation and Health **6 Hours**

Definition and importance of sanitation, Application of sanitation in the food industry and food service establishment, Microorganisms and their relationship to sanitation

Unit 3: Hygiene and Sanitation in Food Plant and Food Service Establishments **8 Hours**

Sanitation in Food Plant and Food business operator Establishments: Cleaning Agents, Disinfectants or Sanitizers, Waste Disposal, Pest and

Rodent Control, General Principles of Food Hygiene, Hygiene Requirements for Licensing and Sale, Health Status of Food Handlers, Personal Hygiene, Facilities to Employees

Unit 4: Sanitary aspects of water supply **6 Hours**

Physicochemical properties of water, Source of water, Quality of water, Water supply and its uses in food industries, Purification and disinfection of water

Unit 5: Food Handling **6 Hours**

Receiving and Inspecting Food Deliveries, Storage Space, Dry Storage, Low-Temperature Storage, Store Room Management

Unit 6: Food Plant Waste Management System **6 Hours**

Energy Efficiency and Conservation, Water Conservation, Byproduct Utilization, Treatment of Solid Wastes, Treatment of Liquid Wastes

Practicals

1. Data Collection and Hazard Identification (Physical, Chemical and Biological)
2. Hygienic Requirements for Manufacturing Premises
3. Practice of sanitation inthe workplace
4. GAP analysis
5. Preparation of different checklist
6. Study on different methods of energy conservation
7. Study on CIP and COP
8. Methods of inspection of food at different points in a manufacturing unit
9. Study on utilization of byproducts
10. Study on different methods of waste treatment

Suggested Readings

1. Food Safety and standards Act 2006, Rules 2011, Regulations, 2011, 10th Edition, ILBCO India, Indian Law Book Company, 2013.
2. Principles of Food Sanitation. N. G. Marriott, Springer, 5th Edition, 2006.
3. Hobbs Food Poisoning and Food Hygiene. Jim Mclauchlin and Christine

Little (Eds), 7th Edition, 2007.

4. Food Plant Sanitation: design maintenance, and good manufacturing practices, by Michael M. Cramer,CRC Press

5. Mukundan, M.K. and Balasubramaniam, S. 2007. Seafood Quality Assurance.CIFT Training Manual 1

6. Gopakumar, K. 2002. Textbook on Fish Processing Technology, Indian Councilof Agricultural Research (ICAR), New Delhi

7. http://egyankosh.ac.in//handle/123456789/10012

Graduate attribute

Course Outcome

- Enable the student to be a 'Hygiene Coordinator'
- Increased employability
- Ability to monitor and supervise the cleaning and sanitation tasks.
- Understanding of basic food safety standards.
- Managerial skills to deal with accidents and emergencies.
- Effective work in an organization.
- Thorough understanding of waste management/recycling

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Processing-I**
Course level: **100-199**

Semester: **First**

Course objective

- To enable the need for food processing, understand the challenges faced by the food processing units and know about the various sectors and sub-sectors of food processing.
- To outline the career opportunities in food processing
- To impart the idea of the unit operation in food processing
- To teach the basic industrial mathematics required in a food processing industry
- To understand the basic concept of different types of machinery required in the food industry and the basic line of different food industries
- To acquaint myself with the basics of food quality parameters and understand the concept of HACCP
- To impart the idea of entrepreneurship and motivate self-employability

Unit 1. Basics of Industrial Food Processing 6 Hours

Food spoilage and causes, food processing, aims of food processing, historical developments in food processing, advantages and disadvantages of food processing, traditional and modern methods of food processing ,various sectors and sub sectors of the food processing industry,the basic problems faced by the food processing industry, relationship with other disciplines, career opportunities, significance of food processing and technology, unit operations and techniques used in unit operations

Unit 2. Basic industrial mathematics 5 Hours

Ingredient formulation,Chemical concentration, Normality, Molarity, pH calculations, serial dilution, ppm, ppb calculation.

Unit 3. Basics of food safety and quality control 8 Hours

Definition of food quality, quality attributes of food, subjective and objective

indices for quality, factors affecting quality in the food chain, effects of intrinsic and extrinsic properties on quality, HACCP

Unit 4. Designing of a Food Industry 8 Hours

Introduction to food plant layout and design, location and site selection for food plant, basic production lines of different food industries, bakery industry, dairy industry, fruits and vegetable processing, meat processing

Unit 5. Introduction to Food Processing Machineries 7 Hours

Basics concepts of food processing machinery, mills, ovens, boilers, freezers, mixers and kneaders, size reduction machinery, pasteurizer, packaging equipment

Unit 6 .Concept of Entrepreneurship 6 Hours

Entrepreneurship, nature and characteristics of entrepreneurship, need for entrepreneurship, becoming an entrepreneur, benefits of self-employment

Practicals

1. Basic Laboratory rules
2. Identification of laboratory glasswares and accessories
3. Identification of different instruments and machineries with their working principles
4. Instrument handling procedures.
5. Construction, operation and utility of food processing laboratory equipment.
6. Preparation of standard solutions- normality, molarity, ppm, ppb and percent calculation
7. Identification of entrepreneurial skills
8. Visit to a food service establishment to study its planning and functioning

Suggested Readings

1. Srilakshmi,B, Food Science (3rd edition), New age International (p) limited Publisher, New Delhi, 2003

2. Fellows, Food process technology: Principles and Technology, CRC publications.

3. Pierson, M. D. (2012). HACCP: principles and applications. Springer Science & Business Media.

Graduate attribute

Course Outcome

- Understanding the need for food processing
- Learning about the basic industrial mathematics
- Awareness about food safety and quality control
- Ability to design the basic concept of a processing plant
- Developing technical skills by thorough learning about the different types of machinery used in a food industry
- Motivating to become an entrepreneur

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Course name: **Bio-resources in Food Processing**

Course level: **100-199**

Semester: **First**

Course objective

- To impart the concept of raw materials in a Food Plant, Raw materials may be primary and processed.
- To impart theoretic and practical knowledge of various bioresources which are used as bulk raw materials in food processing plants. These raw materials may be of plant or animal origin.
- To introduce the concept of nutraceuticals and functional foods.
- To ready the student to understand the role of micro-organisms in Food Processing.

Unit 1: Introduction to Bioresources 6 Hours

Bioresources, types of bioresources, bioresources in food processing, the concept of raw materials and ingredients, underutilized bioresources

Unit 2: Plant-Based Bioresources in Food Processing 8 Hours

The concept of primary processing, different plant-based bio resources- raw fruits and vegetables, cereals, grains, pulses, oil seeds, tea, coffee, spices and their quality standards, selection of plant-based raw materials for the preparation of various products and their properties, the concept of nutraceuticals and functional foods.

Unit 3: Animal-Based Bioresources in Food Processing 12 Hours

Different types-meat, fish, poultry, egg, milk and their quality standards, selection of animal-based raw materials for the preparation of various products and their properties

Unit 4: Micro-organisms as Bioresources in Food Processing 6 Hours

Concept of probiotic and prebiotic, Industrially important micro-organisms, beneficial role of micro-organisms

Unit 5: Raw Materials for Food Processing 8 Hours

Raw materials quality inspection in the food industry, quality requirements

of raw materials, the concept of sampling, concept of FIFO and FEFO, management of raw materials in the food industry

Practicals

1. Identification of different plant-based bioresources and their application in Food Processing
2. Identification of different animal-based bioresources and their application in Food Processing
3. Identification of selection criteria of raw materials for food production
4. Study on health benefits imparted by traditional foods
5. Food Sampling
6. Identification of underutilized bioresources

Suggested Readings

1. Potter, N.N. and Hotchkiss, J.H. 2007. Food science. The AVI Pub. Co. Inc., Westport, Connecticut, USA.

2. Bawa. A.S, O.P Chauhan etal. Food Science. New India Publishing agency, 2013

Graduate attribute

Course Outcome

- Understanding of the selection criteria for raw materials to be used in Food Processing
- Awareness of the health benefits of different traditional foods.
- The ability of sampling and management of raw materials at different points in a Food Processing Unit
- Awareness of value-addition in foods and the importance of underutilized bio-resources for its utilization in the near future for product formulation.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Semester II

Qualification Pack: Supervisor-Food Processing Industries FIC/Q9009 (NSQF level 5)

Course name: **Food Quality and Regulation – I**

Course level: **100-199**

Semester: **Second**

Course objective

- To provide students with a comprehensive understanding of the principles and regulations governing food safety and quality maintenance.
- To familiarize students with the different international and national food regulatory agencies and their roles in ensuring food safety and quality.
- To explore the various aspects of food regulations, including labelling, packaging, hygiene practices, and quality control measures.
- To examine the potential hazards in the food supply chain and develop strategies for risk assessment and mitigation.
- To enhance students' knowledge of foodborne illnesses and their prevention, including the identification and control of microbiological, chemical, and physical hazards.
- To develop students' skills in analyzing and interpreting food quality data and applying appropriate quality control measures.
- To foster critical thinking and problem-solving abilities in addressing complex food regulatory challenges and issues.
- To promote ethical considerations and professional responsibility in complying with food regulations and maintaining food quality.
- To encourage students to stay updated with the latest advancements in food regulations and quality maintenance practices.
- To prepare students for careers in the food industry, regulatory agencies, quality assurance departments, and related fields by equipping them with the necessary knowledge and skills.

Unit 1: Basics of Food Quality **8 Hours**

Definition, quality concepts, quality attributes (safety, sensory, shelf life,

convenience, extrinsic attributes), factors affecting food quality; Definition and introduction to general terms-quality, quality control, quality assurance, total quality management in the food industry;Food standards and specifications- compulsory and voluntary standards; Objectives, functions and principles of quality control; Difference between food quality controland quality assurance, assessment of raw materials and finished products

Unit 2: Basics of Food Safety **8 Hours**

Food Safety, Hazards and Risks Meaning, definition, Types of hazards – Biological hazards, physical hazards, chemical hazards, nutrition – related diseases. Risk assessment and management; Natural toxicants in foods, pesticide residues in foods, investigation of food borne disease outbreaks

Unit 3: Pre-requisite Program **8 Hours**

Pre-requisite programs – Good Manufacturing Practices, Personal hygiene, Occupational health and safety specification, differences between PRP and OPRP, Traceability and accountability, recalling procedures, training

Unit 4: HACCP and its Principles **8 Hours**

Introduction to HACCP and its latest developments, Principles-Conducting a hazard analysis, CCP identification, establishing critical limits for each CCP, establishing CCP monitoring procedures, establishing corrective actions procedures, and establishing procedures for HACCP verification and validation, documenting the HACCP Program, Implementation of HACCP.

Unit 5: General Principles for food safety regulation atRegional/National Level **8 Hours**

Structure of Food law, Food regulation, Laws and regulations to prevent adulteration and cross contamination; hygienic practices; Overview of relevant National Bodies-APEDA, BIS, MPEDA, Spice Board, Tea Board, Coffee Board

Practicals:

1. Personal hygiene practices followed in food industries
2. Implementation of HACCP for
    a. Bakery Industry
    b. Fruits and vegetables-based industry
    c. Dairy industry
    d. Meat, fish, and poultry industry
3. Study on identification of natural toxicants in foods
4. Study on pesticide residues in foods
5. Study on assessment procedures for raw materials and finished products in the industry

Suggested Readings

1. Roessler, E. B., Amerine, M. A., Pangborn, R. M. (2013). Principles of Sensory Evaluation of Food. United States: Elsevier Science.
2. Early, R. (2012). Guide to Quality Management Systems for the Food Industry. United Kingdom: Springer US.
3. Furia, T. E. (2017). Regulatory Status of Direct Food Additives. United Kingdom: CRC Press.
4. Jellinek, G. (1985). Sensory Evaluation of Food: Theory and Practice. Germany: E. Horwood.
5. Lawless, H. T., Heymann, H. (2016). Sensory Evaluation of Food: Principles and Practices. United States: Springer New York.
6. Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.
7. Herschdoerfer, S. (2012). Quality Control in the Food Industry V2. United States: Elsevier Science.
8. Encyclopedia of Food Sciences and Nutrition. (2003). Netherlands : Academic Press.
9. Ranganna, S. (2005). Hand Book of Analysis And Quality Control For Fruit And Vegetable Products. India: Tata McGraw-Hill Publishing Company Limited.

10. Export/Import policy by Govt. of India
11. Alli, I. (2004). Food Quality Assurance: Principles and Practices. United Kingdom: Taylor & Francis.

Graduate attribute

Course Outcomes:

- By the end of this course, students should be able to:
- Explain the importance of food safety and quality maintenance in the food industry and society.
- Identify and analyze the roles and responsibilities of various food regulatory agencies at the national and international levels.
- Comprehend and apply the relevant laws, regulations, and standards governing food safety and quality maintenance.
- Evaluate and implement appropriate labelling, packaging, and hygiene practices to ensure compliance with food regulations.
- Conduct risk assessments and develop risk mitigation strategies to prevent and manage potential hazards in the food supply chain.
- Demonstrate an understanding of foodborne illnesses, their causes, and prevention methods, including the identification and control of microbiological, chemical, and physical hazards.
- Interpret food quality data, conduct quality control tests, and implement quality assurance measures to maintain food quality standards.
- Analyze and propose solutions to complex food regulatory challenges and issues, considering ethical considerations and professional responsibility.
- Stay updated with the latest advancements in food regulations, industry best practices, and emerging technologies for quality maintenance.
- Apply the acquired knowledge and skills to pursue careers in the food industry, regulatory agencies, quality assurance departments, or related fields

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Processing –II**

Course level: **100-199**

Semester: **Second**

Course Objectives:

- To provide students with a comprehensive understanding of the principles and concepts of food processing.
- To introduce students to the various unit operations involved in food processing, such as cleaning, sorting, grading, preservation, and packaging.
- To familiarize students with the different techniques and technologies used in food processing, including thermal processing, freezing, drying, fermentation etc
- To develop students' knowledge and skills in selecting appropriate processing methods based on the characteristics of different food commodities.
- To explore the factors that influence food quality during processing, such as ingredient selection, process control, and packaging.
- To examine the impact of food processing on nutritional value, sensory attributes, and shelf life of processed foods.
- To foster an understanding of food safety considerations in processing, including sanitation practices, microbial control, and regulatory requirements.
- To promote critical thinking and problem-solving abilities in addressing challenges related to food processing, such as process optimization, waste reduction, and sustainability.
- To enhance students' awareness of emerging trends and advancements in food processing technologies.
- To prepare students for careers in the food industry, research and development, quality assurance, and related fields by equipping them with the necessary knowledge and skills.

Unit 1: Unit operation in Food processing **8 Hours**

Introduction to unit operation, techniques used in unit operation-separation, size reduction, mixing and kneading, milling, drying and dehydration,frying, baking, roasting, smoking, freezing and refrigeration

Unit 2: Pre and primary processing –some basic concepts **8 Hours**

Introduction, production, harvesting and handling of fresh foods; production of raw materials for processing; primary processing-cereals, pulses,oilseeds, minimally processed fresh foods

Unit 3: Low temperature processing **12 Hours**

Refrigeration –requirements, storage changes in foods during refrigeration storage, refrigeration load; freezing and frozen storage-freezing curve and methods, changes in foods during freezing, factors determining the freezing rate, dehydro freezing, IQF and frozen fruits and vegetables

Unit 3: Heat processing **12 Hours**

Heat processing –blanching, pasteurization, sterilization, canning, dielectric heating, baking, roasting, frying, thermal processing-thermal death curve, determination of processing time and temperature; effect of heat on microorganisms and enzymes, the effect of heat on nutritional and sensory characteristics of foods

Unit 4: Food Concentration **4 Hours**

Food concentration methods, changes in food during concentration, ultrafiltration and reverse osmosis

Unit 5: Food product development **8 Hours**

Definition and classification, characterization and factors in shaping new product development, the role of ingredients and processing in defining attributes, shelf-life requirements and factors affecting shelf life and product attributes,the process of flow sheet development, concept testing

Practicals:

1. To study the different machineries involved in the unit operation and their working principles
2. study the process of freezing in food samples and prepare the freezing curve
3. Study on various primary processing techniques involved in cereals, pulses and oilseeds
4. Study on different types of freezers used in the food industry
5. Preservation of foods by various food concentration methods
6. To study the various steps involved in food product development and develop a new food product and conduct a shelf-life study of the new product

Suggested Readings

1. Fellows, P.J. (2016). "Food Processing Technology: Principles and Practice" (4th ed.). Woodhead Publishing.
2. Singh, R.P., & Heldman, D.R. (2017). "Introduction to Food Engineering" (5th ed.). Academic Press.
3. Brennan, J.G. (Ed.). (2018). "Food Processing Handbook" (2nd ed.). Wiley-Blackwell.
4. Clark, S., Jung, S., & Lamsal, B. (2019). "Food Processing: Principles and Applications" (2nd ed.). Wiley.
5. Campbell-Platt, G. (Ed.). (2016). "Food Processing Technology: Principles and Practice" (3rd ed.). Wiley-Blackwell.
6. Saravacos, G.D., &Kostaropoulos, A.E. (Eds.). (2015). "Handbook of Food Processing Equipment" (2nd ed.). Springer.

Graduate attribute

Course Outcomes:

- Understand the fundamental principles and concepts of food processing and its significance in the food industry.
- Identify and describe the various unit operations involved in food

processing and their respective roles in transforming raw materials into processed food products.

- Evaluate and select appropriate processing techniques and technologies for different food commodities based on their characteristics and desired outcomes.
- Demonstrate an understanding of the factors influencing food quality during processing and apply appropriate process control measures to maintain quality standards.
- Assess the impact of food processing on the nutritional composition, sensory attributes, and shelf life of processed foods.
- Apply food safety practices and regulatory requirements to ensure the microbiological safety and quality of processed food products.
- Analyze and propose solutions to optimize food processing operations, reduce waste, and improve sustainability in the food industry.
- Stay updated with the latest advancements and emerging trends in food processing technologies.
- Utilize acquired knowledge and skills to contribute effectively to food industry sectors such as research and development, production, and quality assurance.
- Apply critical thinking and problem-solving skills to address challenges and make informed decisions related to food processing.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

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Course name: **Food Plant Layout and Utilities**

Course Level: **100-199**

Semester: **Second**

Course objective

- To impart the concept of plant layout
- To impart theoretical and practical knowledge of various types of plant layout
- To understand the selection criteria of the location of plant layout.
- To understand the different symbols and flow diagrams in plant layout
- To impart knowledge on food plant sanitation
- To understand different food plant utilities

Unit 1: Plant layout **8 Hours**

Plant layout –Definition, and principles, factors in planning layouts; Methods of layout planning –Unit areas concept, two –dimensional layouts, Principles of plant layout

Unit 2: Types of plant layout **8 Hours**

Types of plant layout –salient features of horticultural, rice, maize, pulses, oil seeds, poultry, fish, meat, milk and milk product plants; experimentation in the pilot layout: size and structure of the pilot plant, minimum and maximum size, types and applications

Unit 3: Location selection criteria **8 Hours**

Location selection criteria –Plant location, factors in selecting a plant, selection of the plant site, preparation of the layout; Selection of processes – Comparison of different processes, batch versus continuous operation. Plant capacity –Equipment design and specifications, scale–up in design, safety factors, specifications, and materials of construction

Unit 4: Flow Diagrams and Symbols **8 Hours**

Flow diagrams-qualitative and quantitative flow diagrams; design; Symbols used for food plant design and layout: introduction, valves, line symbols, fluid handling, heat transfer, mass transfer; symbols used for food plant design and layout: storage vessels, conveyors and feeders, separators, mixing and communication and process control and instrumentation symbols.;

Unit 5: Food plant Sanitation **3 Hours**

Food plant sanitation-Environmental protection, regulations, CIP, COP

Unit 6: Food Plant Utilities **8 Hours**

Food plant utilities: process water, steam, electricity, plant effluents;Selection of equipment material and energy balance, equipment design and selection, Process and controls-Control systems, instrumentation control, maintenance

Practicals:

1. Study of plant layout
2. Preparation of different food plant layout
3. Study of different symbols and flow diagrams used in plant layout
4. Study of food plant utilities
   a. process water
   b. steam,
   c. electricity,
   d. plant effluents

Suggested Readings

1. Moerman, F. (2010). "Food Plant Engineering Systems" (2nd ed.). CRC Press.
2. Lopez-Gomez, A., & Barbosa-Cánovas, G.V. (2016). "Food Plant Design" (1st ed.). CRC Press.
3. Baker, C.G.J., & Stier, R.J. (Eds.). (2018). "Handbook of Food Factory

Design" (1st ed.). Wiley.
4. Cramer, M.M., & Nelson, P.E. (2012). "Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices" (2nd ed.). CRC Press.
5. Berk, Z. (2013). "Food Process Engineering and Technology" (2nd ed.). Academic Press.
6. Maroulis, Z.B., &Saravacos, G.D. (2013). "Food Plant Economics" (1st ed.). CRC Press.

