

Department of Food Technology Vikram University, Ujjain (MP)

Syllabus M. Sc. Food Technology (For UTD)

Course Structure Choice Based Credit System (CBCS)

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2021-2023 ONWARDS

VIKRAM UNIVERSITY, UJJAIN**SYLLABUS PRESCRIBED FOR THE DEGREE OF THE MASTER OF SCIENCE IN BOTANY IN
UNIVERSITY TEACHING DEPARTMENT****(Academic Session 2021-2023 & Onwards)****[PROGRAMME UNDER CHOICE BASED CREDIT SYSTEM (CBCS) – ORDINANCE - 14]**

This brochure of the programme for the M.Sc. degree in Botany consists of six parts, viz., (A) Information from the relevant Ordinance(s) / Statutes, (B) Programme Objective (C) Programme Outcomes (D) Programme Specific Outcomes (PSOS) (E) Scheme of examination and (F) Courses of study.

A. INFORMATION FROM THE RELEVANT ORDINANCE (S)/STATUTES**1. DURATION OF THE COURSE**

M.Sc. Food Technology will be a full time two-year programme to be covered in four semesters, each of six months duration. The first year of the programme will complete the I and II semesters, and the second year will complete the third and fourth semesters. The maximum duration of the programme shall be twice of the minimum duration of the programme, i.e. four years.

2. ADMISSION TO THE COURSE

The number of seats shall be in accordance with the directives by the University. A candidate, who after having secured the B.Sc. degree with at least 50 % marks from a recognized university with a subject of Life Science/Bioscience/ Science disciplines, B.Pharm, B.E./B. Tech. Biotechnology, B.V. Sc, B.D.S., MBBS, B.Sc. (Agri) or equivalent, shall be eligible for admission to the course. The admission to the course will be on the basis of the merit and according to guidelines from the University and Government of Madhya Pradesh. After the term-end examination at the end of each semester, the student will be provisionally admitted to the next semester.

3. TUITION AND OTHER FEES

The admitted candidate shall pay the course fee in addition to the tuition fee and such other fees as prescribed by the University.

4. PROGRAM OF THE STUDY

All School of Studies in Vikram University, Ujjain will have Choice Based Credit System (CBCS) in M Sc. Food Technology (For UTD). The student will have to earn 104 actual credits (Valid Credits) and 16 virtual credits (Total 120 credits) in total four semesters (Two years duration). The course will comprise of Lecture (L), Seminars (S), Practical (P), Library Assignments (LA), Project work (PW) and Comprehensive viva.

The Semester will consist of 16-18 weeks of academic work. One Credit is equivalent to one hour (60 minutes) of teaching (Lecture) or two hours (120 minute) of S, P, LA and PW per week in a semester. The credits for the course have been distributed among the courses under Core, Skill Development, Generic Elective and Discipline Specific Elective categories. The credits associated with the courses will be valid credits, while credits associated with Comprehensive viva voce will be virtual credits.

During the semester, a teacher offering the course will do the continuous evaluation of the student at three points of time by conducting three tests of 40 marks each. Of these, two must be written tests and the third may be written test/Quiz/Seminar, Assignment for theoretical courses. Marks obtained in two best tests out of three will be awarded to the student. In each course, there shall be End Semester Examination of 60 Marks. Each student has to appear in at least two tests and End semester examination; otherwise, the student will be awarded Ab grade in that course. Examination and evaluation of the courses will be as per Ordinance 14 of the Vikram University, Ujjain.

The syllabus for the theory and practical examination will be prescribed by the Board of Studies in Food Technology, Vikram University, Ujjain .

5. CONTINUOUS EVALUATION

During the semester, a teacher offering the course will do the continuous evaluation of the student at three points of time by conducting three tests of 40 marks each. Of these, two must be written tests and the third may be written test/quiz/seminar/assignment. Marks obtained in two best tests out of three will be awarded to the student.

6. ATTENDANCE

The student whose attendance is less than 75 % will not be allowed to appear in the end semester examination and he/she will be declared fail in that semester.

7. END SEMESTER EXAMINATION

There shall be end semester examination at the end of first, second & third semester. The semester examination will be held every year normally in December and June or on the dates declared in the academic calendar of the University. A student proceeding to appear in end semester examination will submit through the Head of the Department his / her application on the prescribed form along with required examination fee, etc. to the Registrar of the University. Every student will appear in four respective theory papers and two combined practical examinations in first, second, & third semesters except for the fourth semester. In the fourth semester, every student will be allotted dissertation work in lieu of four theory papers. Allotment of the dissertation will be done by a Departmental committee comprising of the Head of the department of Food Technology. The dissertation may be undertaken in UTD or in any of the National Laboratories/ Institute/ Universities/ Government approved Companies/ Industries. In such cases, there will be two supervisors, one from the parent department and another from the place where the student completes his/her dissertation work.

The dissertation will be evaluated by the external examiner who has expertise in the concerned subject. For the purpose of holding viva-voce, the supervisor will be the internal examiner along with the external examiner who has evaluated the dissertation. The scheme of marks for evaluating the various components of the dissertation will be followed as given in the syllabus.

8. CONDITION FOR A PASS

For each course, each student has to appear in at least two tests and end semester examination, otherwise the student will be awarded "Ab" grade. The total marks obtained in end-semester examination, and best of two tests under continuous evaluation will decide the grade in that course. In addition, student also has to get valid credits for Skill development modules' courses and Virtual credits and grades for Comprehensive viva-voce. The grading will be made on 10-point scale as follows:

Letter Grade	Grade Points	Description	Range of Marks (%)
O	10	Outstanding	90-100
A+	9	Excellent	80-89
A	8	Very Good	70-79
B+	7	Good	60-69
B	6	Above Average	50-59
C	5	Average	40-49
P	4	Pass	35-39
F	0	Fail	0-34
Ab	0	Absent	Absent

For passing the examination in each semester, a candidate must have secured a minimum of 35% marks ("P" Grade: 4 Grade Points) in the course. If the marks obtained by the student in a course are less than the minimum cut-off percentage of marks, then "F" Grade will be awarded. If a student obtains "F" or "Ab" Grade in any course, he/she will be treated to have failed in the course. He/she has to reappear in the examination of the course as and when conducted or arranged by the UTD. Marks obtained earlier in continuous assessment may be carried forward and added to the marks obtained in repeat end semester examination to decide the grade in the repeat course.

The theoretical, practical and skill development courses can be repeated whenever offered or arranged by the UTD but within maximum duration of the programme. He/she can avail multiple repeat attempts to pass the course. The student will be promoted to the next semester if he/she secures at least 12 valid credits in a semester. In case the student secures less than 12 valid credits in any semester, then the student will be asked to repeat entire semester and that semester will be treated as zero semester.

The decision of the teacher regarding the evaluation and the grade shall be final. However, a student submits in writing for review of his Marks/Grade to the Head/Director who will place the case before the board of comprehensive viva voce. The decision of the board will be final. Result of review will be declared by the concerned Head/Director. Review is effective only when grade improves. Review will be allowed only if –

- The prescribed fee is paid.
- The candidate applies within 7 days of the declaration of the grade in that course.

There will be no provision for revaluation. However the candidates can apply for Re-totalling in one course per semester.

1. In matters not covered under this Ordinance 14, general rules of the University shall be applicable.
2. In case of any dispute/ambiguity, the ruling of the Vice-Chancellor shall be final and binding.

B. PROGRAMME OBJECTIVES

The Master of Science degree programme in Food Technology imparts knowledge and understanding of Biology, Biochemistry, Food Chemistry, Food Microbiology, Food Science, Food processing, Food safety, Food quality, Food product storage, Food product preservation, Food product packaging and Food product distribution.

The Programme also provides sufficient understanding and cognitive abilities to design and develop technologies for food processing, preservation and packaging as per the legal and safety requirements. In addition, the programme imparts knowledge and training to develop transferable skills and entrepreneurship abilities.

The objectives of the programme are to enable the students to:

1. To impart knowledge of Biology, Food -Biochemistry, Food Chemistry and Food Microbiology
2. To impart knowledge and understanding of technology of vegetables, fruits, plantation crops, meat, poultry, dairy and sea foods, bakery and confectionery.
3. To impart abilities to design technologies for food processing and food preservation
4. To impart abilities to design and develop food packaging and distribution
5. To train students on use of various instrumentation for the evaluation of food quality and safety
6. To train students to conduct scientific experiments and document scientific investigations
7. To educate on professional ethics, economics, social sciences, inter personal and

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communication skills relevant to professional practice,

8. To provide a general perspective on lifelong learning and opportunities for a career in industry, scientific organization, education, business and commerce

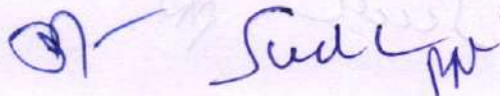
C. PROGRAMME OUTCOMES

After successful completion of the program, Students will have knowledge on the fundamentals of food science, food chemistry and biochemical changes during processing and preservation, nutraceuticals, also students will be able to understand and apply sensory evaluation of food.

