

DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY



CIRCULAR NO.SU/Sci.& Tech./B.Voc./33/2018

It is hereby inform to all concerned that, on the recommendation of the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following curriculum under B.Voc. programme viz: Certificate, Diploma, Advanced Diploma and B.Voc. Degree** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith:

1.	B.Voc. Industrial Automation,
2.	B.Voc. Automobile Technology,
3.	B.Voc. Farm Equipment and Machinery,
4.	B.Voc. I.T.Skills and Software Development,
5.	B.Voc. Architectural Planning and Interior Design,
6.	B.Voc. Dairy Products,
7.	B.Voc. Drill Technology,
8.	B.Voc. Plant Tissue Culture and Green House Technology,
9.	B.Voc. Renewable Energy Source,
10.	B.Voc. Computer Hardware & Networking Maintenance.
11.	B.Voc.Food Processing and Preservation.
12.	B.Voc. Sustainable Agriculture.
13.	B.Voc. Bioproducts technician

This is effective from the Academic Year 2018-2019 and onwards.

This curriculum are also available on the university website www.bamu.ac.in

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
Ref.No.
SU/B.Voc/2018/21709-22148
Date:- 12-12-2018

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Deputy Registrar,
Syllabus Section.

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Copy forwarded with compliments to :-

- 1] **The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.**
- 2] **The Director, University Network & Information Centre, UNIC,
with a request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.
- 2] The Section Officer, [BCS Unit] Examination Branch,
- 3] The Section officer, [Eligibility Unit], Dr.BAMU,A'bad.
- 4] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
- 5] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
- 6] The In-charge, [E-Suvidha Kendra], Rajarshi Shahu Maharaj
Pariksha Bhavan, Dr. Babasaheb Ambekar Marathwada University.
- 7] The Public Relation Officer, Dr.BAMU,A'bad.
- 8] The Record Keeper. Dr.BAMU,A'bad.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.



Curriculum of B.Voc.

Food Processing and Preservation

UNDER THE FACULTY OF SCIENCE & TECHNOLOGY.

[Effective from 2018-19 & onwards]

Curriculum for Bachelor of Vocational Education (B. Voc.) in Food Processing and Preservation

The Bachelor in Vocation program Food Processing and preservation is divided into six semester having 180 credits. Each semester will have courses based on General Education Components and Skill Development Components, out of which six subject will be dedicated for theory (each theory course will have inbuilt practical / tutorial/ skill development components) and Food Processing and preservation course will be devoted to Laboratory Work / Project / Industrial Training / In-plant Internship. This program offers following **General Education Components** which include communication skill, Basic language (Marathi and Hindi), Environment Science, Personality development, etc. whereas **Skill Development Components** includes Food chemistry, biochemistry, Microbiology and Biotechnology, human Nutrition, Processing Technology of Fruits & Vegetables, Cereals, Legumes, oil seeds, spices and condiments , Meat, fish and poultry, milk and milk products, Bakery and confectionary technology. Food analysis, food safety, Regulations and quality management, special implant training, seminar and project etc.

Preamble:

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad is offering a three year Bachelor Program in Vocational Education (B. Voc.) in Food Processing and preservation from Academic year 2018-19. The curriculum design of this program is undertaken in the following framework (Preamble).

1. Although there has been remarkable progress in all sectors of education in last couple of decades, the less regulated area of the education sector- vocational training-seems to have lost its significance/ importance. This has led to the widening gap between the supply and demand for skilled manpower across various food processing industries and R&D organizations. This shortage of skills has translated directly into unemployment among an increasing number of graduates who pass-out every year and are forced to bare- trained in order to become marketable. This program is designed to produce a skilled manpower so that wide variety of options in different sectors of Food Processing

would be available and it will improve the opportunities for the unemployed youths in the country in both the private and public sectors.

1. According to recent survey of FICCI (Federation of Indian Chambers of Commerce & Industry) on skill demand in food processing industries, it has been observed that a majority percentage of organizations are dissatisfied with the skills of the available trained manpower. For instance, 58% of the respondents were dissatisfied with technical skills and knowledge needed for the job. Also 72% showed discontent with employees' ability to use appropriate and modern tools, equipment, and technologies specific to their job roles. This programme aims to provide some solution for this problem and this would facilitate to improve:
 - a. Quality of training
 - b. High drop-out rates
 - c. Linkages with Universities and industry
 - d. Inadequacy of resources
2. This program is intended to offer practical, hands on training and skills needed to pursue an occupation. It will provide options to the students to select the courses of their choice which are directly aligned to land a job in a chosen profession or a skilled trade. The end result of this program is to enable an individual to at train self-employment.