Graduate attribute

Course Outcome

- Understanding of the plant layout and its different types
- Awareness of the selection criteria of plant location
- Awareness of using different symbols and flow diagrams used in plant layout
- Understanding of food plant sanitation and different food plant utilities

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester III

Qualification Pack: Food Microbiologist FIC/Q7603 (NSQF level 6)

Course name: **Food Quality and Regulation – II**

Course Level: **200-299**

Semester: **Third**

Course Objectives:

- To provide students with a comprehensive understanding of the principles, practices, and regulations governing the quality and safety of food
- To equip students with the knowledge and skills necessary to assess, monitor, and maintain food quality standards throughout the food supply chain
- To impart the roles and responsibilities of FSSAI and other national standards, also introduce various initiatives taken by FSSAI
- To understand students about the general principles for food safety regulations at both the national and international level

Unit 1: Basic Concept of Food Laws and Regulations **12 Hours**

Food laws and regulations, concepts of codex Alimentarius, ISO series, GMP, GHP, 5S,4M, AIB, six sigma, PCI, SOP, Checklist, audit system, documentation; FSSAI, the role of various food standards in India- PFA, FPO, AGMARK and BIS.Recent development in food quality regulation, MOFPI and schemes for Establishing food industries in India

Unit 2: FSSAI **12 Hours**

FSSAI:-Introduction to the law, Salient features of Food Safety& Standards Act, 2006, Structure of FSSAI, Administrative set up at the State level and central level, Licensing and registration, Licenses granted by Central Licensing Authority, Documents/ Format required for Registration/ Licensing, Food Laboratories:Accreditation of Food Laboratory, Referral Laboratories, Hierarchy of Food Safety Authorities; Food Labelling;

Promoting safe and wholesome food (Eat Right India, Food Fortification, Clean street food Hub, RUCO, BHOG and various other social and behavioural change initiatives taken by FSSAI)

Unit 3: General Principles for food safety regulation at the internationallevel **12 Hours**

FAO, World Health Organization (WHO), Joint FAO/WHO Food Standards Program -JECFA, JEMRA, JMPR;Codex Alimentarius Commission- Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India, World Trade Organization (WTO), Principles of the trading system. SPS and TBT, differences between SPS & TBT; WTO agreement on the application of SPS

Unit 4: Standard Operating Procedures **12 Hours**

Defining Standard operating procedure: purpose, Format, developing and implementing; effective writing; SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, personal hygiene, facility and equipment. Systems in laboratory accreditation, GRN making, Invoice making and maintenance

Practicals:

1. Identification of Food Logos
2. Study on food Labelling
3. Preparation of SOP for
    i. Receiving raw materials
    ii. Finished products
4. Preparation of GRN, Invoice
5. Preparation of checklist
6. Study on 5S Practices in the food industry
7. Visit a food industry and prepare a report on various quality laws and regulations followed

Suggested Readings

1. Amerine, M.A., Pangborn, R.M., &Rosslos, E.B. (2015). "Principles of Sensory Evaluation of Food." Academic Press.

2. Early, R. (2001). "Guide to Quality Management Systems for Food Industries." Blackie Academic.

3. Jellinek, G. (2019). "Sensory Evaluation of Food - Theory and Practice." Elsevier.

4. Macrae, R., Roloson, R., & Sadler, M.J. (2014). "Encyclopedia of Food Science & Technology & Nutrition." Academic Press.

5. Ranganna, S. (2015). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products." Tata McGraw-Hill.

6. InteazAlli (2018). "Food Quality Assurance: Principles and Practices." CRC Press.

7. Vasconcellos, J.A. (2003). "Quality Assurance for the Food Industry: A Practical Approach." CRC Press.

Graduate attribute

Course Outcome

- Understand the fundamental concepts and principles of food quality and safety.
- Identify and evaluate the factors that affect food quality, including raw materials, processing, storage, and distribution.
- Comprehend the regulatory frameworks and guidelines related to food quality and safety at national and international levels.
- Assess and implement quality control and quality assurance programs in food production, processing, and handling.
- Evaluate the impact of food quality and safety on public health, consumer perception, and the economy.
- Develop effective communication and problem-solving skills to address food quality and safety issues.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Chemistry-I**

Course Level: **200-299**

Semester: **Third**

Course objective

- To demonstrate a sound knowledge of the chemical properties of food components (water, carbohydrates, proteins, enzymes)
- To understand the relationship between the properties and structures of chemical components and ingredients to the functional and chemical properties of foods.
- To understand the physical and chemical interactions between food components and their impact on quality.
- To learn and understand the chemistry concerningthe role and functionality of constituents of the food.

Unit 1: Water **6 Hours**

Structure of water and ice, Physical properties of water, Types of water in food, Water holding capacity and water binding capacity, the concept of Water activity and relation to food stability

Unit 2: Carbohydrates **10 Hours**

Classification, Structure, Properties, sourcesandReactions of Carbohydrates; Reducing & Non-reducing sugar; Glycosidic bonds; Structure of starch, cellulose, glycogen, pectin.; Difference between amylose & amylopectin; Gelatinization and Retrogradationof starch;Chemical Reactions of Carbohydrates, Browning reactions - Enzymatic & Nonenzymatic browning

Unit 3: Proteins **10 Hours**

Classification of amino acid- structure, essential and non-essential amino acids, Peptide bond; biological roles of protein; Classification of protein according to shape; classification of protein according to composition and solubility Structure of protein, chemical bonds involved in protein structure;

Physical-chemical properties of proteins; Denaturation of protein, sources of food proteins

Unit-4: Enzymes **10 Hours**

Introduction, classification of enzyme, enzyme kinetics, enzyme activity, factors affecting enzyme activity. Enzyme inhibitors- reversible (Competitive, Noncompetitive & Uncompetitive), enzyme activity- zymogens inactivation, covalent modification and feedback inhibition; Enzyme immobilization and its application; Enzymes used in the food industry

Practicals:

1. Determination of acidity and pH
2. Determination of moisture by drying method
3. Carbohydrates-qualitative test, estimation of reducing sugar, total sugar
4. Determination of protein by the Kjeldahl method
5. Study on water activity of different foods
6. Study on various techniques of enzyme immobilization

Suggested Readings

1. Belitz, H.-D., Grosch, W., &Schieberle, P. (2016). "Food Chemistry" (4th ed.). Springer.
2. Fennema, O. (2013). "Food Chemistry" (4th ed.). CRC Press.
3. Coultate, T.P. (2009). "Food: The Chemistry of Its Components" (6th ed.). Royal Society of Chemistry.
4. Damodaran, S., Parkin, K.L., & Fennema, O.R. (Eds.). (2017). "Fennema's Food Chemistry" (5th ed.). CRC Press.
5. Hui, Y.H., et al. (Eds.). (2021). "Food Chemistry: Principles and Applications" (2nd ed.). Wiley.
6. Nielsen, S.S. (2020). "Food Analysis" (5th ed.). Springer.
7. Pomeranz, Y., & Meloan, C.E. (2000). "Food Analysis: Theory and Practice" (3rd ed.). Springer.

Graduate Attribute

Course Outcome

- Students will get introduced to Food Chemistry
- Students will be able to understand the basic chemistry of water, carbohydrates, proteins and enzymes
- Students will learn about the classification and properties of carbohydrates, proteins and enzymes
- They will know different tests used for the estimation of carbohydrates, and protein in the food industry

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Microbiology – I**

Course Level: **200-299**

Semester: **Third**

Course objective

- To enable the students to gain an insight into basic aspects of food microbiology.
- To understand the advanced techniques in the microbial analysis of food.

Unit-1: Introduction to food microbiology **8 Hours**

Discovery and History of microbiology, current status, the role of food microbiology, sources of microorganisms in food, Changes caused by microorganisms in food, Growth and survival of microorganisms in foods, biological, chemical and physical changes caused by microorganisms, physical and chemical methods to control microorganisms

Unit 2: Microscope **4 Hours**

Introduction, types of microscopes, parts of a microscope, Maintenance of the Microscope

Unit-3: Characteristics of Microorganisms **8 Hours**

Classification of microorganisms, nomenclature, morphology - yeast and moulds, bacterial cells, viruses; important microbes in food, microbial growth characteristics - Microbial reproduction, nature of growth in food

Unit-4: Culture Media **8 Hours**

Introduction to the microscope, culture media – differential media, selective media, transport media, pure culture, microbial culture techniques, Pure culture techniques – pour, spread and streak plate method; thermal inactivation of microbes; the Basic concept of F, Z and D value

Unit 5: Staining Techniques **5 Hours**

Staining characteristics, Basic principle of simple and grams staining process, mordant and its action, acidic and basic dyes

Unit 6: Microbial Growth in Food **7 Hours**

Microbial growth characteristics, Factors affecting microbial growth – temperature, pH, oxygen concentration, water activity, Psychrophiles, halophiles, mesophiles, Thermophiles; Growth curve – lag, log, the stationary, decline phase

Practicals

1. Introduction to Food Microbiology and Laboratory Safety
2. Operation and use of laboratory equipment
    a. Autoclave
    b. Laminar airflow
    c. Hot air oven
    d. Incubator
    e. Microscope
    f. Colony counter
3. Functioning and use of a compound microscope
4. Cleaning and sterilization of glassware
5. Preparation of cotton plug
6. Preparation and sterilization of Culture media
7. Pure culture techniques-Pour plate spread plate and streak plate
8. Simple staining, Gram Staining, Negative staining
8. Morphological study of bacteria and fungi using permanent slides

Suggested Readings

1. Doyle, M.P., & Buchanan, R.L. (Eds.). (2013). "Food Microbiology: Fundamentals and Frontiers" (4th ed.). ASM Press.
2. Jay, J.M., Loessner, M.J., & Golden, D.A. (Eds.). (2020). "Modern Food Microbiology" (8th ed.). Springer.

3. Adams, M.R., & Moss, M.O. (2019). "Food Microbiology" (4th ed.). Royal Society of Chemistry.

4. Frazier, W.C., Westhoff, D.C., & Vanitha, N.M. (2020). "Food Microbiology" (8th ed.). McGraw-Hill Education.

5. Ray, B., & Bhunia, A.K. (2017). "Fundamentals of Food Microbiology" (5th ed.). CRC Press.

6. Juneja, V.K., &Sofos, J.N. (Eds.). (2019). "Pathogens and Toxins in Foods: Challenges and Interventions" (2nd ed.). ASM Press.

7. Montville, T.J., & Matthews, K.R. (Eds.). (2014). "Food Microbiology: An Introduction" (4th ed.). ASM Press.

Graduate attribute

Course Outcome

- Students will develop knowledge and understanding of different food microorganisms and know different techniques used to detect microorganisms
- Students will develop knowledge and understanding of different food microorganisms and different techniques used in their detection.
- Students will enable to know the basics of microbiology.
- Students will understand the causes of food spoilage of different foods and their type

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):
Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University
Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester IV

Course name: **Food Quality and Regulation – III**

Course Level: **200-299**

Semester: **Fourth**

Course objective

- To explore the various aspects of food regulations, including labelling, packaging, hygiene practices, and quality control measures.
- To familiarize students with the different tools and techniques required for total quality management in a food processing industry
- To introduce students to the concept of audit, and preparation of audit reports for different audit exercises
- To develop students' skills in handling customer-related problems
- To foster critical thinking and problem-solving abilities in addressing complex food regulatory challenges and issues.
- To promote ethical considerations and professional responsibility in complying with food regulations and maintaining food quality

Unit1: Food Labelling **6 Hours**

General concept and importance of labelling; Nutrition Labeling, Health Claims, Nutrition Claims, Nutrient definitions allowed on food labels. Laws related to food labelling and packaging, Indian Institute of Packaging

Unit 2: Total quality management- Tools and Techniques **14 Hours**

Total quality management (TQM)-Definition, features and importance; Total Quality Management (TQM) in Food Industry. Introduction to quality management -Definition, Scope, Significance and Objectives of Quality management;Seven old and new Quality management tools, Kaizen Principle, Statistical process control – Mean & range chart, P chart and C

chart, Seven deadly wastages, PDCA cycle, Quality circle, Continuous improvement of productivity -Six Sigma Concept.

Unit 3: Audit **6 Hours**

Introduction to audit, Types of audit, conducting open meeting and close meetings in auditing, preparation of audit reports for different departments-audit exercise

Unit 4: Country-Specific Standards **6 Hours**

European Committee for Standardization (CEN), PAN American Standards Commission (COPANT), Euro-Asian Council for Standardization, FDA, EPA, EU, ASEAN, EFSA (European Food Safety Authority)

Unit 5: Handling customers and complaints **6 Hours**

Definition- customer, consumer, food chain, types of complaints, handling customer, evaluation and solution of a problem, report making, CAPA.

Practicals:

1. Perform audit and report-making using Excel
2. Study on complaint handling and report making
3. Preparation of SOP for
    a. Receiving raw materials
    b. Finished products
4. Preparation of GRN, Invoice
5. Preparation of checklist
6. Study on 5S Practices in the food industry
7. Visit a food industry and prepare a report on various quality laws and regulations followed

Suggested Readings

1. Roessler, E.B., Amerine, M.A., & Pangborn, R.M. (2013). "Principles of Sensory Evaluation of Food." Elsevier Science.
2. Early, R. (2012). "Guide to Quality Management Systems for the Food Industry." Springer US.
3. Furia, T.E. (2017). "Regulatory Status of Direct Food Additives." CRC Press.

4. Lawless, H.T., & Heymann, H. (2016). "Sensory Evaluation of Food: Principles and Practices." Springer New York.
5. Ranganna, S. (2005). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products." Tata McGraw-Hill Publishing Company Limited.
6. Moss, M.O., & Adams, M.R. (2019). "Food Microbiology" (4th ed.). Royal Society of Chemistry.

Graduate attribute

Course Outcomes:

- Evaluate and implement appropriate labelling, packaging, and hygiene practices to ensure compliance with food regulations
- Familiarizing students with the different tools and techniques required for total quality management in a food processing industry
- Preparation of audit reports for different audit exercises to be performed in a food industry
- To foster critical thinking and problem-solving abilities in dealing with customer-related problems

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Chemistry – II**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

To enable the students to:

- Understand the relationship between nutrition and human well-being.
- Know and understand the functions and chemical structure of the required component in our body.
- To know the major and minor components of foods.
- To know the composition and properties of food.

Unit 1: Lipids **10 Hours**

Classification of lipids according to chemical composition, fatty acids; saturated and unsaturated fatty acids; Fatty acids-essential fatty acids, structure, chemical reactions of lipids; Physical properties – Refractive index, melting point, smoke, flash and fire point, Chemical properties-Saponification value, iodine value, acid value, Peroxide value, Rancidity: Hydrolytic and oxidative rancidity; mechanism of auto-oxidation of fat;Antioxidants- natural and synthetic.

Unit 2: Food Pigments **4 Hours**

Classification of food pigments, Chlorophyll, Myoglobin, anthocyanins, flavonoids, betalains, quinones and xanthones, carotenoids, curcumin

Unit 3: Vitamins **4 Hours**

Classification of Vitamins; sources, functions and Vitamin, deficiency diseases in humans, causesfor losses of vitamins in foods, daily recommended allowance

Unit 4: Minerals **4 Hours**

Classification of Minerals, sources, functions, nutritional aspects of minerals, Bioavailability

Unit 5: Food Additives **8 Hours**

Definition, the difference between food additives and adulterants; Permitted food additives in foods – Antioxidants, natural and chemical antioxidants,

permitted antioxidants in foods, Natural and synthetic colours, application of colours in the food industry, restriction on the use of colours in foods; Flavoring agents:nature identical flavours, artificial flavouring substances; function of emulsifiers and stabilizers in foods, permitted emulsifiers and stabilizers used in foods. Natural and chemical sweeteners,nutritive additives

Unit 6: Aroma Compound **4 Hours**

Properties of Aromatic Compounds, Classification of Aromatic Compounds, Analysis of Aroma of Food

Practical:

1.Determination of ash/mineral in a food sample.

2.Study on crude fat analysis in food samples.

3. Determination of vitamin C content in food samples.

5.Study on the estimation of – Saponification value, iodine value, acid value, peroxide value and iodine number of food sample

7. Study of food pigments present in different foods

8. Study of different food additives

Suggested Readings

1. Gunstone, F.D., John L. Harwood, J.L., & Fred B. Padley, F.B. (2007). "The Lipid Handbook" (3rd ed.). CRC Press.
2. Pokorný, J., &Yanishlieva, N. (Eds.). (2006). "Autoxidation in Food and Biological Systems." CRC Press.
3. Akoh, C.C., & Min, D.B. (2008). "Food Lipids: Chemistry, Nutrition, and Biotechnology" (3rd ed.). CRC Press.
4. Nielsen, S.S. (2017). "Food Analysis" (5th ed.). Springer.
5. Skerrett, P.J., & Willett, W.C. (Eds.). (2014). "Essential Concepts in Food Science." CRC Press.
6. Branen, A.L., Davidson, P.M., & Salminen, S. (Eds.). (2019). "Food Additives" (2nd ed.). CRC Press.
7. Gropper, S.S., Smith, J.L., &Carr, T.P. (2017). "Advanced Nutrition and Human Metabolism" (7th ed.). Cengage Learning.
8. Whitney, E.N., Rolfes, S.R., Crowe, T., & Cameron-Smith, D. (2019). "Understanding Nutrition: Australia and New Zealand Edition" (4th ed.). Cengage Learning.
9. Food Safety and Standards Authority of India (FSSAI). (2016). "Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011." FSSAI.
10. Joint FAO/WHO Expert Committee on Food Additives (JECFA).

(2021). "Compendium of Food Additive Specifications." Food and Agriculture Organization (FAO) of the United Nations.

Graduate attribute

Course outcome:

- They will learn about the classification of lipids, Rancidity, and Autoxidation of fats.
- They will acquire knowledge about the basics of Lipids, vitamins, minerals, pigments and additives
- They will learn about different food additives used in the food industry
- Gain knowledge of the core component of a required nutrient.
- Increased awareness of the diet.
- Know about the permissible limit of food additives.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Microbiology – II**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

- To acquire elementary knowledge about micro-organisms.
- To develop an understanding of the role of microorganisms in the environment, Industry and in the maintenance of health.
- To understand the importance of safe handling of food and disease caused by microorganisms.
- To acquire knowledge about harmful and beneficial microorganisms.

Unit 1: Study of Different Microorganisms **8 Hours**

Cellular, A cellular microorganisms;Morphological and Ultra-structure of a microbial cell (Gram-positive and Gram-negative bacterial membrane, spore, pili, flagella),

Unit 2:Microbial Food Products for human consumption **8 Hours**

Single Cell Protein (SCP), Microbial SCP production by bacteria, algae, mushroom cultivation, the concept of probiotics, prebiotic, symbiotic and bioactive foods; fermented foods

Unit 3: Microbial Agents of Food-Borne Illness **8 Hours**

Foodborne infections and intoxication, food poisoning, microbial toxins, Gram Negative and Gram-positive food-borne pathogens

Unit 5: Spoilage in Different Food Groups **8 Hours**

Food spoilage - Introduction, sources of microorganisms in foods, spoilage in cereals, vegetables and fruits, meat, eggs, poultry, fish, milk and milk products, canned foods, nuts and oil seeds, fats and oil

Unit 6: Beneficial Uses of Microorganisms **8 Hours**

Microorganisms used in food fermentation, intestinal bacteria and probiotics, food bio preservatives of bacterial origin, food ingredients and

enzymes of microbial origin. Economic importance of microorganisms

Practicals:

1. Standard Plate Count of different food samples
2. Estimation of Microbial load in a food sample and plot a growth curve
3. Isolation and Identification of
    i. Escherichia coli
    ii. Yeast and mould
    iii. coliform
4. Estimation of Total plate count of food samples
5. Microbial study of food samples stored at different environmental conditions
6. Assessment of surface sanitation by swab/rinse method
7. Preparation of fermented foods
8. Conduct an industrial visit and prepare a report on the scope of microbiology in the food industry

Suggested Reading:

1. Cappuccino, J.G., & Sherman, N. (2018). "Microbiology: A Laboratory Manual" (12th ed.). Pearson.
2. Harrigan, W.F., & McCance, M.E. (2016). "Laboratory Methods in Food Microbiology" (3rd ed.). Academic Press.
3. Atlas, R.M. (2010). "Handbook of Microbiological Media" (4th ed.). CRC Press.
4. Lee, G. (2016). "Microbiology and Molecular Biology in Foods" (2nd ed.). Wiley-Blackwell.
5. Harrigan, W.F., & Wilkinson, L. (2014). "Food Microbiology: Fundamentals and Frontiers" (5th ed.). ASM Press.
6. Beuchat, L.R., Doyle, M.P., & Montville, T.J. (Eds.). (2013). "Food Microbiology: Fundamentals and Frontiers" (4th ed.). ASM Press.
7. Golden, D.A., & Bishop, P.A. (Eds.). (2018). "Introduction to Laboratory Safety" (3rd ed.). CRC Press.