1. Students will demonstrate an ability to work in modern tools and equipments to analyze food composition, identify microorganism responsible for food spoilage. Students will be able to understand the principles behind analytical techniques used in evaluating the biochemical properties of food; they will be able to identify the microorganism responsible for food spoilage and the methods to control the food spoilage.
2. students will demonstrate knowledge in various engineering properties of food and its application in food industry, concept of mass balance and energy balance, unit operations in food processing, conventional and advanced methods of food preservation, methods of packing, post-harvest practices so as to develop food products and develop device for food industry.
3. Students will also develop specific skill based on their interest in bakery and confectionery, meat, poultry and fish processing, food fermentation, dairy processing. Students will also be able to apply the principles of Hazard Analysis and Critical Control Points (HACCP) to ensure safe food processing, Students will also have knowledge in regulations governing the manufacture and sales of the food products.
4. To undertake research in an area related to the program of study. The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.
5. Scope of Entrepreneurs Small- scale business provides good scope for the growth of entrepreneurial activities. An entrepreneur has good opportunity and vast scope in selling service rather than manufacturing a product. ... This sector provides a wider scope for the potential entrepreneur to develop his or her own industry.

D. PROGRAMME SPECIFIC OUTCOMES (PSOS)

1. An ability to apply the knowledge of science, microbiology and technology.
2. An ability to apply the knowledge of underlying chemistry, properties and effects of processing on food components.
3. An ability to use the techniques, skills, and modern tools necessary food processing operations.
4. Demonstrate knowledge and understanding of technology and management principles, manage projects efficiently in food science and technology and multidisciplinary environments after consideration of economical and financial factors.
5. An ability to design and conduct experiments, as well as to analyze and interpret data.
6. An ability to apply knowledge for production of safe food and shelf-life extension of food



products.

7. An ability to identify, formulates, and solves food science and technology problems.
8. An ability to extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data. Contribute individually/in group(s) to the development of scientific/technological knowledge in food science and technology

The student will be able to design and execute experiments related to Food Science. He/ She will be able to pursue independent researches in basic and applied researches in governmental, industrial and private academic and research establishments.

SCOPE OF FOOD TECHNOLOGY

Food technology is a branch of food science which majorly deals with the manufacturing, processing, preserving, and packaging of food and its articles.

Future scope for food technology: Universities and colleges around the globe are adopting this branch of food science into their curriculum. India is essentially an agricultural country and the economy is basically agrarian in nature. More than 70% of the population lives in rural areas and out of them 80% depend on agriculture for employment and livelihood. For an agrarian country economy, rural population can be considerably benefited by food technology at least in the following three ways:

1. Instant foods, energy foods and baby foods can be produced from the locally available raw materials which will reduce child malnutrition.
2. Integrated food management for storage, transportation and distribution.
3. Application of food technology practices for processing traditional foods by way of drying, pickling, salting and smoking.
4. Manufacturing and processing of different type coffee, tea and cocoa powder or product description.
5. Manufacturing and processing of meat and poultry products.
6. Advance information of flavors and methods dairy manufacturing products.

A food technologist can get the job of a Quality Assurance Manager, Laboratory Supervisor, Food Packaging Manager or as a technician in food processing and packaging industry or even as a research associate in premier institutes, universities and research and development units. Companies like Hindustan Lever, Heinz, Nestle and many others recruit food technologists periodically for bringing about an improvement in their products. Both the private and public sectors provide job opportunities to food technologists. Food technology is vast. There are numerous fields you can step your foot into after choosing Food Technology, Food science and technology.

- Food chemistry and nutrition
- Food microbiology
- Food engineering
- Food quality, laws and food safety management
- Packaging laws and study of different type of packaging items
- Food additives and different type's preservation techniques of food items.

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Students can pursue for M.sc in food technology. As a food scientist, their main activity is the improvement and development of new food products. As food losses during storage and processing can be enormous, food scientists are involved in adapting and developing preservation methods appropriate and affordable to various regions of the world. They must also find creative ways to meet the consumer demand. The aims of food industry today-

1. To extend the shelf life of food by preservation techniques
2. To increase variety in the diet by providing a range of attractive flavors, colors, aromas and texture in food
3. To provide the nutrients required for health
4. To work on healthy and herbal products

Thus food technology has a wide range of employment opportunities to students. It has a wide scope as food industry is one of the largest growing industries in the world.

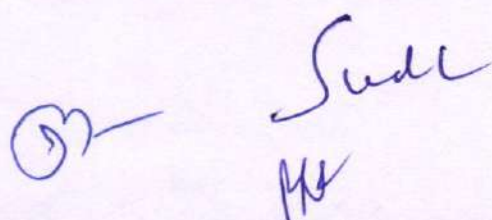
CBCS Ordinance no-14

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The Semester will consist of 16-18 weeks of academic work. One Credit is equivalent to one hour (60 minutes) of teaching (Lecture) or two hours (120 minute) of S, P, LA and PW per week in a semester. The credits for the course have been distributed among the courses under Core, Skill Development, Generic Elective and Discipline Specific Elective categories. The credits associated with the courses will be valid credits, while credits associated with Comprehensive viva voce will be virtual credits.

During the semester, a teacher offering the course will do the continuous evaluation of the student at three points of time by conducting three tests of 20 marks each. Of these, two must be written tests and the third may be written test/Quiz/Seminar, Assignment for theoretical courses. Marks obtained in two best tests out of three will be awarded to the student. In each course, there shall be End Semester Examination of 60 Marks. Each student has to appear in at least two tests and End semester examination; otherwise, the student will be awarded Ab grade in that course. Examination and evaluation of the courses will be as per Ordinance 14 of the Vikram University, Ujjain.

The details of the course are given below:-

A handwritten signature in blue ink, appearing to read 'Sudh', with the initials 'MS' written below it. To the left of the signature is a small circular mark containing the number '5'.

VIKRAM UNIVERSITY, UJJAIN MP
SUBJECT- FOOD TECHNOLOGY
(Session -2021-2023 onwards)
M. Sc. I SEMESTER (CBCS), SCHEME

Course Code	Course Name	Course type	Credits	Marks		
				Internal Examination Marks	University Examination Marks	Total Marks
FT 101	Principles of Food Processing & Preservation	Core	5	40	60	100
FT 102	Food Biochemistry & Nutrition	Core	5	40	60	100
FT 103	Food Microbiology	Core	5	40	60	100
FT 104	Food Chemistry	Generic Elective*	5	40	60	100
FT 105	Advances in Food Technology					
FT 106	Biostatistics, Computer applications					
FT 107	Entrepreneurship Development (Assignment)	Skill Development course**	4	30	50	80
FT 108	Laboratory-I (Laboratory Skill Development/Survey)	Core	2	15	25	40
FT 109	Comprehensive Viva (Virtual Credits)	Core	4		80	80
	Grand Total		30			600

* -Any 01 of 03 Generic Elective can be co-opted by the students.

** -Common course offered by the university/Assignments/MOOC course etc.

-One Credit is equal to 20 marks

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SUBJECT- FOOD TECHNOLOGY
M.Sc. II SEMESTER (CBCS) SCHEME

Course Code	Course Name	Course Type	Credits	Marks		
				Internal Examination Marks	University Examination Marks	Total Marks
FT 201	Food Quality control, Laws & Management	Core	5	40	60	100
FT 202	Food Engineering	Core	5	40	60	100
FT 203	Food Packaging	Core	5	40	60	100
FT 204	Neutraceuticals and Functional Tool	Discipline specific Elective*	5	40	60	100
FT 205	Fruits & Vegetable Technology					
FT 206	Meat, Fish and Poultry products					
FT 207	Skill Development In Food Product Formulation/Assignments	Skill Development course**	4	30	50	80
FT 208	Laboratory-II(Laboratory Skill Development/Field work)	Core	2	15	25	40
FT 209	Comprehensive Viva (Virtual Credits)	Core	4		80	80
Grand Total			30			600

* -Any 01 of 03 Discipline Specific Elective can be co-opted by the students.

** -Common course offered by the university/Assignments/MOOC course etc.

-One Credit is equal to 20 marks

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SUBJECT- FOOD TECHNOLOGY
M. Sc. III SEMESTER (CBCS) SCHEME

Course Code	Course Name	Course Type	Credits	Marks		
				Internal Examination Marks	University Examination Marks	Total Marks
FT 301	Food Biotechnology	Core	5	40	60	100
FT 302	Fermentation Technology	Core	5	40	60	100
FT 303	Dairy Technology	Core	5	40	60	100
FT 304	Food Additives, Spices and Flavor Technology	Discipline Specific Elective	5	40	60	100
FT 305	Processing of Cereals, Legumes, Oil seeds and Sugar crops					
FT 306	Product Development from food Industry Refuse					
FT 307	Personality Development/ Skill Development In Food Product Formulation/Assignments	Skill Development Course*	4	30	50	80
FT 308	Laboratory-III (Laboratory Skill Development/ Minor Project)	Core	2	15	25	40
FT 309	Comprehensive Viva (Virtual Credits)	Core	4		80	80
	Total	Grand	30			600

*-Any 01 of 03 Discipline Specific Elective can be co-opted by the students.