Program Outcomes:

Vocational Education is education that prepares the students for specific job role in various sectors in food processing industries and Professional organization. It trains the students from a trade, technician or professional position in R & D organizations for specific job roles.

The program outcomes are the skills and knowledge which the students have at each exit level/at the time of graduation. These outcomes are generic and are common to all exit levels mentioned in the program structure.

- i. Students with vocational training can find work in several state and central government organizations, non-profit groups, and academic institutions and in private sectors as well.

- ii. This program prepares students for specific types of occupations and frequently for direct entry into the market.
- iii. After completion of this program students will have enough competences, to get benefit from market opportunities.
- iv. This program would enable students to update their knowledge and professional skills for entering the work force executing income generating activities or occupying better positions
- v. At each exit level of this program, students will be able to
 - a) Apply knowledge of general education subjects and skill development subjects to the conceptualization of food processing technologies.
 - b) Designing and formulation of new food products, on the basis of consumers demands, development of methodology/technologies of food processing, design that meet solutions needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
 - c) Conduct and undertake investigations of problems of including design of processing technology for various type food, food analysis, food quality and safety aspects and interpretation of data in order to provide valid conclusions.
 - d) Create, select and apply appropriate processing technology/techniques, resources, modern processing tools in order to improve the quality, safety and the shelf life fresh and process food.
 - e) Communicate effectively on minimal processing activity and value addition to the farmers/producers/grower at large, such as being able to comprehend and write effective reports, design documentation and make effective presentations.
 - f) Demonstrate understanding of the social, health, safety, legal and cultural issues and the consequent responsibilities relevant to Food processing.
 - g) Understand and commit to professional ethics and responsibilities and norms/regulation for manufacturing of process food and its effects on health.

- h) Understand the impact of food processing technologies solutions in a societal context and demonstrate technical know-how and understanding of food safety, quality for sustainable development.

Exit Options:

Bachelor of Vocation (B. Voc.) is launched under the scheme of University Grants Commission for skill development based on higher education leading to Bachelor of Vocation (B.Voc.) Degree with multiple exits as Diploma/Advanced Diploma under the National Skill Qualification Framework (NSQF). The B. Voc. programme incorporates specific job roles and their National Occupational Standards along with broad based general education.

1. B. Voc. Programme has been designed as per National Skill Qualification Framework emphasizing on skill based education.
2. LEVELS OF AWARD:

The certification levels shall lead to certificate/Diploma/Advanced Diploma/ B. Voc. Degree in Food processing and Preservation.

Award	Duration	Corresponding NSQF level
Certificate in Food Processing and Preservation	6 Month	4
Diploma in Food Processing and Preservation	1 Year	5
Advanced Diploma in Food Processing and Preservation	2 Year	6
B. VOC. Degree in Food Processing and Preservation	3 Year	7

The suggested credits for each of the years are as follows:

NSQF level	Skill component credits	General education credits	Normal calendar duration	Exit point /awards
6 Month	18	12	One Semester	Certification in Food Processing and Preservation
Year 1	36	24	Two Semesters	Diploma in Food Processing and Preservation
Year 2	36	24	Four Semesters	Advanced Diploma in Food Processing and Preservation
Year 3	36	24	Six Semesters	Degree in Food Processing and Preservation
Total	108	72		

Eligibility criteria for Admission:

1. A candidate will be eligible to join 1st semester of B. Voc. Food Processing and Preservation course, if he/she has passed 10+2 examination (Science Stream) or 10+2 vocational stream related to Food Production/Food Processing of recognized Board/university, or any other examination recognized as equivalent thereto.
2. The course of study of B.Voc. shall be divided in to six semesters and university examination will be held at the end of every semester in the months of December (for semester I, III & V) and May/June (for semester II, IV & VI) or as fixed by the University.
3. Semester examination will be open to regular candidates who have been on the rolls of a college affiliated to this University and meet the attendance and other requirements.

Admission, Registration and Promotion Process:

Admission will be done on the basis of Percent mark obtained by candidate in Twelfth science or Common entrance test conducted by college or admission criteria as decided by the authority for first semester.

The students will have to clear / qualify at least 50% of theory papers / courses from second semester and all papers / courses (inclusive of theory and practical) from first semester for getting promoted to second year. Similarly the students will have to clear / qualify at least 50% of theory papers / courses from fourth semester and all papers / courses (inclusive of theory and practical) from third semester for getting promoted to third year.