Graduate attribute

Course Outcome:

- They will learn how to clean equipment and sterilize them.
- They will learn about the handling of a compound microscope.
- They will understand different staining methods for bacteria and their

importance. They will understand the difference between bacteria and fungi.

- They will learn different methods used for the isolation and enumeration of bacteria from food samples.
- Students will learn how to use an instrument like a microscope, autoclave, membrane filters, laminar airflow etc.
- Helps them to acquire jobs in microbiological labs.
- They will know what will cause food-borne illness.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Analysis: Tools and Techniques**

Course Level: **200-299**

Semester: **Fourth**

Course Objectives:

- To provide conceptual knowledge about sampling and quality of the foods to students.
- To provide Hands-on determination of Moisture content of food, protein content of food etc.
- To provide Hands-on determination of pH and Titratable acidity.
- To provide Hands-on determination of ash content, fat content, pigments, vitamins etc.

Unit 1: Concept of Sampling **8 Hours**

Sampling: - Terminologies in sampling, Selection of sampling procedures, Factors affecting the choice of the sampling plan, Sampling procedures probability and non – probability sampling

Unit 2: Analysis of pH and Acidity **8 Hours**

pH and Titratableacidity: - Acid-base equilibrium, General principles, Reference electrode, Indicator electrode, Buffers, titration, Indicators, standard alkali, standard acid, sample analysis, and the acid content in food.

Unit 3: Analysis of Moisture **8 Hours**

Moisture Assay: - Importance of moisture assay, forms of water in food, Oven drying methods – forced draft oven, vacuum oven, microwave oven. Chemical method – Karl Fischer titration

Unit 4: Analysis of Carbohydrates **10 Hours**

Importance of analysis of carbohydrates, sample preparation, Chemical methods for the analysis of carbohydrates: Nelson- Somogyi method, DNS method, Phenol Sulfuric acid method and Anthronemethod; Importance of dietary fibre, major components of dietary fibre, principle, procedure and application of total soluble and insoluble fibre

Unit 5: Analysis of Fats and Proteins **10 Hours**

Continuous solvent extraction methods: Goldfish method, Semi-continuous solvent extraction methods: Soxhlet method, Discontinuous solvent extraction method: Mojonnier method. Non-Solvent wet extraction method: Gerber method; Analysis of Proteins: - Importance of protein analysis, principle and procedure of Kjeldahl method, Biuret and Lowry method

Unit 6: Analysis of Ash, Vitamins and Pigments **8 Hours**

Importance of ash in food analysis, sample preparation, Dry ashing, wet ashing, Soluble and insoluble ash in water, ash insoluble in acid, Analysis of Minerals: - Importance of analysis of minerals; Analysis of Vitamins - Importance of analysis of vitamins; 2, 6 Dichlorophenol indophenols titrimetric method for vitamin C**;** Pigment analysis- Importance of color and food quality; Presence and distribution of pigments in foods. Analysis of chlorophyll, carotenoids, anthocyanins

Unit 7: Sensory Analysis **3 Hours**

Sensory analysis-definition, methods of sensory evaluation

Unit 8: Food Adulteration **3 Hours**

Adulteration and adulterant, types of adulteration, methods of detecting adulterants in foods

Practical:

1. Determination of pH and acidity of the given sample.
2. Determination of moisture content of different samples
3. Analysis of carbohydrates- nelson-somogyi method, DNS Method, Anthrone method
4. Analysis of dietary fibre
5. Estimation of fat content
6. Detection of adulterants in different foods
7. Estimation of vitamin C from food sample
8. Sensory analysis of foods by different methods

Suggested Readings

1. Nielsen, S.S. (2017). "Food Analysis" (5th ed.). Springer.
2. Belitz, H.-D., Grosch, W., &Schieberle, P. (Eds.). (2013). "Food Chemistry" (4th ed.). Springer.

3. Lees, M. (Ed.). (2019). "Food Analysis: Theory and Practice" (2nd ed.). Springer.

4. Wrolstad, R.E., Acree, T.E., Decker, E.A., Penner, M.H., Reid, D.S., Schwartz, S.J., Shoemaker, C.F., Smith, D., &Sporns, P. (2019). "Handbook of Food Analytical Chemistry" (2nd ed.). Wiley.

5. Downey, G. (Ed.). (2021). "Advances in Food Analysis Techniques" (2nd ed.). CRC Press.

6. Otles, S., &Cagindi, O. (Eds.). (2014). "Handbook of Food Analysis Instruments" (2nd ed.). CRC Press.

7. Paolucci, M., & Liuzzo, G. (2018). "Advanced Methods for Food Analysis" (1st ed.). Elsevier.

Graduate attribute

Course Outcomes:

- On the successful completion of the course, a student will be able to gainhands-on experience and training on the determination of proximate analysis.
- Understand the detection of adulteration in food samples.
- To provide Hands-on qualitative and qualitative evaluation of food samples.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Semester V

Qualification Pack: **Production Manager FIC/Q9003 (NSQF level 7)**

Course name: **Food Preservation Technology**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To acquaint the students with fundamental principles and various techniques of food preservation.
- To understand the information about food spoilage and why preservation is required.
- To gain knowledge about different techniques such as freezing, sterilization, canning etc.
- To obtain knowledge about the intrinsic factor and extrinsic factors that affect food spoilage.
- To know the emerging technologies in food preservation

Unit 1: Introduction to food preservation **8 Hours**

Definition and significance of food preservation, factors influencing food spoilage and deterioration, traditional food preservation methods, food preservatives: natural and chemical. Perishable, non-perishable food, causes of food spoilage.

Unit 2: Food preservation by low temperature **8 Hours**

Freezing and refrigeration: Introduction to refrigeration- cold storage, freezing. Principle of freezing, changes occurring during freezing, types of freezing- slow and quick. Introduction to thawing, changes during thawing and its effect on food.

Unit 3: Food preservation by high temperature **8 Hours**

Thermal Processing: Commercial heat preservation methods – Sterilization, commercial sterilization. Pasteurization: principles of pasteurization, HTLT, LTLT, Blanching. Canning and bottling: Principles of canning and bottling.

Unit 4: Food preservation by moisture control **8 Hours**

Drying: Definition of drying, preservation, sun drying. Dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve - names of types of driers used in the food industry. Evaporation: Definition, factors affecting evaporation, names of evaporators used in food industry.

Unit 5: Food preservation by irradiation **4 Hours**

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation- mechanism of action, uses of radiation processing in food industry.

Unit 6: Emerging technologies in food preservation **8 Hours**

High pressure processing (HPP), Pulsed electric field (PEF) processing, Ohmic heating, Ultrasound processing, Membrane processing, Microwave, Nanotechnology in Food

Practicals

1. Identification of Class I and Class II preservatives.
2. Study on storage stability of foods under different environmental conditions.
3. Comparison on shelf life study of foods by application of natural and chemical preservatives.
4. Food preservation by low temperature- freezing, refrigeration.
5. Food preservation by high temperature-sterilization, pasteurization.
6. Demonstration of food preservation by canning.
7. Blanching of different fruits and vegetables.
8. Adequacy of blanching.

Suggested Readings

1. Food Processing and Preservation- Subbulaksmi G., and Udipi S.
2. Principles of Food Science, Vol. II- G. Borgstron, Mc. Millan Co. Ltd. London.
3. Principles of food preservation Part I& II- Owen R. Fenemma. 4
4. Food Science- Potter, CBS publishers.
5. The technology of Food Preservation - N.W. Desroiser and N.W. Desrosier
6. Introduction to Food Science & Technology- G.P. Stewart & M.A. Amerine
7. Food Processing Operations Vol. III -M.A. Joslyn and J.J. Heild.
8. Preservation of Fruits and Vegetables- Giridhari Lal, G.S. Siddappa, and G.L. Tondon

Graduate attribute

Course Outcomes:

- Students will enable to understand different food preservation techniques, and processes.
- Students will enable to extend the shelf life of different food products by using the various methods of food preservation
- Students will be able to learn the principles and methods involved in the processing of perishable as well as Non-perishable foods and their effect.
- Acquaint the knowledge of different techniques for food preservation.
- Get knowledge about the various root cause of food spoilage.
- Develop skills in the application of increasing the shelf life of the product.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Fermentation Technology**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To understand the principles of food fermentation technology
- To study the types of starters used in the Food Industry
- To study the production of various fermented foods, alcoholic and non-alcoholicbeverages.

Unit 1: Introduction to Fermentation technology **6 Hours**

History, Scope and Development of Fermentation technology; Isolation and screening of industrially important microorganisms – primary and secondary screening; Maintenance of Strains; Strain improvement.

Unit 2: Fermentation media **8 Hours**

Natural and Synthetic media; Basic components of an medium (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Types of fermentation on the basis of medium used; formulation and process optimization; Role of buffers in media; Process of aeration, and agitation.

Unit 3: Fermenter design **8 Hours**

Types of fermentation on the basis of Fermenter design; Basic design of Fermenter, Types of Fermenters; Scale up study and Product development; Upstream and Down-stream processing and Product recovery.

Unit 4: Production of Microbial Products **8 Hours**

Production of alcohol; Organic acid – Citric acid; Vinegar, Cell immobilization, microbial transformation, sewage treatment, biosensor, bioleaching and effluent treatment.

Unit 5: Fermented foods **8 Hours**

Types of fermentation on the basis of end products; Fermented dairy products, alcoholic beverages; methods of manufacture for sauerkraut, tempeh, miso, soya sauce; traditional fermented foods from North east region of India and their manufacturing methods .

Practicals

1. Demonstration of Fermenters- design, construction and working principle.

2. Study of different types of Fermenters.

3. Preparation of various fermented foods

   a. Alcoholic beverages.
   b. Fermented Dairy products .

4. Preparation of sauerkraut.

5. Preparation of bamboo shoot, fermented fish of north east origin.

Suggested Readings

1. Robert W Hutkins. 2006. Microbiology and technology of fermented foods. WileyBlackwell
2. Y. H. Hui and E. OzgulEvranuz. 2012. Handbook of plant-based fermented foods and beverage technology. CRC press

Graduate attribute

Course Outcome:

- Students will be able to understand the importance of fermentation and different microorganisms associated with foods.
- Students will have an idea about sewage treatment.

- Students will gain knowledge about regional and international fermented foods and their benefits.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Technology for Plant Products**

Course Level: **300-399**

Semester: **Fifth**

Course Objectives:

- To teach the importance of horticultural crops, fruits & vegetables, tea, coffee and spices etc.
- To understand the basic composition and structure of fruits & vegetables, oil seeds, cereals and legumes
- To impart technical knowledge on processing into value-added products.
- To teach the importance of preservation techniques and increase self-life.

Unit 1: Industrial Processing of Fruits and Vegetables **12 Hours**

Chemical composition and nutritive value of fruits and vegetables, preparing fruits and vegetables for processing; preparation and maintenance of work area and process machineries; Post harvest losses of fruits and vegetables and causal factors; maturity indices of fruits and vegetables; climacteric and non-climacteric fruits; packaging of whole fruits and vegetables; post harvest physical and chemical treatment to enhance the shelf life of fruits and vegetables; microbiological spoilage of fruits and vegetables and analysis of products.; FPO Specifications and processing for jam, jelly ketchup, Juice, Squash, cordial, nectar, RTS, Crush , puree, paste, etc.

Unit 2: Cereals and cereals product **12 Hours**

Structure and nutritional composition of different types of cereals; Importance of cereals for nutrition; Technologies for cereal processing; Rice types, Physical properties of rice, cooking properties, parboiling, milling, rice products and byproducts; wheat – types, milling of wheat, wheat flour, wheat based products; millet and millet based products

Unit 3: Pulses, Legumes and Oil-seeds processing **8 Hours**

Present status and future prospects of legumes and oilseeds; Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds Chemical composition, nutritional value and anti-nutritional compounds in legumes and oilseeds; Methods of removal of anti- nutritional compounds; Pulse and legumes processing; Factors affecting milling quality and quantity; Oil seed milling; Refining of oils; Hydrogenation of oils, rancidity in oil

Unit 4: Industrial Processing of Tea, Coffee and Spices **12 Hours**

Tea plant, types of tea, green tea, black tea, white tea, oolong tea, yellow tea, instant tea, CTC Tea, orthodox tea flavored tea, industrial processing techniques, tea fermentation and compounds, quality of tea, health effects, Assam tea, storage of tea, innovative tea-based products, tea-wine, kombucha, etc.; Coffee plant, different types, processing, quality analysis; Major international quality specifications of spices. Spice processing, Value-added spice products: Spice volatile oils, spice oleoresins.

Practicals

1. Estimation of total soluble solids (TSS).

2. Preparation of fruit jam/ fruit jelly/marmalade.

4. Preparation of fruit juice/squash/cordial/nectar.

5. Preparation of pickle/mixed pickle.

6. Preparation of tomato products-sauce, puree, ketchup.

7. Physical characteristics of rice- bulk density, true density, porosity, 1000 kernel length and weight.

8. Cooking quality of rice- minimum cooking time, elongation ratio, water uptake ratio.

9. Processing of tea leaves.

10. Quality analysis of different spices.

11. Demonstration of coffee processing.

Suggested Readings

1. Post-harvest physiology, handling and utilization of tropical and subtropical fruits and vegetables by E. B. Pantastico, AVI Publishing company, INC

2. Post-harvest technology of fruits and vegetables: handling, processing, fermentation and waste management. Vol I and II. Verma L. R. and Joshi V.K.

3. Preservation of fruits and vegetables- Girdharilal, G. S. Siddapa and G. L. Tandon.

4. Fruits and vegetables preservation principles and practices- Srivastava R. P and Sanjeev Kumar.

5. Essentials of food science

6. David Dendy A.V. Cereals and cereal products: technology and chemistry- 2000

7. Association of Operative Millers Cereal Millers Hand Book, Burgess Publishing company, USA, 1963.

8. Pomeranz Y, "Modern Cereal science and Technology" MVCH Publications, NY, 1987.

Graduate attribute

Course Outcome:

- Develop proficiency skills in producing different types of processed fruits & vegetables products.
- Operating & maintenance of the modern processing equipment&types of machinery

- To make different processed fruit &vegetable-based products with quality assurance and safety.
- Students will be able to understand the importance of processing and preservation of horticultural crops, fruits & vegetables, cereals, legumes and oil seed
- They also understand different technology used in different milling industries, refineries etc.
- They will have an idea about new product development using plant-based food.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Production and Operation Management**

Course Level: **300-399**

Semester: **Fifth**

Course objective:

- To understand the basic concept of food production and operation management
- To understand managing the production and operations of food processing unit through production planning and control, directing and controlling finance, human resources, and ensuring product and process quality.
- To understand basic work in a food production plant: Planning, Products Planning, Line Balancing, Scheduling, Inventory Management, Forecasting etc.
- To know the importance of the production system in an organization.
- To understand the link between various activities of the production system.
- Direct and control human resources for the operation of the food processing unit.
- Ensure product and process quality in the food processing unit.

Unit 1: Introduction to Production and Operation Management

8 Hours

Nature and scope of production/operation management –objectives, introduction, concept of production, production system, types of production, production management, operation management, scope of production and operation management, benefits of production management, responsibility of a production manager, decisions of production managements.

Unit 2: Productivity **4 Hours**

Productivity-introduction, meaning of productivity, definitions, importance of productivity, how to improve productivity, methods of measurement of productivity

Unit 3: Production Planning **8 Hours**

Production planning and controlling-objectives, introduction, production planning and control meaning, importance of production planning and control, challenges in production planning and control, factors affecting production planning and control, types of production system, types of manufacturing process, steps of production planning and control.

Unit 4: Inventory and Maintenance Management **8 Hours**

Inventory management-objectives, introduction, definition, different types of inventory, need for inventory management, Good Inventory Management Practices, inventory management techniques; Introduction and meaning, objectives of maintenance, types of maintenance, maintenance planning, maintenance scheduling

Unit 5: Scheduling **4 Hours**

Scheduling– introduction and meaning of scheduling, objectives, selection criteria for the type of scheduling.

Unit 6: Waste management **4 Hours**

Waste–introduction and meaning, reasons for generation and accumulation, identification and control of waste, disposal of scrap.

Practicals

1. Measurement of productivity
2. Demonstration of production system
3. Demonstration of inventory management
4. Demonstration of maintenance management
5. Demonstration on industrial waste management system

6. Conduct an industrial visit and prepare a report on the production management system

Suggested Readings

1. Production and Operation Management Paperback – 2015 by K.ASWATHAPPA (Author, Contributor), K. Shridhara Bhat. Himalaya Publishing House Pvt. Ltd,
2. Principles of Food Production operation by Yogesh Singh, I K International Publishing Pvt. Ltd.
3. Production and operation management: concepts, models and behaviors, 5th edition. Prentice hall of India, Adam and Ebert. 2006
4. Modern production/operation management, Wiley India, Buff ES 2008
5. Panneerselvam, ―Production and Operations Management‖ PHI. Ajay K Garg, Production and Operations Management, TMH.
6. Prof. L.C. Jhamb: Production Operations Management, 18th edition, Everest Publishing House.
7. Dipak Kumar Bhattacharyya, Production and Operations Management, Universities Press.
8. B. Mahadevan, Operations Management: Theory and Practice, Pearson.
9. Kenneth K. Boyer, Rohit Verma, Operations Management, Cengage Learning.

Graduate outcome

Course Outcome:

- Students will have basic ideas about production and operations in food industries.
- They will learn to be disciplined in inventory management, maintenance management quality management etc.
- Understand the importance of the location of the food production plant.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

SEMESTER VI

Course name: **Baking and Confectionery Technology**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

- To teach about the raw material, and their function for making different bakery and confectionery products.
- To impart technical knowledge on processing bakery and confectionery products.
- To teach about leavening agents, shortening agents etc.
- To understand different equipment used in bakery and confectionery industries.

Unit 1: Introduction to bakery science and technology **8 Hours**

Overview on bakery and bakery products; list the various types of industries within the bakery sub sector; scope, present status and future perspective; Classification of bakery products; Bakery ingredients and their functions- Essential ingredients: Flour, yeast and sour dough, water, salt- Other ingredients: Sugar, color, flavor, fat, milk, milk powder and bread improvers; Leavening agents, Shortenings, emulsifiers and antioxidants; Problems of baking.

Unit 2: Equipments **8 Hours**

Introduction to utensils and equipments used in bakery industry with their purpose; Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, and laminating; Fermentation enclosures and brew equipment - Ovens and Slicers

Unit 3: Bread making process **12 Hours**

The Chemistry of Dough Development; process and stages of mixing , Bread making methods- Straight dough/bulk fermentation, Sponge and dough, Activated dough development, Chorley wood bread process; Advantages and disadvantages of various methods of bread-making; Characteristics of good bread: Internal characters; external characters; Bread defects/faults and remedies; Spoilage of bread-Causes, detection and prevention.

Unit 4: Other bakery products **12 Hours**

Production of cakes and cookies/biscuits; Types of biscuit dough – Developed dough, short dough, semi-sweet, enzyme modified dough and batters; Cake making: Ingredients and their function, Structure builders, Tenderizers, moisteners and flavor enhancers; cake faults and remedies ;Production process for Wafers- type of flour, raising agents and maturing; Other miscellaneous products- puff pastry

Unit 5: Confectionery Products **8 Hours**

Definition, importance of sugar confectionery; General technical aspects of industrial sugar confectionery manufacture ,Types of confectionery - Caramel, Toffee and Fudge and other confections-:- ingredients - Formulation - Processing method- Quality control- Aerated confectionery- Methods of aeration- Manufacturing process-product quality parameters, faults and corrective measures, Spoilage of confectionery products

Practicals

1. Determination of moisture content and comparison of different raw ingredients, finished goods
2. Determination of sedimentation value, ash, acid insoluble ash, grittiness, alcoholic acidity, gluten content of wheat flour.
3. Determination of yeast activity.
4. Demonstration of different equipments used in bakery industry.
7. Preparation of different bakery products-bread, cake, biscuit/cookies, bun, pastries.