**-Common course offered by the university/Assignments/MOOC course etc.

- One Credit is equal to 20 marks

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SUBJECT- FOOD TECHNOLOGY
M. Sc. IV SEMESTER (CBCS) SCHEME

Course Code	Course Name	Course Type	Credits	Marks		
				Internal Examination Marks (40%)	University Examination Marks (60%)	Total Marks
FT 401	Project Work/ Onsite Training 1- Project work and Presentation 2- Project Report assessment and Viva-voce	Core	12	100	140	240
FT 402	Industrial Visit/Food Industry/Dairy Industry etc Visit Minor Report writing	Core	4	30 (Report)	50 (Viva voce)	80
FT 403	Review Writing	Core	4	30 (Report)	50 (Viva voce)	80
FT 404	Seminar/Group Discussion	Core	3	25 (Write up)	35 (Presentation)	60
FT 405	Poster Presentation	Core	3	25 (Write up)	35 (Presentation)	60
FT 406	Comprehensive Viva (Virtual Credits)	Core	4		80	80
	Grand Total		30			600

- One Credit is equal to 20 marks

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DEPARTMENT OF FOOD TECHNOLOGY
SUBJECT: FOOD TECHNOLOGY
M. SC. SEMESTER - I

Code No. : FT 101: PRINCIPLES OF FOOD PROCESSING & PRESERVATION (Core)

Objective: To identify and select preservation methods appropriate for specific foods and to learn the effects of preservation methods on the quality of food.

Learning Outcome: Students shall develop the knowledge of need of food processing and learn various preservation techniques. To impart knowledge on the causes of food spoilage and principles of different techniques used in processing and preservation of foods, Knowledge about baking and milling of process.

UNIT-I

Introduction: Definition and scope of Food science and technology, historical development of food processing and preservation, general principles of food preservation
Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking. **Baking:** Principle of baking & several changes in baked products

UNIT-II

Radiation: Source of radiations, mode of action effect on microorganisms and different nutrients dose requirements for radiation preservation of food.

Microwave heating: Principles and application in Food processing

UNIT-III

Refrigeration and Freezing Preservation: Refrigeration and storage of fresh food major requirement of refrigeration plant atmospheric storage, refrigerated storage of various food freezing point of selected food influence of freezing and quality of the food product. Method of freezing, freeze drying, storage, and thawing of frozen food

UNIT-IV

Chemical Preservation: Preservation of food by use of sugar, salt, chemicals, antibiotics & by Smoking, Concentration: Application in food Industry processes and equipment for manufacture of various concentrated foods and their keeping quality, **Fermentation:** Application in preservation of food pickling. Curing etc

UNIT-V

Drying: Processing and preservation by drying, various methods employed in production of dehydrated food products, selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying, tray or tunnel drying, spray drying, drum drying, fluidized bed drying. Physical and chemical changes during drying, control of chemical changes, desirable and undesirable changes, Packaging and storage

of dehydrated food products.

Text books and Reference materials

1. Desrosier NW & James N. (2007). Technology of food preservation. AVI. Publishers
2. Fellows, P.J. (2005). Food processing technology: Principle and Practice. 2nd Ed. CRC Publishers
3. Jelen, P. (2005). Introduction to Food Processing. Prentice Hall
4. N.M.Potter, Food Science and Technology.

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Code No. : FT 102: FOOD BIOCHEMISTRY AND NUTRITION (Core)

Objective: To acquaint the students about Food biochemistry and Nutrition of various foods.

Learning Outcome: To emphasize the need for greater and more efficient utilization of the existing food sources and development of entirely sources of different food groups. Digestion and metabolic pathways of different components knowledge about water, fat soluble vitamin and minerals and recommendatory dietary allowance:

UNIT-I

Introduction to different food groups and its importance in nutrition Carbohydrate: Introduction, digestion, food sources. Metabolic pathways for breakdown of carbohydrates: glycolytic pathway, pentose phosphate pathway, citric acid cycle, electron transport chain, ATP balance, gluconeogenesis, deficiency, metabolic defects such as diabetes associated with carbohydrates.

UNIT-II

Protein: Introduction, Essential amino acids. Food sources, metabolic defects, Metabolism of proteins - outlines (digestion and absorption), Nitrogen balance & nitrogen pool, Evaluation of quality of proteins, deficiency symptoms, prevention and cure.

Fat: Digestion: Introduction, digestion, metabolism outlines, essential fatty acids, food sources, metabolism of fat and fatty acid, nutritive functions, effects of excess and deficiency: obesity, cardiovascular diseases, Nutritional significance of lipoproteins.

UNIT-III

Fat soluble vitamins: Salient features, requirements, food sources, effects of excess and deficiency. **Water soluble vitamins:** Salient features, requirements, food sources, effects of excess and deficiency. **Minerals:** salient features, requirements, food sources, effects of excess (if any) and deficiency factors affecting utilization.

UNIT-IV

Energy metabolism: Basal metabolic requirements and activity, SDA- specific dynamic action of food, respiratory quotient of food, caloric requirement of humans.

Recommendatory dietary allowance: concept of balance diet, menu planning in different ages and diseases.

UNIT-V

Colorimetry: Introduction, beers & lamberts law, extinction coefficient, general principles of colorimeter, application in food industry.

Flourimetry: Introduction, principle, instrumentation & Application. Flame photometry: Instrumentation & application.

Spectroscopy: General principle, instrumentation, types-atomic absorption spectrophotometer, UV-Visible, principle, instrumentation & applications

Text Books / References:

1. Modern Experimental Biochemistry, Boyer, Pearson Education
2. Lubert stryer, Biochemistry, Freeman & Co, N.Y.
3. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons

Code No.: FT 103: FOOD MICROBIOLOGY (Core)

Objective: To understand the role and significance of different microbes and their activity in food safety, food quality and food shelf-life especially during food production to food storage.

Learning Outcome: Students will be able to understand the principles behind microbiological techniques used in evaluating the quality of food. They will be able to identify the microorganism responsible for food spoilage and the methods to control the food spoilage. It focuses on the study of microbial ecology related to fermentation, preservation, investigation of food borne illness and national and international Food Legislation.

UNIT-I

Definition, Historical development, Classification, propagation and importance of Yeast, Mold and Bacteria; Importance and significance of microorganisms in Food.

Factors affecting the growth of microorganisms in food - Intrinsic and Extrinsic parameters that affect microbial growth

UNIT-II

Food Hygiene and Sanitation: Contamination during handling and processing and its control; Indicator organisms; rapid methods in detection of microorganisms.

Sterilization, Thermal inactivation of microbes- Concept, determination & importance of TDT, F, Z & D values, factors affecting heat resistance, pasteurization. Protection and preservation of Foods: Modified atmosphere, Radiation.

UNIT-III

Water: Chemistry, role in food storage, water activity and growth of microorganisms, physical, chemical and microbiological characteristics of water.

Outlines of indicators of water and food safety and quality; Microbiological criteria of foods and their significance

UNIT-IV

Food spoilage: Characteristic features, dynamics and significance of spoilage of different groups of foods ; Cereal and cereal products, vegetables and fruits, meat, poultry and sea foods, milk and milk products, packed and canned foods.

Food borne diseases: Bacterial food borne diseases (Staphylococcal intoxicification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic *Escherichia coli* Diarrhea, *Clostridium perfringens* gastroenteritis, *Bacillus cereus* Gastroenteritis), Mycotoxins: Aflatoxicosis, Deoxynivalenol Mycotoxicosis, Ergotism.

UNIT-V

Food Fermentation: Microbial culture in food fermentations and their maintenance & evaluation. factors affecting activity of culture, single and mixed cultures of cultures; Therapeutic value of fermented foods.

Probiotics and Prebiotics: definition, characteristics, history and classification, Safety considerations on probiotics, application of probiotics and prebiotics in food industry

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Text books and Reference materials:

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi
3. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi
4. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi

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Code No. : FT 104: FOOD CHEMISTRY (Generic Elective)

Objective-To acquaint the students about chemistry of various foods

Learning Outcome: The student will have an idea of food constituents, importance and their daily dietary allowances; scope and prospects for food industries. Student will understand the changes in food during cooking, processing, storing and even digestion. Knowledge of the chemical components (nutritional value) of food is essential for developing a food product with essential amino acids and fatty acids. This also informs the health importance of food chemistry

UNIT-I

Carbohydrate: General introduction, classification, properties and functions of carbohydrates, role of carbohydrate in food industries, Starch, cellulose, hemicelluloses, gums, pectic substances, Modified starch.

Browning reactions in food: Enzymatic and non-enzymatic browning in foods of vegetable and animal origin during storage and processing of foods.

UNIT-II

Protein: General introduction, classification, structure, properties, purification and denaturation of proteins, protein derived from milk, egg protein, meat protein, fish muscle protein, oil seed protein and cereal protein. Modified proteins and application in food industry, Single Cell Protein, Allergens associated with food.

UNIT-III

Lipids: General introduction, classification, properties, functions and requirements of food lipids, Vegetable and animal fat, margarine, lard, butter.

Refining of crude oil, hydrogenation and winterization, Frying and shortenings, Flavor changes in fats and oils, lipid oxidation & factors affecting lipid oxidation

UNIT-IV

Vitamins: General introduction, Fat- and Water-soluble Vitamins, effect of various processing treatments, **Minerals:** General introduction, effect of various processing treatments.

Fortification: Methods, Significance and applications.

UNIT-V

Enzymes: General introduction, Nature, nomenclature, classification, properties and functions of enzymes. Factors affecting rate of enzymatic action.

Enzyme activity in different food systems, Introduction of Flavor production by enzymes

Plant pigments and their role in Food Industry: Carotenes, Xanthophylls, Chlorophyll, Bitter Substances and Tannins.