Dropout students will be allowed to register for second or third year as and when the concerned courses are offered by the College, however he/she should not exceed more than twice the duration of the course from the date of first registration at the Centre. Therefore, for obtaining B. Voc. degree a student will have to complete all semesters successfully within 6 years/12 semesters.

Vocational Educational Programme Implementation Committee (VEPIC):

The Vocational Educational Programme Implementation Committee (VEPIC) will consist of the Principal as a Chairman, course coordinator and two faculty of the concern course/specialization as members. The Committee will monitor the smooth functioning and implementation of the B.Voc. Programme in Food Processing and Preservation.

Choice Based Credit and Grading System (CBCS):

The choice based credit and grading system has been adopted. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. It gives greater freedom to students to determine their own pace of study.

- Students will have to earn 30 credits for the award of Six Month Certificate in Vocation in Food Processing and Preservation.
- Students will have to earn 60 credits for the award of one year Diploma in Vocation (D. Voc.) in Food Processing and Preservation.
- Students will have to earn 120 credits for the award of two year Advance Diploma in Vocation (Adv. D. Voc.) in Food Processing and Preservation.

- Students will have to earn 180 credits for the award of three year Bachelor Degree in Vocation (B. Voc.) in Food Processing and Preservation.

Credit-to-contact hour Mapping:

- One Credit would mean equivalent of 15 periods of 60 minutes each for theory lecture.
- For laboratory course/ workshops/internship/field work/project, the credit weightage for equivalent hours shall be 50% that for lectures.
- For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures.

Attendance:

Students must have 75 % of attendance in each course for appearing examination otherwise he / she will not be strictly allowed for appearing the examination of each course. However, students having 65 % attendance may request Head of the concerned Institution for the condonance of attendance on medical ground.

Evaluation Methods:-

The assessment will be based on Continuous Internal Assessment (CIA) and semester end examination (SEE).

There shall Continuous Internal Assessment for each theory paper. In each semester, 20% (i.e. 15) marks shall be for CIA and 80% (i.e. 60) marks for ESE. Marks obtained by the student in all heads viz. CIA and ESE shall be added while declaring the final result.

Continuous Internal Assessment (CIA):- The internal marks shall be assigned on the basis of tutorials/home assignment/seminar presentation and weekly tests/class test/ preliminary examination to be conducted by the concerned college. These marks shall be communicated to the University before commencement of semester end examination.

End Semester Examination (ESE):

- i. The end semester examination for each theory and practical paper shall be conducted by the University at the end of each semester.
- ii. Duration of theory examination shall be of three hours for a paper of 75 marks and two and half hour for a paper of 60/40marks. Practical examinations shall be of three hour duration for every semester end examinations respectively.
- iii. The respective college is advised to arrange maximum number of experiments from the list of experiments provided with the syllabus or experiments based on theory syllabus.
- iv. Assessment of laboratory courses and project will also have 50 % internal and 50 % semester end assessment. Semester end practical examination will be of 25 marks and 25 marks will be for internal examination. Student must perform at least eight experiments from each laboratory course. The semester end practical examination will be conducted at the end of each semester along with the theory examination.
- v. Students without certified journal shall not be allowed to appear for the practical examination.

Examination Scheme

- A student shall be evaluated for his/her academic performance in a course through class tests, tutorials, practical's, homework assignments, term papers, field work, seminars, quizzes, Test examinations, teachers assessments and the End-Semester Examination as applicable.
- At the end of the semester, there would be an End Semester Examination as per syllabus. For the examination of First Year for the academic year 2018-2019, the minimum percentage for passing for each course code, practical examination and ESE is 40 %, failing which he/she will get F grade for that course code. This rule will be progressively applicable for higher classes in next consecutive years.
- The project work shall be evaluated by midterm seminar(s), quality of work carried out, project report submission and the viva-voce examinations.
- The industrial/field training shall be evaluated through the quality of work carried out, the report submission and presentation(s).

Rule for combined passing:

- To pass the examination a candidate must obtain minimum 40% of Marks in each End Semester Examination & CIA taken together, however the candidate must obtain minimum 35% of Marks at the End Semester Examination.
- To pass a subject where there is no provision of class test, the candidate must obtain 40% of Marks in the End Semester Examination.
- If the candidate remains absent for CIA, his performance should be treated as "Zero" Marks.