8. Microbial analysis of bakery products.

Suggested Readings

1. Matz, Samuel A., ―Bakery Technology and Engineering□, Third Edition, Chapman & Hall, London.

   2. Cauvain, Stanley P, and Young, Linda S., ―Technology of Bread Making□, Second Edition Aspen publication. Maryland, 1999
2. Zhou. W, HuiY, H; (2014), "Bakery Products Science and Technology", 2nd Edition, Wiley Blackwell Publishers,
3. 4.Pyler, E. J. and Gorton, L.A. (2009), "Baking Science & Technology" Vol.1 Fourth Edition,Sosland Publications.
4. Stanley P. Cauvain, Linda S. Young, (2008), "Baked Products: Science Technology and Practice". John Wiley & Sons Publishers
5. Edwards W.P. ― Science of bakery products□, Published by The Royal Society of Chemistry, UK,2007

   7. Samuel A. Matz., ―Equipment for Bakers□, Pan Tech International Publication. 1988.

Graduate attribute

Course Outcome:

- Students will get practical knowledge about different bakery and confectionery products.
- They will understand the importance of moisture content, pH, emulsifiers etc.
- They will have an idea about new product development in the field of bakery and confectionery.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Technology for Animal Products**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

- To study the processing of different dairy products, meat, fish and poultry products.
- To study the different products of animal-based products.
- To study the nutritional aspect of the animal-based product

Unit 1: Compositional and Nutritional aspect of Animal foods

12 Hours

Fish - fresh water and marine, composition, spoilage of fish microbiological, physiological, biochemical. Meat – Definition of carcass, red meat and white meat, composition of meat, meat products, abattoir, slaughter methods, marbling in meat, post mortem changes in meat-rigor mortis, tenderization of meat, ageing of meat. Egg-composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality

Unit 2: Fish Processing **8 Hours**

Marine and fresh water fish, popular fishes, Preservation of fish-Chilling, Freezing, curing, drying, salting – salting methods: brining, pickling, curing and canning of fish. Smoking - smoke production, smoke components, quality, safety and nutritive value of smoked fish, pre - smoking processes, smoking process control. Fishery products: Surimi - Process, traditional and modern production lines, quality of surimi products. Fish protein concentrates (FPC), fish protein extracts (FPE), natural causes of rapid spoilage, fish glazing, other preservation techniques, fermented and non-fermented fish products, fish drying and dried fish products of Assam, storage.

Unit 3: Meat processing **10 Hours**

Meat Quality - colour, flavor, texture, Water Holding Capacity (WHC), Emulsification capacity of meat, Preservation of meat –Refrigeration and freezing, thermal processing - canning of meat, dehydration, meat curing and smoking, Meat products: Sausages - processing, RTE meat products.

Unit 4: Egg processing **8 Hours**

Egg- Structure and Composition of egg and nutritive value; Factors affecting egg quality, egg quality evaluation, primary processing, egg white and egg yolk, egg as natural emulsifier, storage; Preservation of eggs - Refrigeration and freezing, thermal processing, dehydration, coating. Egg products- Egg powder, frozen egg pulp, designer eggs.

Unit 5: Dairy processing **12 Hours**

Co-operative dairy schemes, milk composition and properties, milk micro-flora, , Platform tests, Milk Processing- collection of milk, homogenization, pasteurization techniques, aseptic packaging, toned and double-toned milk, recombined and reconstituted milk, lactose intolerance, flavored milks, dahi and yoghurt, paneer, chana, butter, ghee, lassi, toffee, milk powder, ice cream- processing and quality, microbiology and storage, recent developments in dairy industry.

Practicals

1. Estimation of moisture content of meat.
2. Preservation of meat.
3. Demonstration of microbial spoilage in meat and meat products.
4. Milk reception operation.
6. To perform different platform tests in milk.
7. Demonstration of Standardization of milk.
8. To estimate milk fat by Gerber method.
11. Demonstration of cream separator.
12. Demonstration of can washer.

13. Demonstration of batch pasteurizer and HTST pasteurizer.

14. Preparation of different dairy products.

Suggested Readings

1. R.A. Lawrie, 1988 Meat Science, Pergamon Press.

2. G.J. Mountney.1995. Poultry Products Technology by Taylor & Francis

3. Parkhurst& Mountney.2012. Poultry Meat and Egg Production.Springer London, Limited, 05-Jul- 2012

4. Food Facts & Principles by Shakuntla Manay N &Shadoksharaswamy N, 1996, New Age World publisher, CA.

5. Egg Science & Technology by Stadelman WJ, & Cotterill OJ, 2002, CBS Publisher, New Delhi.

6. Fish Processing & preservations by Charles L, Cutting

7. Sukumar de; Outlines of dairy technology -oxford university press.

8. Indian dairy products, K.T.Acharya publication

9. Milk hygiene in milk production processing and distribution, FAO Publication.

10. Fliud milk industry, J.S Handerson, A.V.I Publishing Company, USA

11. Milk Hygiene in milk production processing and distribution, F.A.O Publication

Graduate attribute

Course Outcome:

- Students will be able to understand the importance of meat, preservation and processing into different products.
- They will have practical knowledge of animal-based products.
- They will learn about quality testing, spoilage etc.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Food Packaging Technology**

Course Level: **300-399**

Semester: **Sixth**

Course Objectives:

The objectives of this course are to

- Establish the different functions performed by packaging material.
- To inform about the health implications of food-package interactions.
- To inform about packaging requirements for fresh and processed food for local and international markets

Unit 1: Introduction to food packaging **8 Hours**

Definition, functions and requirements for effective packaging, packaging criteria, classification of packaging-primary, secondary and tertiary packaging, Flexible and rigid packaging, Importance of packaging

Unit 2 Materials for food packaging **8 Hours**

Paper, glass, tin, aluminium-polymer coated, tin free steel cans, cellophane, plastics- different types of plastics including bioplastics and edible films, active/intelligent films.

Unit 3: Different forms of food containers **8 Hours**

Boxes, jar, cans, bottle; Interaction of package with foods; Packaging requirements for various products-fruits and vegetables, meat, fish, milk and dairy products, canned foods, dehydrated foods.

Unit 4: Modern concepts of packaging technology **8 Hours**

Aseptic packaging, form-fill seal packaging, edible films, retort pouch packaging, Gas flushing, tetra pack, vacuum packaging, MAP & CAP, active packaging, intelligent packaging.

Unit 5: Food packaging laws and specifications **8 Hours**

Quality testing of packaging materials; Paper and paper board-thickness, bursting strength, tensile strength, puncture resistance; Flexible packaging materials (plastics)-density, tensile strength, WVTR, GTR, seal strength.

Practicals

1. Demonstration of different packaging materials

2. Determination of water vapor transmission rate of various packaging materials.

3. Demonstration of measurement of carton's dimension as per organizational standard.

4. To determine the thickness of paper and paper board.

5. Demonstration on biodegradable packaging materials

Suggested Readings

1. Coles,r; dowel, d.m; kirwan,j. food packaging technology. Black well publishing ltd
2. Niir board; food packaging technol;ogy handbook national institute of industrial research , New Delhi
3. PirengerO.G.andA.L.Baver: Plastic Packaging Materials for Food Wiley VCH, GmbH,

Graduate attribute

Course Outcome:

- Students will be able to understand the need for packaging food.
- Understand the various functions of food packages as influenced by their characteristics
- Understand the health implications of food-package interactions

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Dr Mohammad Imtiyaj Khan, Assistant Professor, Department of Biotechnology, Gauhati University

Dr Debasish Borbora, Assistant Professor, Department of Biotechnology, Gauhati University

Course name: **Internship**

Course Level: **300-399**

Semester: **Sixth**

Duration: 40 Hours

Conduct in workplace

A student will undergo an industrial internship in the field of their specialization during the semester break (winter) of the academic year.

Evaluation will be done by the department based on the feedback received from the industrial management on the student's performance during the tenure

Report making and verbal presentation

After completion of the internship, the student will prepare a report on his/her work and experience

Evaluation will be based on the quality of the report and presentation

Project report+ presentation +viva

Bachelor of Vocation (B.Voc.)[Herbal Processing Technology]

a. Four-year Undergraduate Programme: B. Voc (Three year)
b. Subject: Herbal Processing Technology
c. Semester: First
d. Course Name: HPT-VC-1014–Introduction to Herbal Processing Technology
e. Existing Base Syllabus: None
f. Course Level: 100-199
g. Syllabus: Total Marks= 100

Unit no.	Unit content	Contact hours	Marks
1. Introduction to Herbs	• History of medicinal and aromatic plants. • erbal Therapeutics: From Ancient Times to the 21stCentury: The Ancient World, The world of Greece and Rome, Twentieth Century, Prospects for the Twenty-first Century.	14	20
2. Indian System of Medicine	• yurveda, Unnani, Siddha, Yoga and Homeopathy. • raditional System of Medicines. • edicinal Plants of North East India.	14	20
3. Crude Drugs	• Sources of Crude Drug • Types of Crude Drug • Classification of Crude Drugs • Major Plant Drugs used in medicine	14	20
Practical	• Identification of Medicinal and Aromatic Plants. • Herbarium preparation of Medicinal and Aromatic Plants. • Identification of Crude Drugs.		20
Internal Assessment			20

h. Reading list:
   - Herbal Drug Technology, by S.S. Agarwal.
   - A Textbook on Mushroom Cultivation by Ashok Aggarwal, Yash Pal Sharma, and EshaJangra.
   - Mushroom Cultivation in India by B.C. Suman and V.P. Sharma.
   - Mushroom Growing by S.C. Dey.

i. Graduate Attributes:The students should have passed 10+2/ H.S in any stream Arts, Science and Commerce.

j. Course Objective: This course will allow students to gain knowledge on conservation, propagation, cultivation, post-harvest processing, value addition,

marketing and other activities related to sustainable management of Herbal Resources.

k. Learning outcome: Students will get skilled in identifying opportunities for encouraging local processing and enterprise development of economically important herbs and medicinal plants.
l. Theory Credit: 3
m. Practical Credit: 1
n. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: First
d. Course Name: HPT-VC-1024–Compost Preparation of Mushroom
e. Existing Base Syllabus: None
f. Course Level: 100-199
g. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Contact hours**	**Marks**
1. Introduction to Mushroom	• lassification of Edible Mushroom. • utritional and Medicinal Aspects of Mushroom.	10	10
2. Compost Preparation of mushroom	• Types of base materials from various agricultural by-products. • Nitrogen (N) and carbon (C) ratio. • Nutrient source, composting, mineral deficiencies. •Necessarytools required to produce a compost.	15	20
3. Types of compost	• Composting ingredients. • Natural compost and Synthetic compost.	10	10
4. Methods of composting	• Short, long; Indoor, Outdoor; storage of the agricultural by-products. • Pasteurization, nematodes, pest fungi, or other pests. • Attributes of a good compost. • Hazards and risks associated with composting.	10	20
Practical	• Compost preparation using different agricultural by-products. • Pasteurization of the compost using different methods.		20
Internal Assessment			20

h. Reading list:
- Herbal Drug Technology, by S.S. Agarwal.
- A Textbook on Mushroom Cultivation by Ashok Aggarwal, Yash Pal Sharma, and EshaJangra.
- Mushroom Cultivation in India by B.C. Suman and V.P. Sharma.

- Mushroom Growing by S.C. Dey.

i. Graduate Attributes:The students should have passed 10+2/ H.S in any stream Arts, Science and Commerce.
j. Course Objective: This course will allow students to gain knowledge & skill on Mushroom production.
k. Learning outcome: Students will get skilled in Mushroom production and will get a certificate on Mushroom Grower.
l. Theory Credit: 3
m. Practical Credit: 1
n. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: First
c. Course Name: HPT-VC-1034–Cultivation of Mushroom
d. Existing Base Syllabus: None
e. Course Level: 100-199
f. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Contact hours**	**Marks**
1. Commercially important type of mushroom	• Based on market's demand, climatic conditions, growing season, availability of raw material and investments. • Collection of mushroom spawns.	10	10
2. Mushroom cultivation site	• Site assessment based on the size of available land, agro-climatic conditions, farm labour and transportation Plan and design a mushroom farm. • Crop rotation method for mushroom cultivation.	10	10
3. Methods of harvesting and post harvesting	• ood harvesting practices, cutting techniques, cleaning methods Removing the water content from the mushroom. • orting and grading the harvests as per required quality specifications Storage area and type of storage. • ackaging, labelling and transportation. • mportance and uses of spent mushroom substrate. • iseases control: Local infections, bacterial diseases, Use of fungicide, pesticide, and insecticide.	15	30
4. Basic small entrepreneurial activities	• emand and supply of produce in the market target customers and assess their needs. • asic accounting. • ollection of information related to various subsidies/funds.	10	10

Practical	• Demonstration of tools, materials and methods used in harvesting. • Packaging, storage, and transport of Mushrooms.		20
Internal Assessment			20

g. Reading list:
   - A Textbook on Mushroom Cultivation by Ashok Aggarwal, Yash Pal Sharma and EshaJangra.
   - Mushroom Cultivation in India by B.C. Suman and V.P. Sharma.
   - Mushroom Growing by S.C. Dey.

h. Graduate Attributes:The students should have passed 10+2/ H.S in any stream Arts, Science and Commerce.

i. Course Objective: This course will allow students to gain knowledge & skill on mushroom production.

j. Learning outcome: Students will get skilled in mushroom production and will get a certificate on mushroom grower.

k. Theory Credit: 3

l. Practical Credit: 1

m. Particulars of Course Designer (Name, Institution, email id):
   1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
   2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Second
c. Course Name: HPT-VC-2014–Medicinal Botany
d. Existing Base Syllabus: None
e. Course Level: 100-199
f. Syllabus: Total Marks= 100

Unit no.	Unit content	Contact hours	Marks
1. Plant Classification	• Systematics, flowering plants, non-flowering plants.	10	10
2. Plant Anatomy	• Cell structure and function, genes, cell division, tissue types and function.	10	15
3. Plant Morphology	• Root structure and function, leaf structure and function, flower structure and function.	5	15
4. Plant Identification	• Trees, shrubs, herbs, habitat.	5	10
5. Plant Physiology	• Germination, photosynthesis, respiration, transpiration, pollination, plant breeding, genetics, tropism, plant response.	10	10
Practical	• Microscopic observation. • Preparation of herbarium of medicinal plants.		20
Internal Assessment			20

g. Reading list:
   - College Botany by BP Pandey.
   - Medicinal Botany & Ethnobotany by Dr. Anil K. Thakur, Dr. Susheel K. Bassi and Dr. S.K. Sood.
   - Medicinal Plants by S.K. Jain.
   - Medicinal Botany by WaseemShahri, MohmadAarif and Chesfeeda Akhter.

h. Graduate Attributes:The students should have passed 1st semester B.Voc. in Herbal Processing Technology.
i. Course Objective: This course will allow students to gain knowledge on plant parts.

j. Learning outcome: Students will get skilled in identifying and classifying the medicinal plants.
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Second
c. Course Name: HPT-VC-2024–Cultivation of Medicinal Plants
d. Existing Base Syllabus: None
e. Course Level: 100-199
f. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Contact hours**	**Marks**
1. Nursery site preparation	• Layout of nursery. • Types of nursery beds, propagation, tilting the soil, Good agricultural practices (GAP). • Nursery management and post work activities.	10	20
2. Propagation ofMedicinal plants	• Selection of seed, types of seed, seed treatment protocols & agronomic practices. • Cuttings, layering and grafting.	10	15
3. Cultivation Management	• Application of organic manures, vermicompost, green leafy manure, bio-fertilizers, irrigation & water management • Inter-cultivation practices • Integrated Pest management	10	15
4. Harvesting of plant parts	• ollection of plant parts, good harvesting practices, appropriate season and time for harvesting, maturity of plant and cutting techniques, control measures to prevent contamination of harvested plant parts.	10	10
Practical	▪ Demonstration of nursery techniques: preparation of seed bed, cuttings bed, soil mix, layering, transfer to polybags, etc. ▪ Cultivation of medicinal and aromatic plants e.g., Citronella, *Curcuma longa*, etc.		20
Internal Assessment	▪		20

g. Reading list:
   - Cultivation of Medicinal Plants, by Subrata Mandal, Sudipa Nag (Mandal), AlokeshDas.

h. Graduate Attributes:The students should have passed 1st semester B.Voc. in Herbal Processing Technology.

i. Course Objective: This course will allow students to gain knowledge & skill on cultivation of medicinal plants.

j. Learning outcome: Students will get skilled in planning &management of nursery site preparation,harvesting of plant parts, etc.

k. Theory Credit: 3

l. Practical Credit: 1

m. Particulars of Course Designer (Name, Institution, email id):
   1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
   2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Second
c. Course Name: HPT-VC-2034–Post-Harvest Management & Marketing
d. Existing Base Syllabus: None
e. Course Level: 100-199
f. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Conta ct hours**	**Mar ks**
1. Post harvesti ng procedur es	• Cleaning, dehydration, sorting and grading of harvests parts • Identification, selection & removal of toxic weeds • Documentation, labelling, packaging, transport & storage of produce.	10	20
2. Market potential and demand of medicin al plants	• Value chain of medicinal plants in the market • Targetconsumers and market characteristics.	10	20
3. Basic accounti ng	• nformation related to various subsidies. • ecord keeping and key marketing channels. • afety checks before operation.	10	10
4. Waste disposal	• Disposal of damagedproduce from environmental factors. • Emergency procedures &safety measures.	10	10
Practic al	• Demonstration of tools, materials and methods used in nursery. • Cultivation, harvesting, packaging, storage, andtransport of medicinal plants.		20
Internal Assess ment			20

g. Reading list:
   - Post-Harvest Management of Horticultural Crops, by Sadhana Pandey, S.N. Pandey, P.H. Pandey.

h. Graduate Attributes:The students should have passed 1st semester B.Voc. in Herbal Processing Technology.
i. Course Objective: This course will allow students to gain knowledge & skill on Post-Harvest Management & Marketing.
j. Learning outcome: Students will get skilled in post harvesting procedures, market potential and demand of medicinal plants, etc.
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Third
c. Course Name: HPT-VC-3014–Fundamental Chemistry
d. Existing Base Syllabus: None
e. Course Level: 200-299
f. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Conta ct hours**	**Mar ks**
1. Chemica l Equilibri um	• Equilibrium expressions • Acid base theories, acid base equilibria, Buffers. • pH scale, calculation of pH values for strong acids, bases, and weak acids solutions.	12	30
2. Introduc tion to Organic Chemist ry	• Role and special properties of carbon; empirical and molecular formula. • Physical properties of organic compounds.	15	20
3. Aromati city	• Structure, stability, and fundamental chemistry of benzene; description of other important aromatic ring systems.	15	10
Practica l	• asic glassware used in the laboratory. • Good lab practices: calibration of equipment and standard solutions preparation. • H of samples.		20
Internal Assessm ent			20

g. Reading list:
   - Fundamentals of Chemistry by Dr. Swati Goyal.
   - Chemistry for Beginners by Ranjan Kumar Mohapatra.
   - Basic Chemistry by Karen Timberlake and William Timberlake.

h. Graduate Attributes:The students should have passed 1st and 2nd semester B.Voc. in Herbal Processing Technology.

i. Course Objective: This course will allow students to gain knowledge on basic chemistry.

j. Learning outcome: Students will get skilled in good laboratory practices specific to a basic chemistry lab.
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Third
c. Course Name: HPT-VC-3024–Soil Analysis
d. Existing Base Syllabus: None
e. Course Level: 200-299
f. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Cont: ct hours**	**Marks**
1. Soil Physical characteristics	• Determination of soil texture, soil moisture content, bulk density measurement, compactness, porosity, hydraulic conductivity of soil.	10	20
2. Soil Chemical characteristics	• Determination of soil pH, EC, turbidity, organic carbon, calcium carbonate (CaCO3) free lime, nitrogen, phosphorus, potassium, and sodium.	10	15
3. Soil metal content characteristics	• Determination of calcium &magnesium, boron, sulphur, zinc, copper, iron, manganese and cation exchange capacity, reclamation of loose and fragile soil. • Determine gypsum content and requirement of soil.	12	15
4. Preparation of Soil Health cards	• ertilizer and micro-nutrients doses (kg/Ha) based upon the soil test calibrated for field conditions, Use of organic manure & green manure crops. • etermination of pesticide & inorganic fertilizer residues. • ntegrated nutrient management practices. • oil fertility mapping using GIS.	12	10
Practical	▪ Soil sample analysis of agricultural land or medicinal herbal garden. ▪ Preparation of Soil Health cards.		20
Internal Assessment			20

g. Reading list:

- Manual on Soil, Plant and Water Analysis, by Dhyan Singh, P.K. Chhonkar, B.S. Dwivedi.

h. Graduate Attributes:The students should have passed 1st and 2nd semester B.Voc. in Herbal Processing Technology.
i. Course Objective: This course will allow students to gain knowledge on characteristics of soil.
j. Learning outcome: Students will get skilled in Soil Analysis
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Third
d. Course Name: HPT-VC-3034 –Water Analysis
e. Existing Base Syllabus: None
f. Course Level: 200-299
g. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Contact hours**	**Marks**
1.Characteristics of water	▪ Determination of water pH, EC, dissolved O_2, BOD. ▪ Total dissolved solids, total suspended solids, carbonates, and bicarbonates.	14	20
2. Metal content in water	● Determine calcium & magnesium, sodium, potassium, nitrogen, boron, chloride, sulphate, heavy metals (As, Pb, Fe).	14	20
3. Preparation of Water Health cards	● ertilizer and micro-nutrients doses (kg/Ha) based upon the water test calibrated for field conditions Use of organic manure & green manure crops. ● etermination of pesticides & inorganic fertilizer residues. ● afety & sanitation guidelines of the water use & reuse.	15	20
Practical	▪ Water sample analysis from sources like well and ponds. ▪ Preparation of Water Health cards.		20
Internal Assessment			20

h. Reading list:
   - Manual on Soil, Plant and Water Analysis, by Dhyan Singh, P.K. Chhonkar, B.S. Dwivedi.