Text books and Reference materials

1. Beltz, H.D. 2005. Food Chemistry. Springer Verlag.
2. Fennema, O.R, 2006, Food Chemistry, Academic Press.
3. Meyer, L.H. 1987. Food Chemistry. CBS publishers and Distributors, New Delhi.
4. Potter, N.N. and Hotchikiss, J.H. (2006), Food Sciences, Fifth edition, CBS publishers and Distributors, New Delhi.

Code No.: FT 105: ADVANCES IN FOOD TECHNOLOGY (Generic Course)

Objective: To understand the importance of various technology used in processing of food.

Learning Outcome: Student will acquire knowledge about improvement in food processing and different application for production and improvement in food nutritional content which can be used in field of food technology.

UNIT-I

Historical development and eras of modern food processing, Application of extrusion cooking in food industry; effect of process variables on the physic-chemical and nutritional characteristics of extruded foods, Thermoplastic extrusion, cooking-preparation of meat analogues and advantages of meat analogues over natural meat. .

UNIT-II

Advances in Non-thermal processing of foods: Bio-preservation, Ultra-sonification, high-hydrostatic pressure processing, pulsed electric processing.

UNIT-III

Advances in fortification (complementation & supplementation); Techniques of food fortification; advances in use of radiation and microwaves in processing of foods.

GM foods: Safety of Genetically Modified food: potential toxicity and allergenicity of GM foods.

UNIT-IV

Encapsulation; Design and structure of microcapsules, Techniques of microencapsulation, advantages and applications of encapsulation.

UNIT-V

Fractionation of fat

Super-critical carbon dioxide extraction

Introduction to food biotechnology: application and food processing

Text books and reference materials:

1. Lopez, G.F.G. and Canovas, G.V.B. "Food Science and Food Biotechnology" CRC Press, Florida, USA. 2003.
2. Bains, W. Biotechnology from A to Z. Oxford Univ. Press. 2009.
3. Cupp J & Tracy TS. *Dietary Supplements*: Humana Press. 2003.

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Code No.: FT 106: BIostatistics, Computer Applications (Generic Elective)

Objective: Imparting knowledge about principles and application of computer in food technology.

Learning Outcome: Student will acquire knowledge about application of computer in the area of food technology and different type statically techniques in the field of food technology.

UNIT-I

Computer Applications: Use of computers for preparing and presenting documents, spreadsheets, Internet. Use of MS Office Library documentation and scientific literature searching, Use of internet in Food Industry

UNIT-II

Population and sample - types of statistical data - collection and classification of data - Frequency tables - Diagrammatic Representation of data - Measures of central tendencies - Mean, Median and Mode: Measures of dispersion - Range, Quartile deviation, standard deviation, Skewness and Kurtosis - Sampling techniques - Simple and Stratified Random Sampling techniques.

UNIT-III

Elementary Probability Theory - Addition and Multiplication - Bayes Theorem - Random Variables and Probability distribution- Binomial, Poisson, and Normal. Study of relationship between variables - correlation: Simple, Partial, Multiple Correlation (three variables); Regression - Simple, Multiple (three Variables). Measures of association - Chi square test for goodness of fit & contingency table.

UNIT-IV

Basic concept of hypothesis testing - Type I and type II errors. Tests based on Means & Proportions on Normal, t & F. One-way analysis of variance (CRD), Two-way analysis of variance (RBD), LSD, - Multiple comparison tests (DMRT, Bonferonni, Dunnett's). Carrying out Data Analysis using MS- excel: Descriptive Statistics - Diagrammatic representation - t test for independent samples, paired samples, F test two sample variances: One-way ANOVA, two-way ANOVA, Correlation & Regression (three variables).

UNIT-V

Framing Proposal for acquiring grants: The question to be addressed - Rationale and importance of the question being addressed - Empirical and theoretical framework- Presenting pilot study /data or background information - Research proposal and time frame - Specificity of methodology - Organization of different phases of study - Expected outcome of study and its implications - Budgeting - Available infra-structure and resources - Executive summary.

Text books and Reference materials

1. Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai.
2. Copper, H.M. (2002). Intergrating research: A guide for literature reviews (2nd Edition).California: Sage
3. Harman, E & Montages, I. (Eds.) (2007). The thesis and the book, New Delhi : Vistar.
4. Mukherjee, R. (1989): The Quality of Life: Valuation in School Research, Sage Publications.

Code No. : FT 107: ENTREPRENEURSHIP DEVELOPMENT (ASSIGNMENT)
(Skill Development Course)

Common course offered by the University/Assignments/MOOC courses etc. / every student will be imparted skills in development of new products and will be evaluated by the concerned teacher. Every student shall deliver at least one seminar on topic of the curriculum/ advances in food technology which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be given due consideration. The average marking will be taken into consideration.

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Code No. : FT 108: LABORATORY –I (Laboratory Skill Development/Survey) (Core)

Objective: To understand the chemistry of food and to develop skills related to quality evaluation of foods using various qualitative techniques.

Learning Outcome: The students shall acquire the practical skills for the sampling of foods and shall be able to carry out quality evaluation foods. They will learn biochemical techniques for estimation of nutritional content in different type of food products, Qualitative analysis of carbohydrates, and Proteins.

A) Biochemistry analysis

1. Qualitative analysis of carbohydrates
2. Qualitative analysis of Proteins
3. Analysis of lipids: acid value, iodine value, saponification value etc
4. Estimation of carbohydrates in food materials
5. Estimation of proteins in food materials
6. Estimation of crude fiber in food materials
7. Estimation of ascorbic acid in food materials
8. Estimation of calcium in food materials
9. Estimation of cholesterol in food materials
10. Estimation of calorific value of foods
11. Balance diet : food exchange list and steps in diet planning.
12. Diet planning for pre-school , school children ,lactating women

B) Processing Of Food and Food Microbiology

1. Determination of moisture in different food samples.
2. Determination of TSS in different food samples.
3. Assessment by Blanching and browning control assessment by different drying methods.
4. Determination of acidity and PH different food samples.
5. Determination of ash in food samples.
6. Determination of gelatinization Stages of sugar cookery used for food processing.
7. Estimation of gluten content.
8. Adulteration test in various food samples.

C) Food Microbiology Lab

1. Preparation of common laboratory media and study of a compound microscope.
2. Staining: Gram's staining,
3. Sub culturing of a bacterial strain in liquid and solid medium.
4. Study of growth of E. coli by a spectrophotometer.
5. Study of microbiological quality of milk by MBRT test.
6. Preparation of synthetic medium for yeast and mould and inoculation with standard strains of yeasts and moulds.
7. Microbiological analysis of typical processed food and unprocessed food.
8. Dilution and Plating by spread -plate and pour -plate techniques.
9. Isolation of pure culture.
10. Test for adulteration in different food samples.
11. Evaluation of microbiological quality of Water and MPN test of coliforms

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Code No.: FT 109: COMPREHENSIVE VIVA (Virtual Credits) (Core)

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

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FOOD TECHNOLOGY
M. SC. SEMESTER – II

Code No.: FT 201: FOOD QUALITY CONTROL, LAWS AND MANAGEMENT (Core)

Objective: To develop knowledge regarding food quality control and related laws to manage in our food protects.

Learning Outcome: This course aims to impart the knowledge of food safety issues, surveillance and monitoring techniques, Food Labeling as well as sanitation and food allergy. To know the principles of Food Safety and Quality. To apply preventive measures and control methods to minimize the hazards in foods. To know the requirements of FSSAI for different food items.

To learn the principles of HACCP and to develop procedures and approaches to identify food safety hazards in food processing.

UNIT-I

Food safety and hygiene: General introduction

Food safety concept- Importance of food safety in food processing. Food hygiene and its practices (GMP/GHP, GAP, GLP). Hygiene verification in food industry, C lean In Place (CIP) - Different sanitizers and detergents- Sanitation and hygiene in quality assurance in different food industries (Fruits and vegetables, M e at , M ilk , Cereal Based) cleaning and sanitation (ETP, WTP, Pest control) prevention and control.

UNIT-II

Concept of quality: Quality attributes- physical, chemical, nutritional, microbial and sensory, evaluation. Quality measurement techniques, process design and control and product design and control, TQM, IPR and Patent.

UNIT-III

Food laws and regulations: Food safety act 2006, 2011 and 2022 basic differences, FSSAI. Various organizations dealing with inspection and traceability and authentication, Certifications (BIS, AGMARK, ISO, FPO, MFPO, PFA, MPO, etc.)

International food laws and regulations: US Federal laws, USDA, FDA, FAO, WHO, CODEX, HACCP with new guideline.

UNIT-IV

Concept of product development -product success and failure ,factors for success ,process of product development ,managing for products success innovation strategy - possibilities for innovation ,building up strategy ,product design, commercialization , launch, and evaluation product development program for RND in food industry .Cost of Quality, Supplier development, Microbial enumeration, production floor environment monitoring, quality of water (Process/Raw/reuse).

UNIT-V

Introduction to sensory evaluation, Selection of sensory panelists; Factors influencing sensory

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measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests Different tests for sensory evaluation-discrimination, descriptive, affective; Flavour profile and tests; Ranking tests; Methods of sensory evaluation of different food products. Selection and training of sensory panel; Detection and threshold tests; Ranking tests for taste, aroma colour and texture; Sensory evaluation of various food products using different scales, score cards and tests;

Text Books / References:

1. Early R. 1995. *Guide to Quality Management Systems for Food Industries*. Blackie Academic.
2. Krammer A & Twigg BA. 1973. *Quality Control in Food Industry*. Vol. I, II. AVI Pub
3. Chhabra TN & Suria RK. 2001. *Management Process and Perspectives*. Kitab Mahal.
4. Jhingan ML. 2005. *International Economics*. 5th Ed. Virnda Pub
5. Kotler P. 2000. *Marketing Management*. Prentice Hall.
6. Reddy SS, Ram PR, Sastry TVN & Bhavani ID. 2004. *Agricultural Economics*. Oxford & IBH.