Results Grievances / Redressal :-

Grievances / redressal committee will be constituted in the college to resolve all grievances relating to the evaluation. The committee shall consist of the Principal of the college, the concerned teacher of a particular course and senior faculty member. The decision of Grievances /redressal committee will have to be approved by Competent Authority.

Earning Credits:

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be measured by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded by the university at the respective exit point.

Grading System:

1. The grading reflects a student-own proficiency in the course. A ten point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the B. Voc. Program. Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I

Table I: Ten point grade and grade description

Marks Obtained (%)	Grade Point	Letter Grade	Description
90-100	9.00- 10	O	Outstanding
80-89	8.00-8.90	A ⁺⁺	Exceptional
70-79	7.00-7.90	A ⁺	Excellent
60-69	6.00-6.90	A	Very Good
55-59	5.50-5.90	B ⁺	Good
50-54	5.00-5.40	B	Fair
45-49	4.50-4.90	C ⁺⁺	Average (Above)
41-44	4.1-4.49	C	Average
40	4.0	P	Pass
< 40	0.0	F	Fail (Unsatisfactory)
	0.0	AB	Absent

1. Non-appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.
2. Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as “failed” in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations. There will be no revaluation or recounting under this system.
3. Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given at respective exit point.

Computation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average)

Grade in each subject / course will be calculated based on the summation of marks obtained in all modules.

The computation of SGPA and CGPA will be as below

1. Semester Grade Point Average (SGPA) is the weighted average points obtained by the students in a semester and will be computed as follows

Sum (Course Credits) X Number of Grade Points in concerned Course Gained by the Student

$$\text{SGPA} = \frac{\text{Sum (Course Credits) X Number of Grade Points in concerned Course Gained by the Student}}{\text{Sum (Course Credits)}}$$

The SGPA will be mentioned on the grade card at the end of every semester.

2. The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance of a student in all semester of the course and will be computed as under.

$$\text{CGPA} = \frac{\text{Sum (All six Semester SGPA)}}{\text{Total Number of Semester}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Grade Card

Results will be declared and the grade card (containing the grades obtained by the student along with SGPA) will be issued by the university after completion of every semester. The grade card will be consisting of following details.

- Title of the courses along with code opted by the student.
- Credits associated with the course.
- Grades and grade points secured by the student.
- Total credits earned by the student in a particular semester.
- Total credits earned by the students till that semester.
- SGPA of the student.
- CGPA of the student (at respective exit point).

Cumulative Grade Card

The grade card showing details grades secured by the student in each subject in all semesters along with overall CGPA will be issued by the University at respective exit point.

Paper Code Description:

The course offered by the university shall have an alphanumeric course code consisting of a string of six characters. The first three characters in a course code shall be capital letters identifying the responsible general component (BVG) and skill development components in Food Processing and Preservation (FPP) of the B. Voc. course. The next three numerical digits give the following information. The first digit specifies the first semester of first year of the UG course. Second and third digit specifies the serial number of the general and skill development component.

Course Structure of F.Y. B.Voc. (Food Processing and Preservation)

Semester-I				Mark		
Paper Code	Title	No. of Credits	Hrs. /week	Internal (CIA)	External (ESE)	Total
Skill Development Components						
FPP-101	General Biochemistry and Microbiology	3	3	15	60	75
FPP-102	Fundamentals of Food and Nutrition	3	3	15	60	75
FPP-103	Principles of food preservation	3	3	15	60	75
FPP-104	Lab-General Biochemistry and Microbiology	3	6	25	25	50
FPP-105	Lab-Fundamentals of Food and Nutrition	3	6	25	25	50
FPP-106	Lab- Principles of food Preservation	3	6	25	25	50
General Education Components						
FPP-107	Communicative English-I	3	3	10	40	50
FPP-108	Hindi	3	3	10	40	50
FPP-109	Lab- Communicative English-I	3	3	25	25	50
FPP-110	Lab-Hindi	3	3	25	25	50
Total		30	39	190	385	575
Semester-II				Mark		
Paper Code	Title	No. of credits	Hrs. /week	Internal (CIA)	External (ESE)	Total
Skill Development Components						
FPP-111	Food Biochemistry	3	3	15	60	75
FPP-112	Food Microbiology	3	3	15	60	75
FPP-113	Processing Technology of Fruits & Vegetables	3	3	15	60	75
FPP-114	Lab- Food Biochemistry	3	6	25	25	50
FPP-115	Lab- Food Microbiology	3	6	25	25	50
FPP-116	Lab- Processing Technology of Fruits & Vegetables	3	6	25	25	50
General Education Components						
FPP-117	Basics of Computer	3	3	10	40	50
FPP-118	Communicative English-II	3	3	10	40	50
FPP-119	Lab-Basics of Computer	3	3	25	25	50
FPP-120	Lab- Communicative English-II	3	3	25	25	50
Total		30	39	190	385	575