i. Graduate Attributes:The students should have passed 1st and 2nd semester B.Voc. in Herbal Processing Technology.
j. Course Objective: This course will allow students to gain knowledge & skill on characteristics of water.
k. Learning outcome: Students will get skilled in wateranalysis.
l. Theory Credit: 3
m. Practical Credit: 1
n. Particulars of Course Designer (Name, Institution, email id):

1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Fourth
c. Course Name: HPT-VC-4014 – Herbal Chemistry
d. Existing Base Syllabus: None
e. Course Level: 200-299
f. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Contact hours**	**Marks**
1. Amino acids and Proteins	• Roles of proteins in living organisms, structure, and properties of 20 essential amino acids, formation, and properties of the peptide bond • Protein folding; secondary, tertiary, and quaternary protein structure, Protein denaturation.	10	15
2. Carbohydrates metabolism	• Roles of carbohydrates in living organisms, Nomenclature, Stereoisomerisms in carbohydrate chemistry, • Structure and properties of important monosaccharides, disaccharides, and polysaccharides.	10	15
3. Lipids	• oles of lipids in living organisms, Classification of lipids, • atty acids (saturated, unsaturated), Glycerides (neutral glycerides, phosphoglycerides), non-glycerol lipids (sphingolipids, steroids, waxes).	10	15
4. Nucleic Acids	• Role of nucleicacids in living organisms, Nomenclature, Chemical composition and structures of nucleosides and nucleotides, • Structure of DNA double helix, Replication, Transcription, Genetic code, and Translation.	15	15
Practical	• Screening test for Proteins by Ninhydrin test or Biuret test • Screening test for Carbohydrates by Benedict's test.		20
Internal Assessment			20

g. Reading list:
   - Herbal Drug Technology by - S.S Agrawal and M. Paridhavi.
   - Biochemistry, by Voet and Voet, John Wiley, and Sons.

h. Graduate Attributes:The students should have passed 1st, 2nd, and 3rd semester B.Voc. in Herbal Processing Technology.

i. Course Objective: This course will allow students to gain knowledge onHerbal Chemistry.
j. Learning outcome: Students will have knowledge on chemistry of biomolecules.
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Fourth
c. Course Name: HPT-VC-4024 – Microbiology
d. Existing Base Syllabus: None

e. Course Level: 200-299
f. Syllabus: Total Marks= 100

Unit no.	Unit content	Cont act hours	Marks
1. History of microbiology	• rief outline of the history of microbiology from the 17th to the 20th century.	10	5
2.Prokaryotic cell structure and function	• omponents of the prokaryotic cell and their function with reference to differential microscopic staining. • ell wall, phospholipids membrane, outer membrane, flagella, pili, capsule, nucleoid, ribosomes, endospores, and inclusion bodies.	12	20
3. Bacteria	• lassification, selected families and groups of Gram-positive and Gram-negative microorganisms and their isolation.	10	20
4. Microbial nutrition and growth	• lemental requirements, culture media, measuring cell growth, growth curves, environmental conditions affecting growth.	10	15
Practical	• Media preparation • Growth curves of Bacteria		20
Internal Assessment	•		20

g. Reading list:
   - Essentials of Microbiology by S. Rajan and R. Solvi Christy.
   - Basic Microbiology by B.K. Khuntia.
   - A Textbook of Basic and Applied Microbiology by K.R. Aneja, Pranay Jain, and Raman Aneja.

h. Graduate Attributes:The students should have passed 1st, 2nd, and 3rd semester B.Voc. in Herbal Processing Technology.

i. Course Objective: This course will allow students to gain knowledge on microorganisms specially bacteria.

j. Learning outcome: Students will get skilled in media preparation and evaluating bacterial growth.
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Fourth
c. Course Name: HPT-VC-4034 – Agri Commodities Management
d. Existing Base Syllabus: None
e. Course Level: 200-299
f. Syllabus: Total Marks= 100

Unit no.	Unit content	Contact hours	Marks
1. Planning & Management of Agri produce	• Plan for receipt of Agri produce, proper and accurate weighing, efficient storing of produce in the warehouse. • Production assessment regulatory and specific requirements for loading and shipment. • Regulatory rules for export.	15	20
2.Determination oftransit requirements	• Proper tagging and packaging of produce and commodities, transportation modes, Cold Storage facilities, supply chain, transit times and routes, workplace policy and procedures.	12	20
3. Record Keeping	• Maintenance of warehouse activities, deposits, withdrawals and related entries, expenses and costs incurred at warehouse as per operational guidelines. • Database maintenance for sending out information to control groups.	15	20
Practical	• Home assignment		20
Internal Assessment			20

g. Reading list:
   - Agribusiness Management, by Dr. Anjan Mishra, Dr. Debasish Biswas,Dr. ArunangshuGiri
   - Agricultural Commodity Futures Market- GouriPravaSamal

h. Graduate Attributes:The students should have passed 1st, 2nd, and 3rd semester B.Voc. in Herbal Processing Technology.

i. Course Objective: This course will allow students to gain knowledge & skill onAgri Commodities Management.
j. Learning outcome: Students will get skilled in Planning & Management of Agri produce.
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Fourth
d. Course Name: HPT-VC-4044 – Warehouse Management
e. Existing Base Syllabus: None
f. Course Level: 200-299
g. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Contact hours**	**Marks**
1. Demandassessment projection	• Data analyses from sales plan • High and low volume periods • Inventory levels, Sales cycle stages.	8	10
2.Factors affecting stock levels	• Stock supply and consignment delivery lead times, internal processing and distribution times, maximum stock carrying capacity, Physical and human resources in relation to projected required stock levels. • Contingency plan for abnormal distribution, stoppages, and slowdowns.	10	10
3. Optimum inventory levels monitoring	• roduction and sales cycle stages. • afety stock levels, Inventory benchmarks. • eriodic inspections of warehouse.	10	15
4. Manpower planning	• Sources and type of manpower, working hours coordination including scheduling, approving time off requests, tracking absences, timekeeping, maintenance of muster roll.	5	10
5. Worker's training	• Quality standards, inventory management, record keeping and resolving team conflicts. • Quality standards during delivery and storage, customer service standards, agreed quality standards and budgetary limits. • Quality standards during storage of Agri commodities / produce.	10	15
Practical	• Home assignment		20
Internal			20

Assessment			

h. Reading list:
   - Basics of Warehouse and Inventory Management, byVR Rangarajan
   - Warehouse Management and Inventory Control, by Philip M. Price and Natalie J. Harrison
   - Warehouse: Layout Planning and Part Feeding Methods, by Kumar and Omkumar.

i. Graduate Attributes:The students should have passed 1st, 2nd, and 3rd semester B.Voc. in Herbal Processing Technology.

j. Course Objective: This course will allow students to gain knowledge & skill on Warehouse Management.

k. Learning outcome: Students will get skilled in Warehouse Management system

l. Theory Credit: 3

m. Practical Credit: 1

n. Particulars of Course Designer (Name, Institution, email id):
   1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
   2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Fifth
d. Course Name: HPT-VC-5016 –Pharmacology
e. Existing Base Syllabus: None
f. Course Level: 300-399
g. Syllabus: Total Marks= 100

Unit no.	Unit content	Contact hours	Marks
1. Introduction to Pharmacology	• Basics of Pharmacokinetics and pharmacodynamics.	12	10
2. Pharmacodynamics	• Mechanism of Drug Action, Receptor Pharmacology. • Introduction to ANS, CNS and CVS • Aspects of Pharmacotherapy, factors modifying drug action, rational use of drugs, clinical pharmacology, and drug development.	15	30
3. Vitamins	• Fat Soluble Vitamins, Vitamin E, Vitamin C, Antioxidant vitamins. • Drug Interaction, Adverse drug Effects.	13	20
Practical	• Home Assignment		20
Internal Assessment			20

h. Reading list:
   - Fundamentals of Experimental Pharmacology, byM N Ghosh
   - Handbook of Experimental Pharmacology, byS.K Kulkarni
   - Text Book of Pharmacology, byF S K Barar

i. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, and 4th semester B.Voc. in Herbal Processing Technology.
j. Course Objective: This course will allow students to gain knowledge & skill onPharmacology.
k. Learning outcome: Students will have knowledge on pharmacology and pharmacotherapy.
l. Theory Credit: 3
m. Practical Credit: 1
n. Particulars of Course Designer (Name, Institution, email id):

1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Fifth
d. Course Name: HPT-VC-5026 –Applied Separation Techniques
e. Existing Base Syllabus: None
f. Course Level: 300-399
g. Syllabus: Total Marks= 100

Unit no.	Unit content	Contact hours	Marks
1. Separation Technologies	• Separation by gravity (batch and continuous), sedimentation. • Centrifugation, ultracentrifugation.	8	10
2. Distillation, Dehydration and Evaporation	• Distillation, Evaporation, drying, roller, spray, freeze and fluidized bed. • Lyophilization, crystallization.	8	10
3. Filtration	• Theory of filtration, batch filters, continuous filters, types of filters, cross flow filtration. • Membrane Processes,reverse osmosis, ultrafiltration, liquid membranes.	5	10
4. Solvent Extraction	• Liquid-liquid extraction. • Principles of solubility in solutions, solvent extraction equilibria, two-phase aqueous extraction.	10	15
5. Chromatography	• Principles of Chromatography, thin Layer chromatography, paper chromatography.	10	15
Practical	• Procedures for centrifugation. • Procedures for thin layer chromatography. • Preparation of plant extract using solvent extraction method.		20
Internal Assessment			20

h. Reading list:
   - Principles and Techniques of Biochemistry and Molecular Biology, byKeith Wilson and John Walker.

i. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, and 4th semester B.Voc. in Herbal Processing Technology.

j. Course Objective: This course will allow students to gain knowledge & skill onseparation techniques.
k. Learning outcome: Students will get skilled in separation techniques like filtration, centrifugation, solvent extraction, and chromatography.
l. Theory Credit: 3
m. Practical Credit: 1
n. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Fifth
d. Course Name: HPT-VC-5036 –Community Strengthening
e. Existing Base Syllabus: None
f. Course Level: 300-399
g. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Conta ct hours**	**Mar ks**
1. Community Strengthening	• Organization of community and key leaders meet. • Role of community institutions in the agriculture projects.	10	10
2. Rural communication techniques	• Street plays, puppet show, folk musical forms, posters, audio-visual media, Developing agenda, Participatory/rapid rural appraisal (PRA/RRA). • Merits/demerits of community institutions.	10	15
3.Organize visits to high impact community owned institutions	• tatutory compliances of formal institutions • pproach and processes adopted in formation and strengthening of the institutions, experiences, difficulties faced, feedback meetings. • ction plan for collective actions through institutional development processes,review/revisit institutional development strategies	12	15
4. Community participation management	• Planning, implementation and monitoring of projects, increase participation, membership, volunteering, and attendance at meetings. • Encourage community members by eliciting the successes of the community, generating further ideas, Support community to establish and increase the maintenance fund for various activities. • Health and safety guidelines at the workplace, team work.	12	20
Practical	• Home Assignment		20
Internal Assessment			20

h. Reading list:
   - Community Organization and Development: An Indian Perspective, by Asha RamagondaPatil.
   - Working with communities: An Introduction to Community Work, by HY Siddiqui.

i. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, and 4th semester B.Voc. in Herbal Processing Technology.

j. Course Objective: This course will allow students to gain knowledge & skill on community strengthening.

k. Learning outcome: Students will get skilled in Community Management system

l. Theory Credit: 3

m. Practical Credit: 1

n. Particulars of Course Designer (Name, Institution, email id):
   1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
   2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology

b. Semester: Fifth

c. Course Name: HPT-VC-5046 –Community Institutions
d. Existing Base Syllabus: None
e. Course Level: 300-399
f. Syllabus: Total Marks= 100

Unit no.	Unit content	Contact hours	Marks
1. Community Institutions	▪ Enhance current capabilities of the community. ▪ Training need assessment (TNA) ▪ Refine and customize the training modules. ▪ Induce a policy/general direction that can guide actions and the development of capacity in the long term.	12	15
2. Strengthening larger community	• Chief functionaries training, proceedings writing, record maintenance. • Building group of institutions.	10	10
3.Finance management	• inancial institutions (commercial/regional rural/co-operative banks, SIDBI, SFCS/SIDCS, NABARD). • stablish, track, and fulfill contractual agreements from funding agencies. • ccounting journals, cash book, ledgers and other records detailing financial transactions.	12	25
4. Administrative records and legal compliances	• Documentation and filing system • Registration under appropriate Indian laws.	10	10
Practical	• Home Assignment		20
Internal Assessment			20

g. Reading list:
- Community Organization and Development: An Indian Perspective-, by Asha RamagondaPatil.
- Working with communities: An Introduction to Community Work, by HY Siddiqui.

h. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, and 4th semester B.Voc. in Herbal Processing Technology.
i. Course Objective: This course will allow students to gain knowledge & skill on Community Institutions.
j. Learning outcome: Students will get skilled in financemanagement and administrative documentation and filing system.
k. Theory Credit: 3
l. Practical Credit: 1
m. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Sixth
d. Course Name: HPT-VC-6016 –Herbal Biotechnology
e. Existing Base Syllabus: None
f. Course Level: 300-399
g. Syllabus: Total Marks= 100

Unit no.	Unit content	Contact hours	Marks
1. Introduction to Plant Tissue Culture	• History of plant tissue culture, comparison of conventional and micropropagation techniques for plant propagation. • Requirements of PTC, setting up a tissue culture lab.	10	15
2. Explant Establishment	• Mother plant preparation, explant selection &preparation and surface sterilization.	10	15
3. Media Preparation	• Media ingredients: Macro and Micro Nutrients, vitamins, plant growth regulators, pH, gelling agents, liquid culture. Media sterilization and dispensing: Autoclaves, Sterile Dispensing.	12	20
4. Tissue and Organ Culture	• Plant Organ and TissueRegenerationand Acclimatization	10	10
Practical	• MS media preparation. • Surface sterilization of explant. • Sterilization of glassware. • Inoculation of explants.		20
Internal Assessment			20

h. Reading list:
   - Plant Tissue Culture: Techniques and Experiments, by Roberta H. Smith and Robert L. Smith.
   - Plant Tissue Culture: Theory and Practice, by S.S. Bhojwani and M.K. Razdan.
   - Introduction to Plant Tissue Culture, by M.K. Razdan.
   - Plant Cell and Tissue Culture: A Tool in Biotechnology- Basics and Application, by Suman Chandra and Hemant Lata.
   - Principles of Plant Tissue Culture and Biotechnology, by Dr. G. S. Sethi

i. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, 4th, and 5th semester B.Voc. in Herbal Processing Technology.

j. Course Objective: This course will allow students to gain knowledge & skill on plant tissue culture.
k. Learning outcome: Students will get skilled in plant tissue culture techniques.
l. Theory Credit: 3
m. Practical Credit: 1
n. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Four-year Undergraduate Programme: B. Voc (Three years)

a. Subject: Herbal Processing Technology
b. Semester: Sixth
c. Course Name: HPT-VC-6026 –Finance Management
d. Existing Base Syllabus: None
e. Course Level: 300-399
f. Syllabus: Total Marks= 100

Unit no.	**Unit content**	**Contact hours**	**Marks**
1. Financial management systems	• Plan, implement and review of financial management systems. • Analyses budget, financial plans for the farm. • Prepare a plan to deal with any contingencies. • Provide guidance and instructions to the team members. • Collect and analyses data to gauge the effectiveness of financial management processes. • Review financial processes for improvements.	12	20
2. Monitor and control of finances and expenses	• onitor actual expenditure and to control expenses across the farm operations. • alculate labor and other expenditure and compare with the budget. • arm production costs and revenues for profit and loss.	10	20
3. Manage risks with respect to farm financing	• Strategies to deal with the risks identified. • Relevant strategies to address and mitigate the risks.	10	10
4.Develop a farm plan	• Business goals • Market trends for procurement of farm inputs. • Water supply and irrigation plan; Infrastructure plan. • Manage procurement and sales processes.	10	10
Practical	• Home Assignment		20
Internal Assessment			20

g. Reading list:
   - Financial Management, byPrasan Chandra.
   - Fundamentals of Financial Management, by James C. VanHorne.

h. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, 4th, and 5th semester B.Voc. in Herbal Processing Technology.

i. Course Objective: This course will allow students to gain knowledge & skill onfinancemanagement.

j. Learning outcome: Students will get skilled in planning &management of finance.

k. Theory Credit: 3

l. Practical Credit: 1

m. Particulars of Course Designer (Name, Institution, email id):
   1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
   2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Sixth
d. Course Name: HPT-VC-6036 –Farm Business Management
e. Existing Base Syllabus: None
f. Course Level: 300-399
g. Syllabus: Total Marks= 100

Unit no.	Unit content	Cont: ct hours	Marks
1. Infrastructure requirements and management	• PPE (Personal Protective Equipment). • Production capacity and production data: identify natural resources,soil characteristics and water resources on the farm; production plan. • Organizational planning processes and potential for improvements or innovations.	15	20
2. Plan and manage production	• rganizational management and strategic plans. • nvironmental sustainability controls. • ffectiveness of production processes. • dministrative records and legal compliances.	15	20
3. Manage farm operational activities	• mplement strategies to address risks involved in farm activities; • ersonal hygiene practices and cleanliness around workplace; • afety guidelines and emergency procedures.	12	20
Practical	• Home Assignment		20
Internal Assessment			20

h. Reading list:
   - Fundamentals of Farm Business Management by SS Johl and TR Kapoor.
   - Management of Agri-Business Contracts and Organizations by Samar K. Datta.

i. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, 4th, and 5th semester B.Voc. in Herbal Processing Technology.

j. Course Objective: This course will allow students to gain knowledge & skill on farm management.
k. Learning outcome: Students will get skilled in farmmanagement system.
l. Theory Credit: 3
m. Practical Credit: 1
n. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

a. Four-year Undergraduate Programme: B. Voc (Three years)
b. Subject: Herbal Processing Technology
c. Semester: Sixth
d. Course Name: HPT-VC-6046 –Internship
e. Existing Base Syllabus: None
f. Course Level: 300-399
g. Syllabus: Total Marks= 100
h. Reading list: Not applicable
i. Graduate Attributes:The students should have passed 1st, 2nd, 3rd, 4th, and 5th semester B.Voc. in Herbal Processing Technology.
j. Particulars of Course Designer (Name, Institution, email id):
    1. Dr. Hridip Kumar Sarma, Associate Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: hridip@gauhati.ac.in
    2. Dr. Sushmita Das, Assistant Professor, Deptt. of Biotechnology, Gauhati University, Guwahati. Email ID: sushmitadas@gauhati.ac.in

Bachelor of Vocation (B.Voc.)[MLT/ML&DT]

GAUHATI UNIVERSITY

SYLLABUS FOR

BACHELOR IN MEDICAL LABORATORY TECHNICIAN

AND

BACHELOR IN MEDICAL LAB &MOLECULAR DIAGNOSTICS TECHNOLOGY

FYUGP STRUCTURE UNDER NEP

GAUHATI UNIVERSITY

Entry Criteria: *The entry criteria for B. Voc. MLT/ML&DT are HS Science passed with Biology as one of the subjects.*

SEMESTER I

PAPER-I

HUMAN ANATOMY AND PHYSIOLOGY (4 CREDITS)

Theory: 60 **Practical: 20** **Internal Assessment: 20**

Theory: 3 Credits **Practical: 1 Credit**

Overview and key learning outcomes: This paper will help the students to understand the basics and fundamentals of cells, tissues, different systems of the body including Musculo-skeletal system, GI system, Respiratory system, Cardiovascular system, Genitourinary system etc.. Further the students have to learn about the medical terminology used in human anatomy, functions of different systems of humans.

Unit	Topics	Credits & Marks
I	**Introduction to Human Anatomy and Physiology** ○ Basic Anatomy and Physiology **Anatomical planes, location and terminology** ○ Anatomical position ○ Anatomical planes ○ Important anatomical terminology ○ Different anatomical regions of the body	1 Credit
II	**Cells and Tissues** ○ Introduction, composition of cell ○ Function of cell ○ Movement through cell membrane ○ Cell cycle, cell division and control of cell division ○ Different types and various functions of tissue ○ Epithelial tissues ○ Connective tissue ○ Muscular tissues ○ Nervous tissues	
III	**Musculo-skeletal System** ○ Introduction and basic terminology ○ Bone structure, types of bones, ○ Bone development, function of bones ○ Organization of the skeleton ○ Different type of joints and cartilage ○ Structure and functions of a Skeletal Muscle, smooth muscle and cardiac muscle ○ Action of skeletal Muscle ○ Muscular response ○ Smooth muscles ○ Cardiac muscles ○ Skeletal muscle actions	
IV	**Gastro-intestinal System** ○ Physiology & anatomy of mouth, Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring) Oesophagus, stomach, small and large intestine, liver, gallbladder, pancreas.	