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Code No.: FT 202: FOOD ENGINEERING (Core)

Objective: The course provides the knowledge about engineering principles to food materials and food processing operations, food machinery, packaging, ingredient manufacturing, instrumentation and control.

Learning Outcome: The students shall be able to understand the basics of mass and energy conservation, fundamentals of fluid flow dynamics as applied to food processing operations. They will learn planning, designing, improving, as well as maintaining the processing system in food industry.

UNIT-I

Mechanical operations in food processing: Introduction, scope and applications **Size Reduction process:** Principles, theories & laws, energy consideration, equipments & size reduction of solid and liquid food products **Mixing & forming:** Theory & applications, mixing indices, equipments for solid and liquid foods products.

UNIT-II

Process Heat Transfer - Thermal properties of foods such as specific heat and thermal conductivity Modes of heat transfer and overall heat transfer, Fourier's law. steady state and unsteady state heat transfer, heat exchange equipment. Rheology of foods: Newtonian fluids and Non Newtonian fluids.

UNIT-III**Unit operation in Food engineering**

Food dehydration: Mechanism of drying, moisture & drying rate curves, constant and falling rate periods, dehydration equipment & freeze drying.

Evaporation: Properties of liquid, heat & mass balance, single & multiple effect evaporation, steam economy, heat recovery, efficiency, equipment & systems.

UNIT-IV

Chilling, refrigeration & freezing: Introduction, types of freezers, pre-cooling & cold storage, Shelf life extension requirements, theories, characteristic curve, cooling rate calculations, chilling & freezing equipment, cryogenics, freeze drying, properties of frozen foods.

UNIT-V**Separation processes:**

Centrifugation: General principles, instrument & types of centrifuges, preparatory & analytical centrifugation & applications

Chromatographic Techniques: General introduction to principles, partition & adsorption chromatography-paper, thin layer, gas & liquid, ion exchange & affinity chromatography gel filtration, HPLC and application in food industry

Membrane filtration technology: Principles of other food processing such as-RO, UF, Dialysis, osmosis, micro-filtration, and nano-filtration -outlines

Text Books / References:

1. Heat Transfer: D.Q. Kern, MGH.
2. R.K.Rajput:2007. Engineering Thermodynamics, 3rd Ed. Laxmi Publications (P) Ltd.,
3. Bangalore. P.K. Nag.2005. Engineering Thermodynamics, 3rd Ed. Tata-McGraw-Hill
4. Basics of Food Engineering, Romeo Toledo

Code No.: FT 203: FOOD PACKAGING (Core)

Objective: The course aims to develop the student's knowledge in various types of packaging food and packaging materials.

Learning Outcome: The students shall gain knowledge on the different types of materials and media used for packaging foods, hazards associated with packaging materials, laws, regulation and the monitoring agencies involved in food safety. They will understand the material Cost reduction strategies and Materials substitution like Bio-plastic, recycled, renewable materials, high- performance barrier materials, and holographic foil are some of the few trends influencing the food packaging landscape

UNIT-I

Introduction to Food Packaging: Packaging terminology- definition, types of packaging. Functions of food packaging, characteristics of food stuff that influences packaging selection.

UNIT-II

Packaging material and their properties: Glass, paper and paper board, corrugated fiber board (CFB), Metal containers -Tin Plate ad Aluminum, composite containers, collapsible tubes, plastic films, laminations, metalized films, Co-extruded films.

UNIT-III

Packaging systems and methods: vacuum packaging, controlled atmospheric packaging, modified atmospheric packaging, aseptic packaging, retort processing, microwave packaging, active packaging, intelligent packaging, edible packaging, shrink and stretch packaging.

UNIT-IV

Packaging of fresh and processed foods: Packaging of fruits and vegetables, fats and Oils, spices, meat, Poultry and sea foods, dairy Products, bakery, beverages, dehydrated and frozen foods.

Liquid and powder filling machines - like aseptic system, form and fill (volumetric and gravimetric), bottling machines. For in Fill Seal (FFS) and multilayer aseptic packaging machines.

UNIT-V

Packaging Laws, Regulations, Evaluation and Quality control- shelf life testing, corrosion, tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation, barrier properties of packaging materials- Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement , prediction of shelf life of foods, selection and design of packaging material for different foods.

Text Books and Reference materials

- 1.NIIR. (2003). Food Packaging Technology Handbook, National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
- 2.Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press,
- 3.Han, J.H. (Ed.) 2005 Innovations in Food Packaging, Elsevier Academic Press,
- 4.Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) 2003 Food Packaging Technology,

Code No.: FT 204: NUTRACEUTICALS AND FUNCTIONAL FOODS

(Discipline Specific Elective)

Objective: To understand the importance of various nutrients and effects of imbalance in human health.

Learning Outcome: Student shall be able to understand the role of various nutrients, their utilization, deficiency diseases and metabolic disorders. Study about probiotic products and work on functional foods

UNIT-I

Nutraceuticals and functional Foods: Definition, concept, history and market; Evolution of nutraceuticals and functional foods market; Classification of nutraceuticals and functional foods; Significance and relevance of nutraceuticals and functional foods in the management of diseases and disorders.

UNIT-II

Natural occurrence of certain phytochemicals- Antioxidants and flavonoids: omega - 3 fatty acids, carotenoids, dietary fiber, phytoestrogens; glucosinates; organosulphur compounds; Dosage for effective control of disease or health benefit with adequate safety; studies with animals and humans; acute and chronic studies; Regulatory issues.

UNIT-III

Probiotics and symbiotics- Probiotics: Definition, types and relevance; Usefulness in gastro intestinal health and other health benefits; development of probiotics products; recent advances in probiotics; Challenges and regulatory issues related to probiotic products.

UNIT-IV

Prebiotics: Definition, chemistry, sources, metabolism, effect of processing. Prebiotic in foods; types of prebiotics and their effects on gut microbes; health benefits of prebiotics; recent development in prebiotics.

UNIT-V

Functional foods: Definition, development of functional foods, use of bioactive compounds in appropriate form with protective substances and activators; Effect of environmental condition and food matrix; Effects of processing conditions and storage; Research frontiers in functional foods, Nutrigenomics- concept of personalized medicine and application in food industry.

Text Books And Reference Materials:

1. Wildman, R.E.C. (2007) Handbook of Nutraceuticals and Functional Foods, second edition. CRC Press
2. Gibson GR & William CM. Functional Foods - Concept to Product. 2000.
3. Goldberg I. Functional Foods: Designer Foods, Pharma Foods. 2004.
4. Brigelius-Flohe, J & Joost HG. Nutritional Genomics: Impact on Health and Disease. Wiley VCH. 2006.
5. Cupp J & Tracy TS. Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press. 2003.

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Code No. : FT 205: FRUITS AND VEGETABLE TECHNOLOGY (Discipline Specific Elective)

Objective: To develop knowledge regarding biochemistry and physiology of fruits and vegetables and their role in pre- and post-harvest changes in product quality.

Learning Outcome: This course aims in providing knowledge about the fruit and vegetable structure, post-harvest physiology and its spoilage. The student shall understand biological, chemical and physical properties of fruits and vegetables and the technologies involved in the processing, preservation and value-addition of fruit and vegetable products.

UNIT-I

Introduction, definition, role, importance and status of post harvest technology.

Fruits and vegetables: Morphology of fruits and vegetables, maturity indices and methods of maturity determinations. Post-harvest physiological and biochemical changes in fruits and vegetables, ripening of climacteric and non climacteric fruits; regulations, methods.

UNIT-II

Post harvest disorders- Factors affecting post harvest changes, handling and packaging of fruits and vegetables, chilling injury & disease, storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber, commodity pre treatments - chemicals, wax coating, VHT and irradiation.

UNIT-III

Canning: Introduction, Canning of fruits and vegetables, its process, spoilage in canned foods. Changes during canning of fruits of vegetables and problems related to storage of canned products.

Pickles and chutney: Preparation of various pickles, sauces and chutneys, problems related to shelf life of pickles and chutneys, quality control.

UNIT-IV

Vinegar: Method of preparation and quality control

Tea, Coffee and Cocoa: Production and manufacturing.

Pectin: Raw material processes and uses of pectin, products based on pectin, manufacturing and quality control.

UNIT-V

Fruits and Vegetables: Preparation of juice, syrup, squashes, jam, jellies, marmalades, cordials and nectars, fortification and soft drinks.

Tomato products: Preparation of various tomato products and quality control.