**Course Structure of S.Y. B.Voc. (Food Processing and Preservation)
Semester III & IV**

Semester-I				Mark		
Paper Code	Title	No. of Credits	Hrs. /week	Internal (CIA)	External (ESE)	Total
	Skill Development Components					
FPP-201	Food Chemistry	3	3	15	60	75
FPP-202	Dairy Technology	3	3	15	60	75
FPP-203	Processing Technology of Cereals, Legumes and Oil seeds	3	3	15	60	75
FPP-204	Lab-Food Chemistry	3	6	25	25	50
FPP-205	Lab-Dairy Technology	3	6	25	25	50
FPP-206	Lab-Processing Technology of Cereals, Legumes and Oil seeds	3	6	25	25	50
	General Education Components					
FPP-207	Personality Development	3	3	10	40	50
FPP-208	Human values	3	3	10	40	50
FPP-209	Lab-Personality Development	3	3	25	25	50
FPP-210	Lab-Human values	3	3	25	25	50
Total		30	39	190	385	575
Semester-IV				Mark		
Paper Code	Title	No. of credits	Hrs. /week	Internal (CIA)	External (ESE)	Total
	Skill Development Components					
FPP-211	Food Biotechnology	3	3	15	60	75
FPP-212	Animal Products Technology	3	3	15	60	75
FPP-213	Bakery & Confectionary Technology	3	3	15	60	75
FPP-214	Lab-Food Biotechnology	3	6	25	25	50
FPP-215	Lab-Animal Products Technology	3	6	25	25	50
FPP-216	Lab- Bakery & Confectionary Technology	3	6	25	25	50
	General Education Components					
FPP-217	Environment Science	3	3	10	40	50
FPP-218	On-job training/QP	3	3	10	40	50
FPP-219	Lab-Environment Science	3	3	25	25	50
FPP-220	Major Project/Seminars	3	3	25	25	50
Total		30	39	190	385	575

Course Structure of T.Y. B. Voc. (Food Processing and Preservation)

Code No.	Subject Title	Credits
General Educational Components		
FPP-501	Food Regulation & Quality Control	4
FPP-502	Food Packaging Technology	4
FPP-503	Plant Design & Technology	4
Skill Development Components		
FPP-504	Spices & Flavor Technology	4
FPP-505	Food Analytical Techniques	4
FPP-506	Project-I	2
FPP-507	Lab-Spices & Flavor Technology	2
FPP-508	Lab-Food Analytical Techniques	2
FPP-509	Lab-Project-I	2
	Total Credits = General Education Components + Skill Development Components	12+18=30
Semester-VI		
General Educational Components		
FPP-601	Entrepreneurship Development	4
FPP-602	Food Safety, Hygiene & Sanitation	4
FPP-603	Waste & Byproducts Utilization	4
Skill Development Components		
FPP-604	Novel Food Processing Technologies	4
FPP-605	Fermentation Technology	4
FPP-606	Lab-Novel Food Processing Technologies	2
FPP-607	Lab- Fermentation Technology	2
FPP-608	Lab- Implant Training Report & Seminar	2
FPP-609	Lab- Project-II	4
	Total Credits = General Education Components + Skill Development Components	12+18=30

Semester-I

Skill Development Components

Semester-I

FPP-101: General Biochemistry and Microbiology

Credits: 3

Learning Objectives:

1. To learn and understand the chemistry with respect to role and functionality of constituents of the food.
2. Students will develop knowledge and understanding of different food microorganisms and know different techniques used to detect microorganisms.

Learning Outcome:

1. Student will be able to understand basic chemistry of carbohydrates, lipids and proteins.
2. Student will be able to know the basics of microbiology.