V	**Respiratory System** ○ Parts of Respiratory System, nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, names of paranasal air sinuses, Physiology of respiration, control of respiration	
VI	**Cardiovascular System and Lymphatic System** ○ Anatomy of physiology of heart, Heart size, location, chambers, exterior & interior, blood supply to the heart, Systemic and pulmonary circulation, Branches of aorta, common carotid artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery. ○ Blood pressure and pulse Blood pressure and peripheral pulse ○ Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses, ○ Lymphatic system – Cisterna chyli & thoracic duct, histology of lymphatic tissue, Names of regional lymphatics, axillary and inguinal lymph nodes in brief	**1 Credit**
VII	**Genito-urinary System** ○ Anatomy of Kidney, Ureter, Urinary bladder, male and female urethra. ○ Histology of Kidney, ureter and urinary bladder. ○ Formation of Urine ○ Micturition ○ Parts of male reproductive system, testis, vas deferens, epididymis, prostate. Spermatogenesis: ○ Parts of female reproductive system – uterus, fallopian tubes, ovary, mammary glands – gross. ○ Oogenesis, Ovulation, Menstrual cycle.	
VIII	**Nervous System** ○ Basic structure and function ○ General function of the Nervous system ○ Nervous tissue ○ Cell membrane potential ○ The synapse ○ Processing impulses ○ Classification of Neurons and Nerve fibers **Basics of sensory, Somatic and Enteric nervous system.** ○ Introduction, meninges, ventriclesand CSF ○ Central Nervous system - Brian and its parts, Spinal cord ○ Peripheral Nervous System - Spinal Nerves, Cranial nerves & autonomic Nervous System	**1 Credit**
IX	**Endocrine System** ○ Name of all endocrine glands Detail on (gross and histology). ○ Pituitary gland ○ Thyroid gland ○ Parathyroid gland ○ Suprarenal gland	

Practical Human Anatomy & Physiology: (1 Credit)

Sl. No.	Experiments
I	Histology of types of epithelium, Histology of serous, mucous & mixed salivary gland.
II	Demonstration of parts of the respiratory system.
III	Demonstration of heart and vessels in body, Histology of lymph node, spleen, tonsil & thymus, Normal chest radiography showing heart shadows.
IV	Demonstration of reflections
V	Histology of three types of cartilages.
VI	Demonstration of parts of urinary systems.
VII	Demonstration of the glands.
VIII	Demonstration of blood pressure with sphygmomanometer, demonstration of peripheral pulse

Reference Books:

Sl. No.	Title	Authors	Publisher
1	Ross and Wilson Anatomy and Physiology in Health and Illness	Anne Waugh Allison Grant	Elsevier
2	Textbook of Medical Physiology	Guyton	Jaypee
3	BD Chaurasia's Human Anatomy	BD Chaurasia's	CBS Publishers
4	Understanding medical physiology	L. Bijlani	Jaypee
5	Principles of Anatomy and Physiology	Gerard J. Tortora & Bryan Derrickson	Wiley

PAPER-II

INTRODUCTION TO BIOMOLECULES, INSTRUMENTATION AND REAGENTS (4 CREDITS)

Theory: 60 **Practical: 20** **Internal Assessment: 20**

Theory: 3 Credits **Practical: 1 Credit**

Overview and key learning outcomes: This paper will assist students in learning fundamental principles of macromolecular function and structure. Additionally, able to identify various laboratory glassware, plastic ware, and instruments, as well as care and maintenance of laboratory equipment and apparatus.

Unit	Topics	Credits & Marks
I	**Introduction to Biomolecules** **Carbohydrates & Lipids:** o Carbohydrates: Introduction, classification into mono, oligo and polysaccharides. Classification of monosaccharides, based on no. of C-atoms. Functional groups- aldoses and ketoses. Biochemical reactions of monosaccharide, Isomerism of Carbohydrates. o Lipids: Introduction, classification of lipids, Important saturated & unsaturated fatty acids. Properties & functions. Derived lipids: Phospholipids, glycolipids, Waxes, Biological role of cholesterol. **Amino acid and Proteins:** o Introduction, classification, optical isomerism, Optical properties, Acid – Base properties. Peptide bond formation and properties. Composition and primary, secondary and tertiary structures of proteins. **Nucleic acids:** o Structures of purine and pyrimidine bases, nucleosides, nucleotides, RNA and DNA (differences), helical structure of DNA (Watson & Crick model), Types of RNA- mRNA, rRNA & tRNA	**2 Credit (20 Marks)**
II	**Instruments (theory and demonstration) Diagrams to be drawn**. o Use, care and maintenance of water bath, water distillation plant, refrigerators, cold box and deep freezer o Centrifuges: Principle, Svedberg unit, centrifugal force. o Different types of centrifuges: Use, care and maintenance of a centrifuge. o Laboratory balances use, care and maintenance of manual balances and electrical balances. o Colorimeter and spectrophotometer, principle and different parts of colorimeter. Cuvettes, significance of cuvettes in colorimeter, cuvette for visible and UV range.	**1 Credit (20 Marks)**
III	**Standard solutions** o Technique for preparations of standard solutions. Significance of volumetric flasks in preparing standard solutions. o Preparations of standard solutions of deliquescent compounds ($cacl_2$, Potassium carbonate, sodium hydroxide etc.)	

IV	**Laboratory Apparatus and Preparation of solutions** o Pipettes – different types (Graduated, volumetric, Pasteur, automatic etc.), calibration of glass pipettes, Burettes, beakers, Petri dishes, depression plates. o Flasks – different types, volumetric, round bottomed, conical etc. o Significance of borosilicate glass; care and cleaning of glassware, different cleaning solutions of glass. o Preparation of Molar, Normal, and Percentage solutions. o Preparation of different dilutions	**1 Credit (20 Marks)**
V	**Bio Medical Waste Management** o To gain understanding of importance of proper and safe disposal of bio-medical waste & treatment. o To gain understanding of categories of biomedical waste. o To learn about disposal of bio-medical waste colour coding, types of containers, transportation of waste, etc. o To gain broad understanding of standards for bio-medical waste disposal o To gain broad understanding of means of biomedical waste treatment.	

Practical Biochemistry (1 Credit)

Sl. No.	Experiments
1	Identification of different laboratory glasswares (Pipettes, Funnels, Measuring cylinders, Test tubes, Centrifuge tubes, test tube draining rack Tripod stand, wire gauze, Bunsen burner etc)
2	Cleaning and maintenance of glassware.
3	Study of instruments and appliances (Centrifuge, Weighing balance, colorimeter etc.)
4	Study of weighing various types of chemicals, liquids, hygroscopic substances
5	Preparation of discard solutions.
6	Calculation and preparation of Percentage solution, Molar solution. Normality solution.
7	Estimation of blood glucose (Fasting, Random and Postprandial)

Reference Books:

Sl. No.	Title	Authors	Publisher
1	Textbook of biochemistry for medical students	D M Vasudevan	Jaypee
2	Fundamentals of biochemistry	J L Jain	S Chand
3	Biochemistry	D Voet, J Voet	Wiley
4	Medical Laboratory Technology Methods & interpretation	Ramnik Sood	Jaypee
5	Textbook of Medical Lab Technology	Praful B. Godkar, Darshan P. Godkar	Bhalani

PAPER-III

INTRODUCTION TO PATHOLOGY (4 CREDITS)

Theory: 60 **Practical: 20** **Internal Assessment: 20**

Theory: 3 Credits **Practical: 1 Credit**

Overview and key learning outcomes: In this paper the students have to know about various blood collection equipment, different types of blood sample collections, need to know about color coded vacutainers, anticoagulants, further the students has to know basics about blood and other samples with suitable collections and various tests. The students have to learn about various laboratory hazards, safety and first-aid and personal hygiene.

Unit	Topics	Credits & Marks
I	**Introduction to pathology** ○ Evolution of pathology ○ Different branches of pathology **Cell injury** ○ Etiology of Cell injury ○ Pathogenesis of cell injury ○ Reversible and irreversible cell injury ○ Cellular adaptations (Atrophy, Hypertrophy, hyperplasia, metaplasia, dysplasia etc)	**1 Credit**
II	**Inflammation** ○ Definition, causes and types ○ Acute inflammation and chronic inflammation ○ Cells involved in inflammation ○ General features of chronic inflammation ○ Systemic effects of chronic inflammation	
III	**Basic Hematology** ○ Hematopoiesis - Erythropoiesis, Leukopoiesis and Thrombopoiesis ○ Blood and its composition (Structure and functions of red blood cells, white blood cells, platelets and related pathologic conditions) **Anaemia** ○ Introduction and classifications (Morphological and etiological), effects of anemia on body. ○ Haematocrit ○ Red cell indices (MCV, MCH, MCHC, RDW) **Methods and types of various sample collection** o Collection of blood (Capillary, venous and arterial blood) o Anticoagulants ○ Interpretation of test request form o Different types of vacutainers and order of blood draw o Collection of CSF & other body cavity fluids o Urine collection & use of preservatives	**1 Credit**
IV	**Introduction to Laboratory** ○ Types of laboratories ○ Laboratory set up ○ Physical aspect of laboratory	

	○ Basic laboratory set up ○ Medico-logical aspects of clinical practice	
V	**Introduction to Immuno-hematology** ○ History of blood group ○ Biochemistry and genetics of ABO and RH blood Group individuals ○ Different blood group systems. ○ Methods of blood grouping (ABO and Rh) ○ Universal donor and recipient concepts	**1 Credit**
VI	**Personnel Hygiene** ○ To develop understanding of the concept of Healthy Living ○ To develop understanding & procedures of Hand Hygiene ○ To be equipped with Techniques of Use of PPE	
VII	**Safety & First Aid** ○ To develop understanding and precautions to ensure Patient's Safety ○ To develop basic understanding and precautions to ensure sample preservation while transporting. ○ Describe common emergency conditions and what to do in medical emergencies. ○ Describe basics of first aid. ○ To develop understanding and precautions to ensure safety ○ Different types of Laboratory Hazards ○ Accidents in the laboratory	

Practical Pathology: (1 Credit)

Sl. No.	Experiments
I	Collection of Blood sample (capillary blood and Venous blood) using correct techniques (Vacutainer and syringe based blood collection)
II	Haemoglobin Estimation (Sahli's method and Cyanmethemoglobin method)
III	Haematocrit (PCV)
IV	Erythrocyte Sedimentation Rate (ESR)
V	Preparation of peripheral blood film and stain with Romanowsky stain.
VI	Blood grouping and Rh typing (Slide method and tube method)
VII	Serum typing or reverse blood typing

Reference Books:

Sl. No.	Title	Authors	Publisher
1	Textbook of Pathology	Harsh Mohan	Jaypee
2	Clinical Pathology hematology & Blood Banking	Nanda Maheswari	Jaypee
3	Essentials of Clinical Pathology	Shirish M Kawthalkar	Jaypee
4	Practical Pathology	Harsh Mohan	Jaypee
5	Textbook of Medical Laboratory Technology	Darshan P. Godkar, Praful B. Godkar	Bhalani Publishing House

Bachelor of Vocation (B.Voc.)[Physical Education]

CourseStructureforCBCS inB.Voc.inPhysicalEducationasperrequirementofUGC &GauhatiUniversity

Semester	CourseType	PaperCode	PaperName	PaperType	Credit
I	Corecourse	PED-VC-1016	History and FoundationofPhysical Education	Theory+Practical	4
		PED-VC-1026	FundamentalExercise, MarchingAndRhythemic	Theory+Practical	4
		PED-VC-1036	Horizonof ExerciseandSports Science	Theory+Practical	4

DETAILED SYLLABUSSEMESTER-I
B.VocinPED, Semester–I

PED-VC-1016: HISTORY ANDFOUNDATIONOFPHYSICALEDUCATION

FullMarks-100 CreditPoint-04
Theory=60,Practical20,Internal=20(Sessional=10,Assignment=6,Attendance=4)

Course outcome: 1.This course will help students to gain knowledgeonFoundationof PhysicalEducation.

2.This course will help students to gain knowledgeonbasisoflife.

Unit 1.IntroductionandScope of Physical Education 20marks

1.1. Meaning,Definition and ScopeofPhysicalEducation
1.2. Aims and Objectives of Physical Education.
1.3.Need and importance ofPhysicalEducation
1.4. Misconceptions about Physical Education in present era.

Unit-2. Historical Perspective of Physical Education 10marks

2.1. History of Physical Education in Ancient time: Greek,Rome,Athens,Sparta.
2.2. Physical Education in ancient India: Vedic, Epic and Buddhist Periods.
2.3. Physical Education during Pre and Post-Independence Period in India.

Unit3.PhysiologicalFoundation 20marks

3.1. GrowthandDevelopment:Stages, FactorsandPrinciples.
3.2. GenderCharacteristics in relation to physical activities and sports
3.3. Kinds of Age:Chronological,Anatomical,Physiological,andMentalage.

Unit 4.Biomechanical and Foundation 10marks

4.1. KineticandKinematic:overview
4.2. Biomechanicsin Daily lifeandSports
4.3.Modernconceptof InactivetoActivelifestyle.

PRACTICAL:(20marks)

1. Trackevents. (Running events)

RECOMMENDEDBOOKS:

1. Graham, G. (2001). *Teaching Children Physical Education: Becoming a Master Teacher*. HumanKinetics,Champaign, Illinois, USA.
2. Kamlesh,M.L.&Singh,M.K.(2006)PhysicalEducation(NaveenPublication).
3. Lau,S.K.(1999)GreatIndianPlayers,NewDelhi,Sports.
4. Lumpkin, A. (2007) Introduction to Physical Education, Exercise Science and Sports Studies,McGrawHill,NewYork,USA.
5. Siedentop, D. (2004) Introduction to Physical Education, Fitness and Sport, McGraw HillCompaniesInc., NewYork,USA.
6. Shaffer, D.R. (2002) Development Psychology: Childhood and Adolescence. Thomson, Sydney,Australia. +
7. Shukla,(2000)MotheronEducation, NationalCouncilof TeacherEducation, NewDelhi.
8. Singh,A.etal.(2000)EssentialofPhysicalEducation,KalyaniPublishers,Ludhiana,Punjab.
9. Wuest, D.A. & C.A. Bucher (2006) Foundation of Physical Education, Exercise Science, andSports.McGrawHill CompaniesInc.;NewYork,USA.
10. Kansal, D.K. (2012) A Practical Approach to Test Measurement and Evaluation Sports andSpiritualSciencePublication, NewDelhi.

B.VocinPED, Semester– I

PED-VC-1026:FUNDAMENTALEXERCISE,MARCHINGANDRHYTHEMIC

FullMarks-100 CreditPoint-04
Theory=60,Practical=20,Internal=20(Sessional=10,Assignment=6,Attendance=4)

Course outcome: 1.This course will enable students to learn theknowledge ofFundamental Exercises.

2.This course will enable students to acquire theknowledge ofMarching, Calisthenics& Aerobics.

Unit1.FundamentalExercise 20marks

1.1.Basic Movement patterns of Exercise
1.2. Upper body Exercise
1.3. Lower body Exercise

Unit 2.Marching 20marks

2.1. Fall in, Attention, Stand at Ease, Eyes right – Eyes front (Dressing), Turning right, left& about.
2.2. Marching: Arm-Leg coordination, Marching, Mark Time, Quick march, Halt,about turnwhilemarchingandMarchingwithSalute.
3.Dismissal

Unit3.FreehandExercise(CALISTHENICS& AEROBICS) 10marks

1.Callisthenics: Standing Mass PT exercise – Two count,fourcount,eightcount,sixteencount,thirty-two count
2.Aerobics-Basicturns, jumps, leapswithMusic

Unit 4.Apparatus Exercise 10marks

4.1. Exercisewithwands,
4.2. Exercise with dumbbell
4.3. Exercise with hoops

PRACTICAL:(20marks)

1. FundamentalExercises(Head,Neck andFacialExercises; ShoulderandChestExercises,etc.)
2. FreehandExercise(CALISTHENICS&AEROBICS)

RECOMMENDEDBOOKS:

1. SinghAetal(2016).EssentialofPhysicalEducation.KalyaniPublisher,NewDelhi
2. Kamlesh M.L., “Physical Education, Facts and foundations” Faridabad P.B. Publications.
3. Barrow Harold M., “Man and movements principles of Physical Education” 1978.
4. Tirunarayan and Hariharan, “Methods in Physical Education.” M/S C.T. and S.H.Allagappa College of
5. Physical Education Karaikudi-4.
6. Charrles, E. Forrythe and Irrn A. Keller, “Administration of High School Athletics.” Prentice Hall Inc. Englewood,N.J. 1979.

B.VocinPED, Semester- I

PED-VC-1036:HORIZONOFEXERCISEANDSPORTSSCIENCE

Fullmarks:100 CreditPoint:04
Theory=60,Practical=20,Internal=20(Sessional=10,Assignment=6,Attendance=4)

Course outcome: 1. This course will help students to gain and develop the knowledge about Olympics and sports

2.This course will help students to understand the laws of learning and Personality.

Unit 1. Introductions to Sports Science and its Branches

1.1. Exercise and sports Physiology and practical application
1.2. Exercise and sports Biomechanics and practical application
1.3. Exercise and sports Psychology and practical application.

Unit 2. Introduction to Sports Medicine 10 marks

2.1. Sports Injuries
2.2. Therapeutic Modalities
2.3. Types of Fracture

Unit 3. Psychological Basis of Physical Education 20 marks

3.1. Laws of Learning
3.2. Play and Play Theory.
3.3. Human Personality Factors

Unit4. OlympicMovement 20marks

4.1. AncientOlympicgames
4.2. ModernOlympicGames
4.3. Winter Olympic Games
4.4. Significanceof Olympic Ring,Olympic flag

PRACTICAL:(20marks)

1.Field Events (Jumping events)

RECOMMENDEDBOOKS:

1. KamleshM.L.,"PhysicalEducation,Factsandfoundations"FaridabadP.B.Publications.
2. BarrowHaroldM.,"ManandmovementsprinciplesofPhysicalEducation" 1978.
3. RavanesR.S.,"FoundationofPhysicalEducation" HoughtonMillinCo.BostonUSA(1978)
4. Singh Ajmer et.al., "Essentials of Physical Education", Kalyani Publishers Ludhiana SecondRevisedAddition2008.
5. DelehV.A.,"WorldHistoryofPhysicalEducation",prenticeHallInc.
6. Loy, Lohn W. Dr. and Kenyon, Gerald S. Sports Culture and Society (Philadelphia: The MacMillanCo.1969).
7. BrailsfordDennis SportsandSociety,(London-RoutledgeandKeganPaul1969)

Bachelor of Vocation (B.Voc.)[Acting]

BVOC – ACTING (Entertainment)

Core Course: Semester-I
Paper 1: ACTING AS ART

Total Credits=4 Total Marks=100 Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objective of this course is to introduce Acting as an Art Form. It looks at Art and Aesthetics and references the Art of Acting and its special power of communication. It also seeks to introduce the different media that are the vehicles of the art of acting.

Course Learning Outcome: This course will enable the students :

i. To identify the elements and properties that may be termed as an Art form, and to discover the communicative power of Acting as one such form and its importance in our society.
ii. To understand the basic qualities that make an Actor and improve their body language, voice quality and imaginative power.
iii. To apprehend the different mediums of acting such as Stage, Film, Television etc. And to understand the distinctive nuances of the for all these different mediums.

Course Content:

THEORY: CREDITS – 3

UNIT I: Defining the parameters of Art

- Definitions of Art: Narrow and Wider connotations
- Understanding Aesthetics: Concepts and Meanings
- Aesthetic Value & the Art of Acting

UNIT II: Art, Acting & Society

- Art, Society & Actors
- Place of Actor/Artist in ancient Indian Society
- Art & Social Responsibility

UNIT III: Acting – History & Concepts

- Acting as an Art: Definition & History
- Basic need for the Art of Acting

- Acting for different Media- stage, street plays, Films, Television, Radio, its explanation and difference of acting in each medium

PRACTICAL: CREDIT – 1

UNIT IV

Activity – Demonstration

- Visual Demonstration of various plays – physical, lyrical, romantic, tragedy, satire etc.
- Visual Demonstration of films of different genre for orientation and exposure and analysis of the same

UNIT V

Activity – Group Discussion

- Group discussion on Art and Aesthetics.
- Group discussion on Social responsibilities of an Artist.
- Group discussion on impact of Art in one's life.
- Group discussion on Acting as an Art.
- Physical work on body movements.
- Work on Voice.

SUGGESTED READING

1. ***What is Art*** by Leo Tolstoy, Translated by Aylmer Maude
2. ***Natyakala aru Abhinoy Silpo*** by Badal Das
3. ***Naatak*** Compiled & edited by Mrinal Kr. Gogoi
4. ***Prasanga: Naatak*** by Dr. Pona Mahanta
5. ***Poetics:*** by Aristotle
6. ***How to read a film:*** by James Monaco

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-I
Paper 2: VOICING AND RECORDING

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objectives: The primary objectives of the course are to give the students an overview and awareness of their vocal ability and the importance of voice & speech in acting. It will acquaint the students with the embodied mechanism and process of human voice production; a general idea of diction and pronunciation, the basic elements of speech and its manipulation. It will familiarize the learners with Voice Recording Systems and equipment.