References:

1. Bose, T.K. Ed. 1985. Fruits of India: Tropical and Sub-tropical. Naya Prokash, Calcutta.
2. Dauthy, M.E. 1997. Fruit and Vegetable Processing. International Book Distributing Co. Lucknow, India.
3. Hamson, L.P. 1975. Commercial Processing of Vegetables. Noyes Data Corporation, New Jersey.
4. Lai, G., Siddappa, G. and Tondon G.L. 1986. Preservation of Fruits and Vegetables, Indian Council of Agril. Research, New Delhi.
5. Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Fruit Science and Technology: Production, Composition and Processing. Marcel Dekker, New York.
6. Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Vegetable Science and Technology. Production,

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Code No.: FT 206: MEAT, FISH AND POULTRY PRODUCTS

(Discipline Specific Elective)

Objective: This course shall educate students about the significance and necessity of organized animal products sector, humane slaughtering of animals and poultry and value addition of meat, poultry, egg and fish.

Learning Outcome: Students shall be well versed of all aspects of meat, poultry, egg and fish industry, processing, preservation and quality control composition, pre and post slaughtering process for all products. Fish and its preservation methods, Quality parameters of raw materials and finished goods,

UNIT-I

Classification of Edible fish; Commercial handling, storage and transport of raw fish; Average composition of fish; Freshness criteria and quality assessment of fish; Spoilage of Fish; Methods of Preservation of fish: Canning, Freezing, Drying, Salting, Smoking and Curing. Fish products- Fish meal and oil and other important by products

UNIT-II

Meat: Introduction, slaughtering methods, components of carcass viz., Muscle, postmortem glycolysis, conversion of muscle to meat, pre and post slaughter factors affecting the quality of meat, PSE and DFD condition. Preservation of meat and meat products

UNIT-III

Poultry: Pre slaughter care, Ante Mortem examination Slaughter, Dressing and Post mortem Composition of chicken Muscle. Pre and Post Slaughter factors affecting Poultry Meat quality; Preservation of poultry Meat; Chilling and Freezing of Poultry Meat; Packaging and Grading; Preparation of products; Cured, Smoked; Canned Barbecue and Curried Poultry

UNIT-IV

Eggs: Structure Composition and Nutritive Value of Value of Egg. Egg Proteins and Functional Properties of egg, Factors affecting Egg quality and its Measurements, Industrial use of Egg, Collection. Grading. Cleaning. Washing Packaging and Spoilage of Egg and products preparation

UNIT-V

Raw Material: Quality Parameters and Evaluation Procedures

Finished Product Quality; Appearance, Color Texture, Viscosity, Consistency; Flavor Defects; Bacterial Contamination and Foreign Matter

References:

1. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
2. Meat; Cole OJA & Lawrie RA; 1975, AVI Pub.
3. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
4. Developments in Meat Science - I & II, Lawrie R; Applied Science Pub. Ltd.
5. Egg Science & Technology; Stadelman WJ & Cotterill OJ; 1973, AVI Pub.
6. Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.

Code No.: FT 207: SKILL DEVELOPMENT IN FOOD PRODUCT FORMULATION
/ASSIGNMENTS (Skill Development Course)

Every student will be imparted skills in development of new products and will be evaluated by the concerned teacher/Assignments/MOOC courses etc./Common course offered by the University Every student shall deliver at least one seminar on topic of the curriculum/ advances in food technology which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be

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**Code No.: FT 208: LABORATORY-II (LABORATORY SKILL DEVELOPMENT/
FIELD WORK) (Core)**

Objective: To understand the effect of various preservation techniques on the quality and safety of food products. To evaluate a processing procedure used to preserve a food product, study of effect of various types of packaging materials, impact of packaging materials in different types of food.

Learning Outcome: The students will be able to understand and utilize different food preservation techniques. Sampling techniques and preparation of test samples, Estimation of Water activity of food sample, Physical and Chemical evaluation of thermally processed food (Canned or Bottled), Pickling and curing of foods. Dehydration of foods and preparation of fruit juice concentrates and powder, physicochemical analysis of dehydrated food sample.

The students will be able to utilize different type of packaging materials, Moisture content in different type of packaging materials. To perform Test for formal shock resistance in glass bottles etc.

(A)

1. Canning of fruits and vegetables.
2. Dehydration of fruits and vegetables.
3. Preparation of tomato juice.
4. Preparation of tomato puree.
5. Preparation of tomato paste.
6. Preparation of various types of pickles.
7. Preparation of tomato ketchup
8. Preparation of tomato mock tail.
9. Preparation of tomato soup.
10. Preparation of tomato chutney.
11. Preparation of jackfruit pickles.
12. Preparation of jams
13. Preparation of lime squashes.
14. Preparation of jellies.
15. Preparation of jam marmalades.
16. Pectin determination
17. Determination of chemical preservatives in fruits and vegetables.
18. Blanching of fruits and vegetables for quality estimation.

(B)

1. Testing of different types of packaging materials.
2. Determine moisture content in give Q package samples.
3. Test for modified starch in different package materials.
4. Test for water absorbency in corrugated fiber board box.
5. Test for types of adhesive used in CFB.
6. Development of new food products and formulations.
7. To perform flap bend test in CFB.
8. Test for formal shock resistance in glass bottles.
9. Graphical representation of moisture contents in different food products.
10. Determination of shelf lives

Code No.: FT 209: COMPREHENSIVE VIVA (Virtual Credits) (Core)

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

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SUBJECT-FOOD TECHNOLOGY
M. SC. SEMESTER- III

Code No.: FT 301: FOOD BIOTECHNOLOGY (Core)

Objective: Imparting knowledge about principles of genetic engineering, use of biotechnology in the production of modified foods, enzymes, vitamins and proteins.

Learning Outcome: Student will acquire knowledge about genetic improvement of microorganisms for production of metabolites which can be used in field of food technology.

UNIT-I

Prospectus of biotechnology- Definition, scope and applications. Application of biotechnology in Food, Recombinant DNA Technology and its application.

UNIT-II

Traditional applications of food biotechnology - Fermented foods: eg dairy products, oriental fermentation, alcoholic beverages, and food ingredients. Health benefits of fermented foods. Types of fermented foods and importance of food fermentation in food preservation and nutritional enhancement.

UNIT-III

Starter cultures - types, designing and development, micro encapsulation and packaging, scopes and challenge; Development and formulation of novel products such as probiotic foods.

Nutrogeonomics - concept, working, significance and relevance. Biosensors and novel tools and their application in food science.

UNIT-IV

Genetically modified foods - concept, types and application, Ethical issues concerning GM foods, testing for GMOs; current guidelines for the production of GMOs; risk assessment and risk management, IPR, GMO Act-2004, Application of biotech in GM Food production

UNIT-V

Enzyme technology- Production of enzymes- Amylase, Protease, Lipase, Lactase and Pectinase Use of enzymes in food and beverage industry, e.g., Cheese, Fruit, Juice, Wine, Meat tenderizing and Dairy products.

Text books and reference materials

1. Lopez, G.F.G. and Canovas, G.V.B. "Food Science and Food Biotechnology" CRC Press, Florida, USA.2003.
2. Joshi, V.K., and Pandey, A. Biotechnology: Food Fermentation. Vols. I, II. Education Puhl. 2002.
3. Bains, W. Biotechnology from A to Z. Oxford Univ. Press. 2009.
5. Lee, B.H. Fundamentals of Food Biotechnology. VCH. 2006

Code No.: FT 302: FERMENTATION TECHNOLOGY (Core)

Objective: Acquaintance with importance of food fermentation and its application in food sector.

Learning Outcome: Student shall be capable to understand working principle underlying fermentation and to optimize the parameters for fermentation. Different processing or equipment's for fermentation.

UNIT-I

Fermentation, types of fermentation, Fermentation Kinetics. Bio-chemical pathways of metabolic reactions for utilization of carbon sources and formation of different metabolites by micro organisms; Strain Development - general techniques of modifying the strains for increased production of industrial products. Use of chemicals, UV rays, genetic engineering to produce newer strains.

UNIT-II

Typical media, Media formulation: - Carbon Source, Nitrogen source, Minerals, Growth Factors, Buffers, Precursors and Inhibitors, O₂ requirement and antifoams.

UNIT-III

Fermentor design, Instrumentation and control, Types of fermenters (Shake flask, Batch/stir tank, Continuous, Bubble column, airlift and Tower fermenter), Types of fermentation processes, aeration and agitation (The oxygen requirement for industrial fermentation, Determination of K_L a values).

UNIT-IV

Downstream Processing: Various equipment for product recovery; micro-filters and Ultrafiltration systems for separation of cells and fermentation medium and for concentration of medium containing product; chromatographic systems of separation; extraction of product with solvent; evaporation and crystallization; centrifugation, different types of centrifuges; drying techniques; instrumentation and controls.

UNIT-V

Fermentative Production: a) Foods: Processes for preparing fermented products including Yogurt (curd) and other Traditional Indian Products like idli, dosa, dhokla, shrikhand, etc. Soya based products like soya sauce, natto, etc., Cocoa, Cheese etc.; Alcoholic Beverages based on fruit juices (wines), cereals (whisky, beer, vodka etc.), sugar cane (rum) etc. Process description, quality of raw materials, fermentation process controls etc.

b) Industrial chemicals: Fermentative Production of Organic acids like (Citric Acid, Lactic Acid), Amino Acids (Glutamic acid, Lysine), Antibiotics (Erythromycin, Penicillin), Polysaccharides (Dextran, Xanthan) etc.; steroids transformation; process descriptions and key controls for optimal production.

Text books and Reference material

1. Vogel, H.C. and C.L. Todaro, 2005 Fermentation and Biochemical Engineering Handbook: Principles, Process Design and Equipment, 2nd Edition, Standard Publishers.
2. El-Mansi, E.M.T, 2007, Fermentation Microbiology and Biotechnology 2nd Edition, CRC / Taylor & Francis.