Unit-I

Carbohydrates

- i. Definition and classification.
- ii. Properties –optical and chemical.
- iii. Structure of glucose: ring structure, Haworth & Fischer's projection, pyranoses, furanoses, isomers, mutarotation.
- iv. Triose, pentose, hexose, heptoses - examples & structures.
- v. Derived monosaccharides: glycosides, furano acids, sugar phosphates, uronic acids, sugar alcohol.
- vi. Disaccharides, glycoside linkage, lactose, maltose, sucrose.
- vii. Oligosaccharides – Trisaccharides, structure of raffinose.
- viii. Polysaccharides – Homo and heteropolysaccharides, structures starch, cellulose, mucopolysaccharides.
- ix. Biological significance

Unit-II

Lipids

- i. Classification simple compounds.
- ii. Chemistry of fatty acids, unsaturated and saturated fatty acids, triglycerides, saponification alkyl ether phospho glycerides, sterols, cholesterol, prostaglandins, glycol lipids.
- iii. Functions of lipid.

Proteins

- i. Classification based on properties of solubility & heat. coagulability.
Fibrous, globular proteins and functions.
- ii. Protein structures: conformation and configuration, primary structure determination, secondary structure α - helix & β -pleated sheet, tertiary & quaternary structure.
- iii. Classification of amino acids: based on acid – base properties.
- iv. Properties of amino acids – solubility, ampholyte, Zwitterions isoelectric pH.
- v. Peptide bonds – Concepts of biological peptide bond formation, types.
- vi. Enzymes – Concepts, definition, nature, active site, properties, physico-chemical factors contributing to catalytic efficiency of enzymes.

Unit-III

Nucleic acids

- i. Structure of nitrogen bases & base pairing.
- ii. Structure of nucleosides & nucleotides, ribose, deoxyribosesugars.
- iii. DNA: properties, forms, structure, function as genetic material. Types of DNA
- iv. RNA : Structure, function, types (r-RNA, m-RNA, t-RNA)
- v. Comparative account of DNA & RNA.
- vi. PH & buffers - pH titration curve, PK value.

Unit-IV

Introduction and Scope of Microbiology:

Definition and history of microbiology, contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, importance and scope of microbiology.

Microscope: Construction and working principles of different types of microscopes-compound, dark field, Phase contrast, Fluorescence and Electron (Scanning and transmission).

Unit-V

Sterilization:

Principles and Applications of (a) Physical Methods- Autoclave, Hot air oven, Laminar airflow, Seitz filter, Sintered glass filter, Membrane filter, (b) Chemical methods- Alcohol, Aldehydes, Phenols, Halogens, Gaseous agents and (c) radiation methods- UV rays, Gamma rays.

Staining techniques:

Principle and types of staining

Microbial Taxonomy:

Concept of microbial species and strains, prokaryotes and eukaryotes, classification of bacteria based on- (a) morphology (shape and flagella), (b) staining reaction, (c) nutrition and (d) extreme environment.

Unit-VI**General Account of Viruses and Bacteria:**

Bacteria – ultrastructure of bacterial cell (both Gram positive and Gram negative) including, endospore and capsule. Viruses-Structure and classification

Principles of Microbial Nutrition:

The requirements for carbon, nitrogen, sulfur growth factors etc, role of oxygen in nutrition, nutritional categories among microorganisms.

Microbial growth:

Kinetics of microbial growth, growth curve synchronous growth, factors affecting bacterial growth.

Reference Books for Biochemistry:

1. Lehninger: Principles of Biochemistry, 4th edition, by David L. Nelson and M.M. Cox (2005) Maxmillan/Worth publishers/W.H. Freeman and Company.
2. Biochemistry, 2nd edition by R.H Garrett and C. M. Grisham (1999). Saunders College Publishing, N. Y. Sons, NY.
3. Biochemistry (2004) by J. David Rawn, Panima Publishing Corporation, New Delhi.
4. Biochemistry, 4th edition, by L. Stryer(1995). W.H. Freeman and Co. NY.
5. Fundamental of Biochemistry, 2nd ed., by Donald Voet, Judith G. Voet and Charlotte W. Pratt(2006), John Wiley and Sons, INC.

Reference Books for Microbiology:

1. Atlas, R.M. (1998) Microbiology: Fundamental and applications, 2nd edition, Macmillan Publishing Company, New York.
2. Pelezar, M.J., Chan, E. G. S. and Krieg, N.R. (1999) Microbiology.
3. Heritage, J., Evance, E.G.V. and Killington, R.A. (1999) Microbiology in action, Cambridge University Press.
4. Prescott, L.M., Harley, J.P. and Klein, D.A. (1999) Microbiology, W.C.B. Oxford.