Course Learning Outcome: After the completion of this course, student(s) will be able to -

i. Understand the importance of voice and speech in acting and appreciate the key factors of effective speech.
ii. Grasp the significance of diction and pronunciation in speech and the process of voice production and control and learn the key factors of voice and speech for better outcome.
iii. Read and recite different prose and poetry pieces clearly; grasp the basic ideas of musical notes, scale etc.
iv. Use the basic recording equipment like microphone etc. for voice recording and dubbing appropriately.
v. Understand the role and responsibility of a voice artist.
vi.

Course Content:

THEORY: CREDITS - 3

UNIT I: What is Voice?

- How voice is produced?
- Introduction to the human mechanism (organs) that produces voice
- What is Speech? Difference between Voice and Speech

UNIT II: What is Sound? Technical Aspects

- Introduction to Sound
- Audio & Audio file formats
- Volume, Pitch, Timber, Tempo, Resonators etc.

UNIT III: Voice/Recording / Music

- Voice Recording Systems and Equipment: Analog, Digital etc. and their basic components.
- Microphones: Types; Function; Pick-up pattern; Uses.
- Headphones and speakers
- Basic Concepts of Music/Musical notes, scale, octaves etc.

PRACTICAL: CREDITS - 1

UNIT V: Recording

- Voice Overs
- Dialogues.
- Voice dubbing.

SUGGESTED READING

- ***Voice into Acting-Integrating voice and the Stanislavski Approach*** by Christina Gutekunst and John Gillett
- ***Practical Recording Techniques*** by Bruce Bartlett and Jenny Bartlett
- ***Music and the Art of the Theatre*** by Adolf Appia
- ***Manchakala*** by Dr. Tarit Choudhury

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 15
No. of Non-Contact classes (Practical): 5

Core Course: Semester-I
Paper 3: VOICE, SPEECH, *PRANAYAMA* & *YOGA*

Total Credit=4
Total Marks=100 (Practical)

Course Objective: The primary objective of this course is to practically introduce different voice and speech exercises for clear diction, pronounciation, modulation etc. to give the students practical experience of different breathing exercises including Pranayama, Yogasanas for physical, vocal and mental fitness and awareness.

Course Learning Outcome: This course will enable the students -

i) To practice voice and physical exercises in appropiate approach without harming their vocal cord and physical injuries.
ii) Deliver speeches with ease; to modulate dialogues for different characters.
iii) To understand and practice dubbing
iv) To create a character through voice

Course Content:

4-CREDIT PRACTICAL PAPER

UNIT I: Voice Activity

- Breathing exercises
- Exercises for voice clarity
- Exercises for sound pitch
- Exercises to increase voice range
- Exercises to increase audibility of voice

UNIT II: Speech Activity

- Exercises for clear pronunciation
- Exercises for sound projection
- Exercises voice modulation
- Adaptation of voice in accordance to a character

UNIT III: Yoga and Pranayama

- Practice of Asanas
- Pranayama
- Concentration Exercises.
- Physical Exercises

UNIT IV: Performance

- Project Preparation
- Selection of story, poem etc.
- Rehearsal
- Recording the final selected story, poem etc.
- Sound Editing.

SUGGESTED READING

- ***Voice into Acting-Integrating voice and the Stanislavski Approach*** by Christina Gutekunst and John Gillett
- ***Practical Recording Techniques*** by Bruce Bartlett and Jenny Bartlett
- ***Manchakala*** by Dr. Tarit Choudhury
- ***Acting with the Voice*** by Robert Blumenfeld

Total credits: 4
Theory Credit: 0
Practical Credit: 4
Number of required classes: 80 (Theory: 0, Practical: 80)
No. of Contact classes (Theory): 0
No. of Non-Contact classes (Theory): 0
No. of Contact classes (Practical): 75
No. of Non-Contact classes (Practical): 5

BVOC – ACTING (Entertainment)

Core Course: Semester-II
Paper 4: THE ART OF STORYTELLING

Total Credits=4 Total Marks=100 Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objective of this course is to introduce the students to various ways and devices of storytelling.

Course Learning Outcome: After the completion of the course the student(s) will :

- Learn the importance and principles of storytelling.
- Get aquianted with the different ways and devices of storytelling.
- Learn the fundamental process of scripting.
- Be able to differentiate between various types of scripts and their key features.
- Be able to prepare scripts for plays / short films / documentaries.

Course Content:

THEORY: CREDITS – 3

UNIT I:

- Early evidence and means of storytelling
- Storytelling as an Art: Basics Principles of Storytelling
- Storytelling Techniques: Various ways of storytelling
- Components of a Story
- Characters: Protagonist/Antagonist/Minor
- Plot / Sub-Plot
- Setting / Locale / Context
- Use of Multimedia in Storytelling

UNIT II:

- Definition and meaning of Folklore
- Definition and meaning of Folktale
- Definition and meaning of Fairytale
- Definition and meaning of Fable
- **Activity –** Collecting stories, folk tales and folklores of the region, understanding their performative elements.

UNIT III

- Basics of Script writing: Processes
- Genres: Scripts for Different Media
    - Radio
    - Television series
    - Film / Shorts
    - Documentary
    - Stage / Street Theatre.

PRACTICAL: CREDIT – 1

UNIT IV

- Final Script Preparation
- Rehearsal/Practice
- Presentation/Performance/Shooting/Recording

SUGGESTED READING

Script Analysis for Actors, Directors and Designers by James Thomas
Folklores of Assam by Jogesh Das
Natyakala aru Abhinoy Silpo by Badal Das
Screenplay: The Foundations of Screenwriting by Syd Field
The Art of Dramatic Writing by Lajos Egri

Total credits: 4
Theory Credit: 2
Practical Credit: 2
Number of required classes: 90 (Theory: 60, Practical: 30)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 20
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-II
Paper 5: DRAMATIC LITERATURE

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objective of this course is to introduce the students to representative dramatic literatures of the world from the classical to the contemporary.

Course Learning Outcome: After the completion of the course the student(s) will :

- Learn about the great dramatic literatures of the world.
- Get aquainted with the key features of Classical Greek plays, Classical Indian Plays, Modern Indian plays and Assamese classical & modern plays.
- Be able to analyse a play and the characters of the play in detail.
- Be able to research the contexts, backgrounds, motivations of a play.
- Be able to create a scene based on a well-made play.

Course Content:

THEORY: CREDITS – 3

UNIT I: WESTERN DRAMATIC LITERATURE

- Reading a Western Classic
  - *Oedipus the King / Hamlet / King Lear*
- Reading Modern Western Plays
  - *Waiting for Godot / Arms and the Man / A Streetcar Named Desire*
- Exploring character background / Understanding Context / Understanding the subtext(s) of the play

UNIT II: INDIAN DRAMATIC LITERATURE

- Reading Sanskrit Drama
  - *Abhijnyanam Shakuntalam / Madhyama Vyayoga / Mricchakatikam*
- Reading Modern Indian Plays
  - *Ashad Ka Ek Din / Ghasiram Kotwal / Hayavadana*
- Exploring character background / Understanding Context / Understanding the subtext(s) of the play

UNIT III: REGIONAL DRAMATIC LITERATURE:

- Reading Ankiya Naat
  - *Raamvijay / Rukminee Haran / Partijat Haran*
- Reading Modern Assamese plays
  - *Karengor Ligiri / Xaraaguri Sapori / Kukurnesiya Manuh*
- Exploring character background / Understanding Context / Understanding the subtext(s) of the play

PRACTICAL: CREDIT – 1

UNIT IV

- Scene work based on classic play scripts.
- Scene work based on modern play scripts.

SUGGESTED READING:

Sophocles, Aeschylus, Euripides, *Greek Tragedy* (Penguin Classics).
Mahim Bora, edited. *Shankardevar Naat.*
William Shakespeare, *Complete Works of Shakespeare.*
Jyotiprasad Agarwala, *Jyotiprasad Agarwalar Natok Xamagrah.*
Vijay Tendulkar, Samik Bandopadhyay, Collected Plays in Translation.
Mohan Rakesh, Mohan Rakesh Ke Sampurna Natak.
Arun Sarma, *Arun Sarmar Nirbachita Natak.*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 45, Practical: 35)
No. of Contact classes (Theory): 35
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 30
No. of Non-Contact classes (Practical): 5

BVOC – ACTING (Entertainment)

Core Course: Semester-II

Paper 6: PRACTICAL STORYTELLING & IMPROVISATION

Total Credits=4
Total Marks=100
Practical=100

Course Objective: The primary objective of this course is to introduce the students to various ways of improvisations for developing stories and play making.

Course Learning Outcome: After the completion of the course the student(s) will :

- Be able to develop stories and scripts for stage plays.
- Get acquainted with different ways of telling a story and scenic improvisations.
- Be able to develop different dramatic characters through verbal and non-verbal improvisations.
- Be able to build dramatic charatcters along with stories.

Course Content:

ALL PRACTICAL: CREDITS – 4

UNIT I: CONCEPTUALISING

- Developing a story through practical improvisations
- Verbal & Non-verbal improvisation
- Character and story development through nonverbal improvisations
- Acting improvisations: Situational, Conditional, Imaginational etc.

UNIT II: SHAPING

- Selecting a suitable story for performance
- Discussing Characters
- Scripting/Script analysis
- Drawing the Background of Characters
- Designing the Character Look
- Set Design/Light Design/Properties Design/Costume Design

UNIT III: REHEARSING

- Rehearsal Process
- Property Making
- Set Making

- Costumes
- Setting up lights
- Makeup

UNIT IV: PERFORMING

- Final Presentation/Performance

SUGGESTED READING:

Voice into Acting: Integrating Voice and the Stanislavski Approach by Christina Gutekunst and John Gillett
An Actor Prepares by Konstantin Stanislavski
Practical Recording Techniques by Bruce Bartlett and Jenny Bartlett
A Practical Handbook for the Actor by Lee Michael Cohn & Melissa Bruder
Acting with the Voice by Robert Blumenfeld
The Young Actor's Handbook by Jeremy Kruse

Total credits: 4
Theory Credit: 0
Practical Credit: 4
Number of required classes: 80 (Theory: 0, Practical: 80)
No. of Contact classes (Theory): 0
No. of Non-Contact classes (Theory): 0
No. of Contact classes (Practical): 70
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-III
Paper 7: INDIAN THEATRE

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objective of this course is to introduce the students to the rich theatrical heritage of India. They will be introduced to the the versatile and multifaceted perfomance styles, genres and acting techniques of Indian Theatre.

Course Learning Outcome: After the completion of the course the student(s) will :

- Comprehend the idea of origin and traditions of the Classical Indian Theatre and the *Natya Shastra*.
- Understand the basic techniques of Acting for Classical Indian plays / Sanskrit plays.
- Identify and apply the basic requirements of performance in a play production designed with a Classical Indian play / Sanskrit play approach.
- Know the changes in Indian theatre brought about with modernity.

Course Content:

THEORY: CREDITS – 3

UNIT I: FOUNDATION OF INDIAN THEATRE

- Introduction to the *Natyashastra*
- *Natyotpatti* – Origins of Theatre in Indian Perception
- *Rasasutra – Bhava*, *Bibhava, Anubhava* and the *Navarasa*

UNIT II: THE FOUR FOLDS OF ACTING

- *Angikam,*
- *Vachikam,*
- *Sattvikam*
- *Aharya*

UNIT III: GESTURE & MOVEMENT

- Single handed gestures *(Asamyukata Hasta)*
- Two handed Gestures *(Samyukta Hasta)*
- Head movements *(Sirabheda*)
- Neck movements *(Griva Bheda*)
- Eye movements (*Dristi Bheda)*

- Gait *(Cari & Mandala*)

UNIT III: MODERN INDIAN THEATRE

- Contexts of Modern Indian Theatre
- Realism & the Proscenium Stage
- Brief Histories –
  - Bengali Theatre
  - Marathi Theater
  - Hindi Theatre
- Introduction to the Development of Regional Theatres

PRACTICAL: CREDIT-1

UNIT III: ABHINAYA

- Practice of gestures, postures and expressing *Navarasa*

SUGGESTED READING:

The Natyashastra. trans. Manmohan Ghosh.
G. K. Bhatt, *Natya-Manjuri-Saurabha.*
Pona Mahanta, *Natakor Kotha.*
Manohar Laxman Varadpande, *History of Indian Theatre.*
Kapila Vatsyayan, *Traditional Indian Theatre: Multiple Streams.*
Julia Hollander, *Indian Folk Theatre.*
Sangeet Natak Akademi, *Contemporary Indian Theatre: Interviews with Playwrights and Directors*
Mrinal Kr. Gogoi, edited. *Naatak*
Badal Das, *Natyakala aru Abhinoy Silpo*
Satyendranath Sharma, *Asomiya Natya Sahitya*
Suresh Awasthi, *Performance Traditions in India.*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-III

Paper 8: WESTERN THEATRE HISTORY

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objective of this course is to introduce the students to the history of Western Theatre and its different major phases.

Course Learning Outcome: After the completion of the course the student(s) will :

- Assimilate a working idea of the history of Western theatre.
- Be able to identify the different styles of Acting of Classical Western Theatre.
- Get familiarized with the timeline of western theatre history.
- Become aware of the transformation of theatres in the nineteenth and twentieth century.
- Be able to improvise and develop scenes based on the great Western classics.

Course Content:

THEORY: CREDITS – 3

UNIT I: GREECE & ROME

- Early evidence of Theatre
- The Early Stage Architecture
- The Classical Greek Era: Tragedy & Comedy
- Aristotle's Poetics
    - The Three Unities
    - Catharsis; Plot etc.
- Theatre in the Roman Era

UNIT II: MEDIEVAL & RENAISSANCE PERIODS

- Mystery Play / Miracle Play / Morality Play
- Impact of the Renaissance
- Theatre during Elizabethan Period: Shakespeare
- Commedia dell'arte
- The New Playhouses

UNIT III: TOWARDS MODERNISM

- Melodrama / Sentimental Comedies
- 19th & 20th Centuries: The transformation of the theatre -
    - Realism
    - Problem Plays

- Expressionism
- Theatre of Cruelty
- Epic Theatre
- The Absurd
- The Avant Garde & Experimental Drama
- Activist Theatre

PRACTICAL: CREDIT-1

UNIT IV:

- Improvisation
- Monologue
- Short Scene selection from Classical Western Plays
- Rehearsal of the Scene
- Final Presentation/Performance

SUGGESTED READING:

Alison Hodge, ed. *Twentieth Century Actors' Training*
Jerzy Grotowski *Towards a Poor Theatre*
Nicholas Dromgoole, *Performance Style and Gesture in Western Theatre*
B. Grose and M. Kenworthy, *History of Western Theatre: A Mirror to Life*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-III

Paper 9: BASICS OF MIME AND PHYSICAL THEATRE

Total Credits=4
Total Marks=100
Practical = 100

Course Objective: The primary objectives of the course are to give the students an overview and practical experience of the art of mime and the techniques of physical theatre.

Course Learning Outcome: After the completion of the course the student(s) will :

- Understand the fundamentals of Mime and Physical theatre and their vital elements.
- Understand the difference between Mime and Physical theatre.
- Be acquainted with the evolution of physical theatre.
- Be able to create performance pieces using Mime techniques.
- Be able to implement the principles of physical theatre in the process of play making.
- Improvise and construct characters applying the techniques of Mime/Physical theatre.

Course Content:

ALL PRACTICAL: CREDITS – 4

UNIT I: MIME

- History and Development of Mime
- Understanding Mime costumes
- Mime-specific Make-up
- Distinctions: Mime and Physical Theatre

UNIT II: PHYSICAL THEATRE

- The 'Method' of Physical Theatre
- Grotowski's Poor Theatre
- Michael Chekhov and Psychological Gesture
- Meyerhold and Biomechanics
- Jacques Lecoq and the Moving Body

UNIT III: ACTIVITY

- Learning the practical nuances of Mime.
- Preparing group / solo mime act

UNIT IV: ACTIVITY

- Learning and practicing the fundamental principles of physical theatre

- body balance and misbalance
- pushing-pulling
- expansion and contraction
- physical rhythm / timing

UNIT V: ACTIVITY

- Developing solo/ group act using the techniques of physical theatre.
- VIVA

SUGGESTED READING:

Jerzy Grotowski *Towards a Poor Theatre*
Michael Chekhov, *To The Actor: On the Technique of Acting.*
Lenard Petit, *The Michael Chekhov Handbook for The Actor*.
Jacques Lecoq, *Theatre of Movement and Gesture*
Adam Mock etal, *Mime Very Own Book*
Claude Kipnis, *The Mime Book.*
Tarit Choudhury, *Manchakala.*

Total credits: 4
Theory Credit: 0
Practical Credit: 4
Number of required classes: 80 (Theory: 0, Practical: 80)
No. of Contact classes (Theory): 0
No. of Non-Contact classes (Theory): 0
No. of Contact classes (Practical): 75
No. of Non-Contact classes (Practical): 5

BVOC – ACTING (Entertainment)

Core Course: Semester-IV

Paper 10: FOLK & TRADITIONAL THEATRES OF INDIA

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20(Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objective of this course is to introduce the students to rich theatrical tradition of India. They will be inducted to the the versatile and multifaceted perfomance styles, generes and acting techniques of Indian Theatre.

Course Learning Outcome: After the completion of the course the student(s) will be able to :

- Understand the key aspects of Indian Folk and Traditional theatres.
- Identify the different styles of acting in various Folk and traditional theatres of India.
- Understand the 'rootedness' of Modern Indian Theatre.

Course Content:

THEORY: CREDITS – 3

UNIT I: INTRODUCTION

- Introduction to Indian Folk and Traditional theatre
- Distinctions between Traditional and Folk theatres
- Popular genres and their impact on society

UNIT II: STYLES & METHODS

- Basic Performance Styles of different traditional and folk theatre forms:
    - *Ankiya Bhaona*
    - *Shumangleela*
    - *Chhau*
    - *Yakshagana*
    - *Nautanki*
    - *Ramleela*
    - *Rasleela*
    - *Tamasha*
    - *Bhawai*
    - *Therekuttu*
    - *Krishnattam* etc

UNIT III: FOLK GENRES IN ASSAM

- Folk theatre forms of Assam:

- *Ojapali*
- *Putola Nach*
- *Dhuliya Bhaona*
- *Bhari Gaan*
- *Pala Bhaona etc*

PRACTICAL: CREDIT - 1

UNIT IV: ACTIVITY

- Visual demonstration of different Folk and Traditional Theatres to identify the distinctive styles of Acting
- Practical understanding & demonstration of basic performance techniques of one traditional/folk theatre form of Assam.

SUGGESTED READING:

Balwant Gargi, *Folk Theatre of India*
Shovana Narayan, *Indian Theatre Traditions (Drama, Music & Dance)*
Biswajit Sinha, *Folk Theatre*
Srinivas Panthukala, *Traditional Folk Media in India*
Kapila Vatsyayan, *Traditional Indian Theatre: Multiple Streams*
Julia Hollander, *Indian Folk Theatre*
Suresh Awasthi, *Performance Traditions in India*
Chaman Ahuja. *Contemporary Theatre of India an Overview*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-IV

Paper 11: ACTING THEORIES & PRACTICES: THE WEST

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objectives of the course are to introduce the students to the Acting theories developed in the west during the Twentieth century and subsequent years.

Course Learning Outcome: After the completion of the course the student(s) will be able to :

- Acquire the understanding of the different schools of Acting developed in the Twentieth century.
- Understand the vital elements and principles of Realistic Acting theories of pioneering acting teachers like Konstantin Stanislavsky, Michael Chekhov, Lee Strasberg, Sanford Meisner, Stella Adler *etal*.
- Understand the practices and exercises developed for realistic approach to acting.
- Develop and build dramatic/cinematic characters using the realistic and method acting techniques.

Course Content:

THEORY: CREDITS – 3

UNIT I: INTRODUCING WESTERN ACTING

- Development of Theories of Acting
- Ancient Concepts of Acting to Diderot's Paradox
- Zola, Realism & Naturalism

UNIT II: REALISM & MAINSTREAM METHODS

- Introduction to Method Acting
- Stanislavsky's Method
- The Lee Strasberg Approach
- The Sandford Meisner Approach
- The Stella Adler Approach

UNIT III: EPIC THEATRE & THE AVANT GARDE

- Bertolt Brecht System of Acting & *Verfrumdungseffekt*
- Michel Chekhov's Psycho-Physical Approach
- New-Age Acting Theories

PRACTICAL: CREDIT - 1

UNIT IV: ACTIVITY

- Exercises with distinctive styles of Acting
- Practical understanding & demonstration of basic acting techniques of at least one specific system/method.