Code No.: FT 303: DAIRY TECHNOLOGY (Core)

Objective: To impart knowledge about processing of milk and its products and legislation for the quality control of milk and milk products.

Learning Outcome: Students shall acquire knowledge about composition, processing, product development, organization and operations involved in milk processing unit. Impact knowledge about frozen milk products, fermented milk products and evaporated and dried milk products

UNIT-I

Composition and characteristic of milk, Collection, chilling, transportation, cream separation, standardization, pasteurization, sterilization, UHT, homogenization, packaging, storage and distribution of fluid milk and cleaning and sanitation of dairy equipment's.

UNIT-II

Technology of fermented milk products: Principles and practices of manufacture, packaging, storage and marketing of Dahi, yoghurt, Shrikhand etc.

Butter: Manufacture, packaging, storage and marketing of butter; butter defects and their control.

UNIT-III

Technology of frozen milk products: Classification, manufacture, packaging, storage and marketing of ice cream, ices, sherbets etc. defects of frozen products and their control.

Technology of indigenous milk products: Principles and practices of manufacture, packaging, storage and marketing of ghee, khoa, Paneer, chhena and milk based foods.

UNIT-IV

Technology of evaporated and dried milk: Manufacture of evaporated milks and milk powders, Sweetened and non-Sweetened condensed milk, SMP, WMP, Packaging storage defects and their control

UNIT-V

Cheese: Manufacture of hard, semi hard, soft and processed cheeses, Storage, grading and marketing of cheese, Cheese defects and their control.

Technology of Dairy by- products: Utilization of skim milk, buttermilk and whey for the manufacture of casein, lactose etc.

References:

1. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.
2. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
3. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
4. Developments in Dairy Chemistry - Vol I & 2; Fox PF; Applied Science Pub Ltd.
5. Outlines of Dairy Chemistry, De S; Oxford.

Code No.: FT 304: FOOD ADDITIVES, SPICE AND FLAVOR TECHNOLOGY

(Discipline Specific Course)

Objective: To impart knowledge about additives in food processing, types of food additives, chemical nature, their analysis and risk and benefits.

Learning Outcome: Student shall gain a thorough knowledge of natural and synthetic food additives and their properties in food. They will understand different flavor components arise from the normal biosynthetic processes of animal and plant metabolism. The knowledge of flavorings and other food additives is essential to achieve either flavor intensification or suppression in different food products.

UNIT-I

Additives in food processing and preservation, their functions, types and safety

Need for food additives in food industry, various additives such as preservatives, antioxidants, emulsifiers, sequesterants, and humectants, stabilizers with respect to their functioning and role and mechanism.

UNIT-II

Food Flavor basics: Olfactory perception of flavor and taste, relationship of taste-sweet, bitter, salt, sour, chemicals causing pungency, astringency, cooling effects-properties. Classification of flavors-natural, nature identical and synthetic

UNIT-III

Flavor production during processing-enzymatic development, effect of roasting (e.g. coffee), frying on flavor developments, staling of flavors

Flavor encapsulation-need, methods and application in food industry

UNIT-IV

Major spices and Minor spices-Oleoresins and essential oils; method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavor identical; quality control; fumigation and irradiation of spices.

UNIT-V

Food Additives and toxicants added or formed during Food Processing: Safety of food additives; toxicological evaluation of food additives and adulterants, food processing generated toxicants: nitroso-compounds, heterocyclic amines. Types of adulteration in food and methods of detection Techniques for flavor extraction-supercritical fluid extraction-continuous and semi-continuous Methods, effects of types of solvents used, and its role in food industry.

Suggested Readings

- 1.Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
- 2.Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.
- 3.Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York.
- 4.Furia, T.E. 1980, Handbook of food additives, Vol I and Vol II.

Code No.: FT 305: PROCESSING OF CEREALS, LEGUMES, OILSEED AND SUGAR CROPS (Discipline Specific Elective)

Objective: To create knowledge about the processing and quality evaluation of cereal grains.

Learning Outcome: Student will acquire the understanding of the technologies used for processing of cereal grains. Understands structure of wheat, Rice and Corn, Oats, Barley. Baking techniques for cereal's based products, Processing of legumes, oilseeds and sugar crops, Oil extraction process and its bi-products

UNIT-I

Wheat: Types, structure & composition and physicochemical characteristics; wheat milling - products and byproducts; factors affecting quality parameters; physical, chemical and rheological tests on wheat flour; additives used in bakery products; flour improvers and bleaching agents; manufacture of wheat based products.

UNIT-II

Rice: Classification, structure & composition, physicochemical characteristics; cooking quality; rice milling technology; by-products of rice milling and their utilization; Rice bran stabilization, oil extraction and refining, parboiling methods of rice criteria of quality of rice: aging of rice - quality changes; processed products based on rice.

UNIT-III

Corn: Types and nutritive value; dry and wet milling, processing of corn in breakfast cereals, snacks, tortilla etc., production of glucose syrups, dextrose, high fructose corn syrups, modified Corn starches.

Barley: composition, milling, malting of barley, changes during malting, uses of malt.
Oat: composition, processing of oat, byproducts of oatmeal milling.

UNIT-IV

Legumes and oilseeds: composition, anti-nutritional factors, processing and storage; processing for production of edible oil, meal, flour, protein concentrates and isolates; development of low-cost protein foods. Oil extraction process - mechanism, oil refining, utilization of bi-products of oil milling.

UNIT-V

Processing of sugar crops and tubers- sugar cane, sugar beet crops and their difference; Sugar production and manufacturing, types and grades of sugars, products of sugars (alcohol, beer, wine and sugar syrups).

Text books and Reference materials:

1. Chakrabarty, M.M. (2003). Chemistry and Technology of Oils and Fats, Prentice Hall
- Dendy, D.A.V., & Dobraszczyk, B.J. (2001). Cereal and Cereal Products. Aspen.
3. Hamilton, R.J. & Bhati, A. (1980). Fats and Oils - Chemistry and Technology. App. Sci. Puhl.
4. Hosney, R.S. (1994). Principles of Cereal Science and Technology. 2nd Ed. AACC.
5. Kay, D.E. (1979). Food Legumes. Tropical Products Institute.
6. Kent, N.L. (1983). Technology of Cereals. 4th Ed. Pergamon Press.

Code No.: FT 306: PRODUCT DEVELOPMENT FROM FOOD INDUSTRY REFUSE
(Discipline Specific Course)

Objective: To create knowledge about the processing and quality evaluation of cereal grains.

Learning Outcome: Student will acquire the understanding of the technologies used for processing of cereal grains, Essential oils extraction and edible films formation. Knowledge about extraction of oil & wax from rice bran

UNIT-I

Fruits & Vegetables: Production of pectin, ethanol, natural gas, citric acid, activated charcoal, fiber extract from applepomace, vitamins.

Production of citrus oil from peels of citrus fruits, Manufacture of candied peel and pectin from albedo of citrus fruits

Production of single cell protein by the use of potato wastes, Recovery of Protein from potato starch plant waste.

UNIT-II

Fish, Meat, Poultry: Production of fish meal; Fish protein concentrate; Animal feed; Shell product;Glue from seafood processing waste.

Texturised fish protein concentrate (marine beet); Utilization of organs and glands of animal as human food.

Production of human food from animal blood and blood protein; Marketable products like chitin, chitosan, fertilizer, nutritional enhancer animal feed from shells.

UNIT-III

Cereals: Feed for livestock from wheat and com bran and germ.

Extraction of oil & wax from rice bran, Puffed cereals from broken rice; Starch, modified starch and industrial alcohol from non usable cereals; Silica from rice husk; Extraction of plolamin (Zein & katirin); Protein from sorghum; Beer spent graining.

UNIT-IV

Dairy industry: Fermentation products from whey. Condensed & dried products from whey; Production of lactose and protein from whey

UNIT-V

Tea, Coffee and Spices

Utilization of tea, coffee and cocoa waste as feed for live stock & poultry, Essential oils extraction and edible films formation from spices as futuristic packaging film.

Books/ References Reading:

1. Joshi, V.K. and Ashok Pandey, 1999, Biotechnology: Food Fermentation, Microbiology, Biochemistry and Technology, Vol. I & vol. II Educational Publisher.
2. Pepler, H.J. and D. Perlman, 2004, Microbial Technology: Fermentation Technology, 2nd Edition, Vol. II Academic Press / Elsevier.