FPP-102: Fundamental of Food and Nutrition

Credits: 3

Learning Objective:

1. Student will enable to understand the importance of nutrient in our daily diet.
2. Student will enable to formulate nutritionally enriched food products as per the requirement.

Learning Outcome:

1. To develop proficiency skill in producing different nutritious food products.
2. Operating & management of balanced diets for different age groups
3. Make different processed food products with quality assurance.
4. Assessment of nutritional status of the women and children

Unit-I

Basic concept of Food: Nutrient, Nutrition, Classification of Food, Classification of Nutrients.

Food constituents - Definition, occurrence, properties and metabolism of Protein, Carbohydrate and Lipids.

Unit- II

Enzymes - Definition, classification, enzyme kinetics.

Browning reactions in foods:

- i. Non enzymic browning: Maillard reaction, browning of ascorbic acid, caramelization of sugars.
- ii. Enzymic browning: Definition, mechanism, control measures.

Unit-III

Biochemical changes in foods of plant and animal origin: fruits, vegetables, cereals, pulses, oilseeds, meat, poultry, seafood, dairy and their products)

Unit-IV

Concept of food and nutrition - Elements of nutrition, Food groups and role of nutrients. Energy metabolism - BMR

Unit-V

Recommended dietary allowances, Balanced diet for different age groups (Infancy to old age).

Unit- VI

Malnutrition-Causes, types, symptoms and prevention, Assessment of nutritional status of the community, National nutrition policy

Reference Books:

1. Biochemistry of Foods:- N.A.M. Eskin, H.M. Henderson, R. J. Townsend.
2. Introduction to the Biochemistry of Foods: Z. Berk.
3. Industrial Enzymes: Structure, Function and Applications - Julio Polaina and Andrew P. MacCabe.
4. Food and Nutrition: - M. Swaminathan.
5. Human Nutrition: - S. Mudambi.

FPP-103: Principles of Food Preservation

Credits: 3

Learning Objective:

To acquaint the students with fundamental principles and various techniques of food preservation.

Learning Outcome:

1. Student will enable to understand different food preservation techniques, process.
2. Student will enable to extend shelf life of different food product by using the various methods of food preservation.

Unit-I

Introduction, sources of food, scope and benefit of industrial food preservation, perishable, non-perishable food, causes of food spoilage. Preservation by salt and sugar – Principle, method, equipment and effect on food quality

Unit-II

Thermal processing methods of preservation – Principle and equipments: Canning, blanching, pasteurization, sterilization, evaporation, etc.

Need and principle of concentration, methods of concentration – Thermal concentration, freeze concentration, membrane concentration, changes in food quality by concentration

Unit-III

Food preservation by use of low temperature – Principle, equipments and effect on quality (Chilling, cold storage, freezing etc.)

Unit-IV

Preservation by drying dehydration and concentration – Principle, Methods, equipment and effect on quality : Difference, importance of drying and dehydration over other methods of drying and dehydration, equipments and machineries, physical and chemical changes in food during drying and dehydration.

Unit-V

Preservation by radiation, chemicals and preservatives: Definition, methods of irradiation, direct and indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms. Deterioration of irradiated foods- physical, chemical and biological, effects on quality of foods. Preservation of foods by chemicals: antioxidants, mold inhibitors, antibodies, acidulants etc.

Preservation by fermentation- Definition, advantages, disadvantages, types, equipments

Unit-VI

Recent methods in preservation: Pulsed electric field processing, High pressure processing, Processing using ultrasound, dielectric, Ohmic and infrared heating. Theory, equipments and effect on food quality.

Reference Books:

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. Food Science- Potter, CBS publishers.
5. 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

FPP-104: Lab. - General Biochemistry and Microbiology

Credits: 3

1. Qualitative tests for:
 - i. Carbohydrates – Benedict's test.
 - ii. Protein – Biuret test.
 - iii. Nucleic acid – Diphenylamine(DNA) and orcinol (RNA) tests
2. Preparation of various solutions and buffers.
3. Qualitative identification of proteins / amino acids
4. Determination of crude lipids, physicochemical constants.
5. To measure pH and Temperature of given sample.
6. Microscopy:
 - i. Different parts of a compound microscope.
 - ii. Use and care of compound microscope.
 - iii. Visit to see an electron microscope.
7. Construction, operation and utility of laboratory equipments
 - i. Autoclave
 - ii. Hot air oven
 - iii. Incubator
 - iv. pH meter
 - v. High speed centrifuge
 - vi. Colorimeter/ spectrophotometer
 - vii. Anaerobic jar
 - viii. Bacterial Filters
 - ix. Laminar air flow.
8. Demonstration of presence of bacteria from – soil/ water/ air/ milk
9. Demonstration of yeast, fungi, actinomycetes, algae, protozoa etc.
10. Microscopic examination of bacteria:
 - i. Monochrome staining
 - ii. Negative Staining
 - iii. Gram's staining
11. Hanging drop technique to demonstrate bacterial motility
12. Micrometry