SUGGESTED READING:

Sonia Moore, *The Stanislavski System*
Alison Hodge, edited. *Twentieth Century Actors' Training*
Dinesh Khanna, *Abhinay Chintan*
Edward Dwight Easty, *On Method Acting*
Sanford Meisner & Dennis Longwell, *Sanford Meisner on Acting*
Tarit Choudhury, *Manchakala*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-IV

Paper 12: STAGEGRAFT & PRODUCTION DESIGN

Total Credits=4 Total Marks=100 Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The objective of the course is to introduce the technical aspects of theatre art like Architectural design, Stage light design, Makeup, Costume design, set design, properties etc.

Course Learning Outcome: The course will enable the students to:

- Understand and distinguish between the Stage Architecture of Greek, Roman, Elizabethan and Indian Sanskrit Theatres.
- Identify the basic elements of stage craft (set, property, costume, lights etc.)
- Understand light design, makeup, costume, properties and their importance in performance.
- Identify the elements of each department to intensify the performance.
- Understand the nature of different types of back-stage work.
- Understand the roles and responsibilities of the production team.
- Extend a helping hand to artists / back stage designers / pre-production teams / post production teams as/when required.

Course Content:

THEORY: CREDITS – 3

UNIT I: UNDERSTANDING THEATRE ARCHITECTURE

- Understanding Space in theatre: Stage geographies
- Different types of theatre and stages

UNIT II: CHARTING THE DESIGN

- Basics of set and property design, mechanical drawing
- 2D and 3D drawing
- Drawing with Perspective
- Presentation [of different elements of sets]

UNIT III: USING COLOUR

- Study of colour theory
- primary / secondary / tertiary / complementary colours
- Warm & cool colours / tints and shades / split complementary colour
- Tangible / non-tangible colours

UNIT IV: COSTUME & MAKEUP

- Basic principles of costume and costume design
- Lines & textures.
- Basic principles of Make-up
- Basic Stage / Screen Makeup – Distinctions
- Prosthetics & Special-Effects Makeup

UNIT V: LIGHT AND SOUND

- Lights: its importance in production, an overview of lighting design.
- Sound: its importance in production, an overview of sound design.

PRACTICAL: CREDIT - 1

UNIT IV: ACTIVITY

- Exercises with specific scenes where all of the elements of stagecraft may be showcased.
- Practical understanding & demonstration of basic techniques of staging and the Actor's body within the space.

SUGGESTED READING:

Adolphe Appia, Richard Beacham ed. *Texts on Theatre*
J. Michael Gillette, Theatrical Design and Production
The Edison Electric Illuminating Company of Boston, *The History of Stage Lighting*
Badal Das, *Natyakala aru Abhinoy Silpo*
H. B. Sharma, *Rang Sthapatya*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-IV

Paper 13: PRODUCTION OF A PLAY [ON JOB TRAINING/ FIELD STUDY]

Total Credits=4
Total Marks=100
Practical=100

Course Objective: The primary objectives of the course are to give the students a practical experience of making/ creating and performing a full-fledged play while doing all the necessary on-stage and back stage duties.

Course Learning Outcome: The course will enable the students to:

- Read and understand the script (dialogues, narrative, and expressions) that would need to be performed, as well as parts being performed by co-artists for the cues.
- Research the characteristics of the character/role being played out in detail (personality, attributes, language, emotions, expressions etc.)
- Read own dialogues and understand the meaning and emotion being portrayed (within the given time frame).
- Understand and interpret characters in scripts/concept(s) within the specified time / rehearsals / discussions with the Director(s), Designer(s).
- Adapt personality and performance in accordance to the requirements of the role.
- Build convincing characters, create dramatic performance and deliver on stage.

Course Content:

PRACTICAL: CREDITS – 4

UNIT I: PRE-PRODUCTION

- Selecting a play
- Script reading
- Character Analysis & Casting
- Improvisations
- Deciding Performance Styles for the play.

UNIT II: DESIGNING

- Designing & Building the Sets
- Property Making
- Costume Designing / Preparation of Costume
- Light & Sound Design & Execution
- Colour Choices
- Publicity Design and Execution

UNIT III: REHEARSAL & STAGING

- Rehearsal
- Performance/Presentation

SUGGESTED READING:

J. Michael Gillette, Theatrical Design and Production
The Edison Electric Illuminating Company of Boston, *The History of Stage Lighting*
Badal Das, *Natyakala aru Abhinoy Silpo*
H. B. Sharma, *Rang Sthapatya*

Total credits: 4
Theory Credit: 0
Practical Credit: 4
Number of required classes: 80 (Theory: 0, Practical: 80)
No. of Contact classes (Theory): 0
No. of Non-Contact classes (Theory): 0
No. of Contact classes (Practical): 70
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-V

Paper 14: BRIEF HISTORY OF WORLD CINEMA

Total Credits=4 Total Marks=100 Theory=60, Practical=20, Internal=20(Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objectives of the course are to introduce the students to the history of world cinema, and give them an overview of the development and progression of World Cinema.

Course Learning Outcome: After the completion of the course the student(s) will be:

- Able to comprehend the history of Cinema
- Understand Cinema as an Art
- Understand various technical developments of the genre
- Understand how cinema can change one's perspective towards the universe
- Analyze the impact of cinema on society
- Visually familiar with different classics of different ages and regions of the world.

Course Content:

THEORY: CREDITS – 3

UNIT I: THE CINEMATIC GENRE

- Definition & Meaning of Film/Movie/Cinema
- The Kinetoscope and beyond: Genesis and Evolution of the Cinematic Art
- Technique, Technicality, Technology

UNIT II: ART, COMMUNICATION & IMPACT

- Film imaging as an Art
- Importance of Cinema – Impact on the Individual and Society
- Films as a means of Mass Communication

UNIT III: DOWN THE YEARS

- The Silent Era: Technical Developments
- The Speaking Image: Technical Developments
- Closer to Reality: The Impact of Sound on Cinema

UNIT IV

- Cinema before World War II
- Cinema after World War II

PRACTICAL: Credit - 1

- Viewing benchmark films and participating in post-viewing analysis:
  - *Birth of a Nation* by D. W Griffith
  - *Bicycle Activity Thief* by Vittorio De Sica
  - *Singing in the Rain* by Gene Kelly & Stanley Donen

SUGGESTED READING:

James Monaco, *How to Read a Film*
Kristin Thompson & David Bordwell, *Film History: An Introduction*
Edward O'Neil, *The Oxford History of World Cinema*
William Everson, *A Pictorial History of the Western Film*
Steven Dkatz, *Shot by Shot*
Andre Bazin, *What is Cinema?*
Satyajit Ray, *Our Films and Their Films*
Vachel Lindsay, *The Art of Moving Picture*
Parthojit Barua, *Cholocitro Taranga*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-V

Paper 15: BRIEF HISTORY OF INDIAN CINEMA

Total Credits=4 Total Marks=100 Theory=60, Practical=20, Internal=20(Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objectives of the course are to introduce the students to the History of Indian cinema. Give them an overview of the development and progression of Indian main stream and its regional diversities.

Course Learning Outcome: After the completion of the course the student(s) will be:

- Able to comprehend the history of Indian Cinema
- Understand various technical development from the beginning
- Understand Regional Cinema: Marathi Cinema, Assamese Cinema, Bengali Cinema etc.
- Understand Indian Cinema before and after Independence
- Understand how cinema can change one's perspective towards the universe
- Impact of cinema in the Indian society
- Visually familiarized with different classics of different ages and region.

Course Content:

THEORY: CREDITS – 3

UNIT I: CINEMA IN INDIA - EVOLUTION

- Early Indian Cinema; Antecedents.
- Development & Growth
- Dramatic Elements in Cinematic Art
- Impact of Cinema on Indian Society
- Cinema as a vehicle of Mass Communication

UNIT II: ART, COMMUNICATION & IMPACT

- Indian Cinema: Before & After the Silent Era
- Independence &Indian Cinema: Before & After
- Golden Era of Indian Cinema
- Bollywood & Arthouse Cinema

UNIT III: REGIONAL DIVERSITIES

- Meaning and Definition of 'Regional' Cinema
- Development & Growth of Regional Cinema in various regions of India:
    - Bengali
    - Marathi

- Tamil Cinema
- Malayalam Cinema etc.

UNIT IV: THE ASSAMESE CHALACHITRA

- Early History & Growth of Assamese cinema
- Impact & Popularity
- Contemporary Scenarios

PRACTICAL: Credit - 1

- Watching Classic films:
  - *Raja Harichandra* by Dada SahabPhalke
  - *AlamAra* by ArdeshirIrani
- Watching Regional films:
  - *XagoroloiBohuDur* by JahnuBarua
  - *PatherPanchali* by Satyajit Ray
- GroupDiscussion& Analysis

SUGGESTED READING:

Ashish Rajadhyaksha & Paul Willemen,ed. *Encyclopedia of Indian Cinema*
Renu Saran, *History of Indian Cinema*
Vamsee Juluri *Bollywood Nation: India through its cinema*
Satyajit Ray, *Our Films and Their Films*
Nirud Choudhary, *Asomiya Cinemar Itishas*
Parthojit Barua, *Cholocitro Taranga*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-V

Paper 16: PROMINENT FILM MAKERS

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20(Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objectives of the course are to introduce the students to the work of some of the world's best known film makers, and to give them a visual demonstration of their films to develop their critical and analytical views on film as a whole, and to analyze these from an actor's perspective.

Course Learning Outcome: After the completion of the course the student(s) will be:

- Appreciate the classic works of renowned filmmakers.
- Analyze these films critically.
- Appreciate the methods of visual story telling of these legends of cinema.
- Acquire awareness of the meaning of symbols, metaphors etc. used in the classics.

Course Content:

THEORY: CREDITS – 3

UNIT I: WORLD CINEMA

- D.W Griffith: life and work
  - *The Birth of a Nation*
  - *Intolerance*
- Sergei Eisenstein: life and work
  - *Battleship Potemkin*
  - *October*
- Charlie Chaplin: life and work
  - *The Kid*
  - *Modern Times*
  - *Gold rush* etc.
- Akira Kurosawa: life and work
  - *Seven Samurai*
  - *Rashomon*
- Vittorio De Sica- his life and work
  - *Bicycle Thieves*
  - *Shoeshine*

UNIT II: INDIAN GREATS

- Satyajit Ray: life and work
  - *The Apu trilogy*

- Jyoti Prasad Agarwala: life and work
    - *Joymoti*
    - *Indramolati*
- Adoor Gopalakrishnan: life and work
    - *Elippathayam*
    - *Swayavaram*
- Dr. Bhabendra Nath Saikia: life and work
    - *Agnisnan*
    - *Aborton*

PRACTICAL: Credit - 1

UNIT III

- Group Discussion & Analysis of each film after screening
- Project work: Choose any one filmmaker and critically analyze the actor's methods in the respective films

SUGGESTED READING:

Akira Kurosawa, *Something Like an Autobiography*
Ronald Bergan, *Sergei Eisenstein: A Life in Conflict*
James Goodwin, *Eisenstein, Cinema, and History*
Lillian Gish, *The Movies, Mr. Griffith and Me*
Robert M. Henderson, *D. W. Griffith: His Life and Work*
Nirud Choudhury, *Asomiya Cinema Itishas*
Arunluchan Das, *Asomiya Cinema kotha*
Rajib Mahanta, *Joimotir Junaki Baat*
C. Dasgupta, *The Cinema of Satyajit Ray*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-V

Paper 17: PRODUCTION I [ON JOB TRAINING]

Total Credits=4
Total Marks=100
Practical=100

Course Objective: The primary objectives of the course are to give the students a practical experience of developing and creating characters for film and developing the script with through the characters.

Course Learning Outcome: After the completion of the course the student(s) will be:

- Develop cinematic characters.
- Understand the subtleties of cinematic characterization.
- Etch out a character on the basis of the script.
- Differentiate between the action and activities of a stage-play character and a character for the camera.
- Develop scenes based on different characters.

Course Content:

ALL PRACTICAL: CREDITS – 4

UNIT I: PREPARING THE ACTOR

- Work on actors' body.
- Activity-exercises for body flexibility or mobility, exercises for body balance, control over body, exercise for physical fitness.
- Reading film scripts and understanding the characters need.
- Activity-character analysis.

UNIT II: PRE-PRODUCTION PROCESS

- Developing an idea
- Drafting a script
- Writing a shooting script

UNIT III: PRODUCTION

- Location Scouting
- Shooting a solo or group act
- Short Scene

UNIT IV: POST PRODUCTION

- Editing
- Dubbing
- Screening of the Film

SUGGESTED READING:

Patrick Tucker, *Secrets of Screen Acting*
David Thomson, *Acting Naturally: The Magic in Great Performances*
Josef Steiff, *The Complete Idiot's Guide to Independent Filmmaking*
Blain Brown, *The Basics of Filmmaking: Screenwriting, Producing, Directing, Cinematography, Audio, & Editing*

Total credits: 4
Theory Credit: 0
Practical Credit: 4
Number of required classes: 80 (Theory: 0, Practical: 80)
No. of Contact classes (Theory): 0
No. of Non-Contact classes (Theory): 0
No. of Contact classes (Practical): 70
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-VI

Paper 18: THE CAMERA AND ITS PARTS

Total Credits=4 Total Marks=100 Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objectives of the course are to acquaint the students with the different parts of the camera and its basic functioning. It will introduce them to the various film shots, framing, camera movement etc.; it will also train them how to behave in front of the camera.

Course Learning Outcome: After the completion of the course the student(s) will:

- Know the different parts of a video camera and its basic functioning & principles.
- Understand and identify the different types of camera shots based on size, angle, movement, focus, positioning etc.
- Understand how to behave in front of the camera in accordance with the shot.
- Know basic screen etiquettes.
- Adapt their acting skills for the camera as required.
- Understand the needs of the audition.
- Adapt their performance to the requirement of the auditions.

Course Content:

THEORY: CREDITS – 3

UNIT I: THE MECHANISM OF THE CAMERA

- Basic knowledge of camera and its parts:
  - Camera lens
  - Viewfinder
  - Shutter speed
  - Aperture
  - Image sensor etc.

UNIT II: CAMERA TECHINIQUES: ANGLES, SHOTS

- Establishment Shots, Point-of-view shot
- Mid-Angle / Low angle shot / Close / Extreme Close shot
- Long shot / Extreme long shot / wide angle shot
- Two-shot, reaction shot, birds-eye (aerial) shot, Tilt shot, Soft focus, Deep Focus, Selective shot, Zoom-in, Zoom-out, etc.
- Trolley shot, Pan / Whip pan / Surveying pan, crab, tracking (dolly) shot, pedestal shot.
- Hand held cameras, process shot.

UNIT IV: ACTING FOR THE SCREEN

- Basic Screen Acting Etiquette
- Frame
- Vocal-tips
- Basic editing knowledge
- Reaction

PRACTICAL: CREDIT-1

- The Student will be required to demonstrate their knowledge of the camera; framing techniques, etc.
- Group Discussions
- Scene Creation, character-through-camera.

SUGGESTED READING:

Andre Bazin, *What is Cinema?*
Satyajit Ray, *Our Films and Their Films*
Vachel Lindsay, *The Art of Moving Picture*
Josef Steiff, *The Complete Idiot's Guide to Independent Filmmaking*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-VI
Paper 19: ICONIC ACTORS

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objectives of the course are to introduce the students to some of the most legendary actors of all time and give them a visual demonstration of their work to develop their critical and analytical views on film acting.

Course Learning Outcome: After the completion of the course the student(s) will:

- Appreciate and aspire to emulate the methods of legendary actors.
- Analyze a film and actors' work critically.
- Understand the arc of a character: adaptation, growth and progression.
- Understand the importance of body and eye movement.

Course Content:

THEORY: CREDITS – 2

UNIT I:

- Marlon Brando: life and work
  - *Julius Caesar, The Godfather*
- Al Pacino: life and work
  - *Godfather, Scent of a Women*
- Anthony Hopkins: life and work
  - *Silence of the Lambs*
- Katherine Hepburn: life and work
  - *Morning Glory*
- Tom Hanks: life and work
  - *Forrest Gump*

UNIT II:

- Dilip Kumar: life and work
  - *Devdas*
- Balraj Sahni: life and work
  - *Garam Hawa*
- Smita Patil: life and work
  - *Manthan*
- Naseeruddin Shah: life and work
  - *Sparsh*

- Bishnu Khargoria: life and work
    - *Xagaroloi Bohu Dur*

PRACTICAL: CREDIT-2

- Students will be required to demonstrate their familiarity with the work and style of the great screen actors
- Group Discussion after every screening
- Scene Re-Creation through their own variation /interpretation of a given character.

SUGGESTED READING OF FILM TEXTS:

- Bimal Roy, *Do Bigha Zameen*
- Satyajit Ray, *Charulata*
- Ritwik Ghatak, *Meghe Dhaka Taara*
- Guru Dutt, *Kagaz Ke Phool*
- Bhupen Hazarika, *Era Baator Xur*
- Michael Curtiz, *Casablanca*
- Robert Benton, *Kramer vs Kramer*
- Mike Nichols, *Who's Afraid of Virginia Woolf?*
- Alfred Hitchcock, *Psycho*

Total credits: 4
Theory Credit: 2
Practical Credit: 2
Number of required classes: 80 (Theory: 40, Practical: 40)
No. of Contact classes (Theory): 30
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 30
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-VI

Paper 20: BASICS OF FILM PRODUCTION & THE ACTOR

Total Credits=4
Total Marks=100
Theory=60, Practical=20, Internal=20 (Sessional=10, Practical=6, Attendance=4)

Course Objective: The primary objectives of the course are to give the students an overview of the film-making process; the stages of production and their importance for the actor.

Course Learning Outcome: After the completion of the course the student(s) will:

- Understand and identify the different stages of filmmaking (Pre-Production, Production & Post- production) and their significance.
- Be able to develop a script for a short film production, understanding the stages of characterization.
- Be able to plan the production procedure for a short film production.
- Understand the techniques involved in film acting or acting in front of camera.

Course Content:

THEORY: CREDITS – 3

UNIT I: INTRODUCTORY

- Detailed Study of the different stages of Filmmaking
- People in the filmmaking process – Hierarchy

UNIT II: PRE-PRODUCTION

- Ideation
- Scriptwriting
- Storyboarding
- Location hunting
- Casting

UNIT III: PRODUCTION

- Production
- Basic film Lights, Sounds
- Basics cinematography
- Basic Make-Up & Costumes

UNIT IV: POST-PRODUCTION

- Basics of Editing
- Colour Correction
- Dubbing
- Distribution
- Publicity & PR

PRACTICAL: CREDIT-1

- Group Discussions
- Running through the theoretical learning in practice –
    - Storyboarding, Camerawork etc
    - Creating complex characters
    - Experimenting with acting processes as per script requirement

SUGGESTED READING

Andre Bazin, *What is Cinema?*
Satyajit Ray, *Our Films and Their Films*
Vachel Lindsay, *The Art of Moving Picture*
Patrick Tucker, *Secrets of Screen Acting*
Milton Smith, *Theory of Acting*
Josef Steiff, *The Complete Idiot's Guide to Independent Filmmaking*
Stephen Hoover, *Film Production Theory and Practical*

Total credits: 4
Theory Credit: 3
Practical Credit: 1
Number of required classes: 80 (Theory: 60, Practical: 20)
No. of Contact classes (Theory): 50
No. of Non-Contact classes (Theory): 10
No. of Contact classes (Practical): 10
No. of Non-Contact classes (Practical): 10

BVOC – ACTING (Entertainment)

Core Course: Semester-VI

Paper 21: PRODUCTION II [ON JOB TRAINING]

Total Credits=4
Total Marks=100
Practical=100

Course Objective: The primary objectives of the course are to provide the students a practical hand on experience of making a short film.

Course Learning Outcome: The successful completion of the course will enable the student(s)to:

- Make their own short film while doing all the pre-production, production and Post-production activities and all requisite duties for a short production.
- Gather experience of acting in front of the camera as flawlessly as far as possible.

Course Content:

ALL PRACTICAL: CREDITS – 4

UNIT I: PRE-PRODUCTION

- Developing Idea
- Scripting
- Screenplay preparation
- Storyboard preparation
- Location Recce
- Preparation for shoot

UNIT III: PRODUCTION

- Arranging the shoot
- Shooting of a Short film

UNIT III: POST-PRODUCTION

- Editing
- Dubbing
- Screening

SUGGESTED READING

Sidney Lumet, *Making Movies*
Ed Pincus, *The Filmmaker's Handbook*
Patrick Tucker, *Secrets of Screen Acting*

John Alton, *Painting with Light*
Stephen Hoover, *Film Production Theory and Practical*
Eve Light Honthaner, *The Complete Film Production Handbook*
John Cantine, Susan Howard, and Brady Lewis, *Shot by Shot: A Practical Guide to Filmmaking*

Total credits: 4
Theory Credit: 0
Practical Credit: 4
Number of required classes: 80 (Theory: 0, Practical: 80)
No. of Contact classes (Theory): 0
No. of Non-Contact classes (Theory): 0
No. of Contact classes (Practical): 75
No. of Non-Contact classes (Practical): 5