**Code No.: FT 307: PERSONALITY DEVELOPMENT/ SKILL DEVELOPMENT IN
FOOD PRODUCT FORMULATION (Skill Development Course)**

Every student will be imparted skills in development of new products and will be evaluated by the concerned teacher/every student shall deliver at least one seminar on topic of the curriculum/ advances in food technology which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be

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Code No.: FT 308: LABORATORY-III (Laboratory Skill Development/Minor Project)
(Core)

Objective: Imparting knowledge about the general methods of quality evaluation, testing and processing cereals and preparation of different type of cereal based products. General methods of quality evaluation, testing and processing fresh milk and preparation of different type milk products

Learning Outcome: The students shall be able to assess the quality of wheat, rice and different type cereals. Preparation of different type of cereal based products and students shall be able to assess the quality of milk and milk products and to develop various milk products. Preparation of different milk products and fat estimation and analysis of fat for milk and milk products

(A) Food Product

1. Detection of adulteration in different types of foods.
2. Determination of moisture content in food product by hot air oven drying method.
3. Determination of yeast quality by its dough rising capacity.
4. Determination of thousand kernel weight of different grains sample.
5. Determination of cooking time in different rice sample.
6. Determination of elongation ratio in different rice sample.
7. Determination of Gluten content in different flour sample.
8. Determination of ash content in flour samples.
9. Determination of Acid insoluble Ash
10. Estimation of fat acidity
11. Determination of Alcoholic acidity
12. Preparation of Bread.
13. Preparation of Biscuits.
14. Preparation of Pizza base.
15. Preparation of Dinner roll
16. Preparation of Cookies.
17. Preparation of Muffins
18. Preparation of Nankhatai.
19. Preparation of Cakes.
20. Preparation of fermented products.
21. Quality evaluation of different biscuit sample- physical and chemical analysis.
22. To determine the foaming capacity of given flour sample.
23. Determination of protein content of flour by Micro Kheldahl Method
24. Estimation of curcumin in turmeric.
25. Determination of capsaicin in content in chilli.

(B) Dairy Product

1. Platform Test Of Milk
2. Adulteration tests.
3. Fat estimation in milk by Garber's Methods.
4. Preparation of flavored milk.
5. Preparation of curd.
6. Preparation of lassi.

7. Preparation of shrikhand.
8. Preparation of ghee.
9. Preparation of khoa.
10. Preparation of chhena and paneer.
11. Determination of total solids in milk, skim milk, butter milk and whey by drying method.
12. Viscosity determination of milk by pipette method.
13. Test for fats: Bromo-thymol blue test.
14. Alcohol test for determining coagulability of milk.
15. Determination of salt content in butter.
16. Casein estimation in milk sample.

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Code No.: FT 309: COMPREHENSIVE VIVA

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

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**SUBJECT-FOOD TECHNOLOGY
M. SC. SEMESTER-IV**

Code No.: FT 401: PROJECT WORK/ONSITE TRAINING (Core)

- 1- Project Work and Presentation**
- 2- Project Report Assessment and Viva voce**

Objective: Every student will be required to undertake a research project (minimum tenure three months) based on any of the areas of food technology, proteomics, genomics, animal, plant, microbial technology, and bioinformatics or preferably related to major food technology research. The project report will be submitted in the form of dissertation duly certified by the supervisor of the dissertation by any research organization, industry, national institutes and/or Universities in India, by seeking the placement. The student then shall have to appear for the viva voce examination.

Learning Outcome: Provide students with theoretical knowledge and practical abilities required to work in the food industry, research centers, and food-related national and international organizations. Contribute to a healthier population by imparting education and understanding of nutritional science. Develop confident and competent individuals, able to adapt to the changing fabric of society through their professional expertise and personal traits.

Guidelines for Dissertations Report Layout:

The report should contain the following components:

Title or Cover Page: The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

Acknowledgements (optional): Acknowledgment to any advisory or financial assistance received in the course of work may be given.

Abstract: It should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to objectives. The abstract have to be concise summary of the scope and results of the project.

Table of Contents: Titles and subtitles are to correspond exactly with those in the text.

Introduction: A brief introduction to the problem that is central to the project and it should aim to catch the imagination of the reader, so excessive details should be avoided.

Materials and Methods: This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Results and Discussion: Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is

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readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note during writing, all figures & tables should as far as possible be next to the associated text, in same orientation as main text, numbered, & given appropriate titles.

Conclusion: This is the final section in which outcome of the work is mentioned briefly.

Future prospects (if applicable)

References / Bibliography: This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname.

Appendices: This contains material which is of interest to reader but not an integral part of the thesis and may be useful to document for future reference.

Assessment and Viva voce of the Project File:

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project

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**Code No.: FT 402 INDUSTRIAL VISIT/FOOD INDUSTRY/DAIRY INDUSTRY
ETC.VISIT MINOR REPORT WRITING (Core)**

Objective: To provide students exposure to industrial set-up and to enable students observe, first hand, work flow and processes in food industries and associated enterprises

Learning Outcome: The student will be able to appreciate different processing and production technologies in various industrial settings. The student will be exposed to the diverse setting in food industries

Review of the state of research in a particular problem involving food, and development of hypothesis, Planning and conducting the experiment, Periodic analysis of data and preparation of report, Final preparation of project report as dissertation to be submitted in partial fulfillment of M.Sc. Programme.

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Code No.: FT 403: REVIEW WRITING (Core)

Objective: A literature review is a survey of everything that has been written about a particular topic, theory, or research question. It may provide the background for larger work, or it may stand on its own. Much more than a simple list of sources, an effective literature review analyzes and synthesizes information about key themes or issues.

Learning Outcome: To discover what has been written about a topic already, to determine what each source contributes to the topic, to understand the relationship between the various contributions, identify and (if possible) resolve contradictions, and determine gaps or unanswered questions.

What is involved in writing a literature review?

1. Research – to discover what has been written about the topic
2. Critical Appraisal – to evaluate the literature, determine the relationship between the sources and ascertain what has been done already and what still needs to be done
3. Writing – to explain what you have found

Steps to writing an effective literature review:

Gathering sources focus your topic: A literature review aims to cover all of the research on a given topic. If the topic is too large, there will be too much material to cover it adequately.

Read with a purpose: Although you will need to briefly summarize sources, a good literature review requires that you isolate key themes or issues related to your own research interests.

Evaluating sources: For each book or article consider:

Credentials: Is the author an expert?

Argument/Evidence: Does the evidence support the conclusion? Is the argument or evidence complete?

When comparing sources, consider:

Conclusions: Does all research arrive at the same conclusion or are there differing opinions? What evidence or reasoning are the differences based on?

Gaps or omissions: What questions are raised by the literature?

Writing a Literature Review-:

Introduction: The introduction should identify your topic, some discussion of the significance of that topic and a thesis statement that outlines what conclusion you will draw from your analysis and synthesis of the literature. If your literature review is part of a larger work, explain the importance of the review to your research question.

Body: In the body, discuss and assess the research according to specific organizational principles (see examples below), rather than addressing each source separately. Most, if not all, paragraphs should discuss more than one source. Avoid addressing your sources alphabetically as this does not assist in developing the themes or key issues central to your review.

Organizing Principles

Principle	When to Use	Example
Theme	-When explaining key themes or issues relevant to the topic -This is the most common way to organize literature reviews.	A literature review of 31 relevant articles published between January 1999 and March 2004 identified 12 categories of neighborhood characteristics relevant to maternal and child health: income/wealth, employment, family structure, population composition, housing, mobility, education, occupation, social resources, violence and crime, deviant behavior and physical conditions. [Example adapted from Rajaratnama, J.K., Burke, J.G. & O'Campo, P. (2006). Maternal and child health and neighborhood context: The selection and construction of area-level variables. <i>Health and Place</i> , 12, 547-556.]
Methodology (also called a methodology review)	When discussing interdisciplinary approaches to a topic or when discussing a number of studies with a different approach.	In dentistry, fluorescent imaging been used for many applications revealing a variety of information about bonded restorations. This review evaluates the different methods used in this area with the intent of determining if standardized methodologies exist. [Example adapted from D'Alpino, P.H.P. et al (2006).Use of fluorescent compounds in assessing bonded resin-based restorations: A literature review <i>Journal of Dentistry</i> , 34 623-634.
Chronology	When historical changes are central to explaining the topic.	A literature review is presented on the evolution of water pollution management and its impact on land pollution from 1900 to 2000 within a hypothesis of whether we could have done more, sooner. Stream pollution science in the context of the fundamental sanitary engineering concepts of reasonable use and assimilative capacity is examined in light of evolving regulatory frameworks from the early 1900s, when regulation and standards were mostly lacking, to the zero discharge goals and comprehensive federal command/control regulations of the late 20th century. [Example adapted from Shrifin, N.S. (2005). Pollution Management in the Twentieth Century. <i>Journal of Environmental Engineering</i> , 131, 676-691.]

Conclusion: The conclusion should provide a summary of YOUR findings from the literature review. Explain what your analysis of the material leads you to conclude about the overall state of the literature, what it provides and where it is lacking. You can also provide suggestions for future research or explain how your future research will fill the gaps in the existing body of work on that topic.

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Code No.: FT 404: SEMINAR/GROUP DISCUSSION (Core)

Objective: Objectives In this paper, you will learn how to: select relevant information, organise material, choose a speaking style appropriate to the situation, use appreciative language, express yourself clearly and audibly, use appropriate non-verbal communication when speaking, use audiovisual aids to support the presentation, deliver an effective presentation, contribute to a group presentation, deal with difficult situations, evaluate your own performance.

Learning Outcome: At the end of the Seminar, go back to these objectives and self-assess your capabilities.

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Code No. : FT 405: POSTER PRESENTATION (Core)

Objective: Is my abstract effective? Why should anyone care? What am I adding to current knowledge? Do I need to explain methods? Have I told them what I found and recommend?

Learning Outcome: A poster can be better than giving a talk, more efficient because: you totally bomb at giving talks, can be viewed while you nap, can hang in the department for years, can reach folks not in your field of research:

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Code No.: FT 406: COMPREHENSIVE VIVA (Virtual Credits) (Core)

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the program by a board of four examiners.

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