FPP-105: Lab. - Fundamentals of Food and Nutrition

Credits: 3

1. Qualitative identification of carbohydrates.
2. Estimations of amino acids in foods.
3. Qualitative identification of lipids.
4. Qualitative & quantitative determination of vitamins.
5. Determination of auto oxidative rancidity of fat and oils.
6. Calculation of BMR and body surface area
7. Calculation of energy value of food.
8. Planning and calculation of nutritive value of balanced diet for different age groups.
9. Assessment of nutritional status of an individual by anthropometric method and diet survey.
10. Enrichment and fortification of daily diet.
11. Computation of energy requirement on the basis of physical activity
12. ACU units.

FPP-106: Lab. -Principles of Food Preservation

Credits: 3

1. Demonstration of various machineries used in food processing.
2. Demonstration on effect of blanching on quality of foods.
3. Demonstration on canning and bottling of fruits and vegetables.
4. Preservation of food by high concentration of sugar i.e. preparation of jam
5. Preservation of food by using salt e.g. Pickle
6. Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid
7. Preservation of food by using chemicals.
8. Preservation of coconut shreds using humectants.
9. Drying of fruit slices in cabinet drier
10. Demonstration on drying of green leafy vegetables
11. Osmotic dehydration of foods e.g. candy
12. Drying of foods using freeze-drying & spray drying process.
13. Preservation of milk by condensation/concentration.
14. Demonstration of preserving foods under cold v/s freezing process.
15. Preservation of food by fermentation (Sauerkraut, idli, tempeh, curd, dhokla etc.)
16. Visit to any food processing industry/unit.

Semester-I

General Education Component

FPP-107: Communicative English-I

Credits: 3

Unit I:

- a) The Clause Elements: S, V, O, C, A
- b) The Basic Sentence Types: Declarative, Interrogative, Imperative, Exclamative
- c) The Tenses: Past, Present, and Future Time
- d) The Punctuation: Punctuation Marks and Capitalisation
- e) Word Power: Forming Nouns, Adjectives, Verbs, Adverbs, Synonyms, and Antonyms
- f) Forming Marathi Alternatives and Translation

FPP-108: Hindi

Credits: 3

उद्देश

4. मानक लिपी का अध्ययन कराना एवं परिचय
5. हिन्दी शब्द समूह का परिचय एवं व्यवहार
6. हिन्दी व्याकरण के प्रति अभिरुची निर्माण कराना

अध्ययन-अध्यापन प्रक्रिया

4. व्याख्यान पद्धति
5. लेखन एवं पठन तथा भाषा कौशल वृद्धि के लिए अभ्यास
6. दृक-श्राव्य माध्यम का प्रयोग

हिंदी व्याकरण

2. मानक लिपि और अंकलेखन

अ. लिपि और वर्णमाला

हिंदी की स्वीकृत वर्णमाला तथा अंक

आ. देवनागरी लिपि के गुण-दोष

देवनागरी लिपि में सुधार

इ. अंकलेखन अक्षरों में

2. हिंदी शब्द-समूह

हिंदी शब्द-समूह वर्गीकरण एवं सामान्य परिचय

5. तत्सम शब्द

6. तद्भव शब्द

7. आगत/गृहीत या विदेशी शब्द

आधुनिक भारतीय आर्यभाषाओं से आगत शब्द भारतीय अनार्य भाषाओं से आगत शब्द
विदेशी भाषाओं से आगत शब्दविदेशी शब्दों की श्रेणियाँ

8. देशज शब्द

शब्द-समूह में परिवर्तन : दिशाएँ और कारण

5. निबंध लेखन

1. सामाजिक 2. शैक्षणिक 3. आत्मकथात्मक 4. वैचारिक 5. सम-सामाजिक

6. व्याकरण

1. लिंग 2. वचन 3. पर्यायवाची शब्द 4. विलोम 5. मुँहावरे

7. पत्रलेखन

1. निमंत्रण 2. बधाई 3. आवेदन 4. संपादक के नाम 5. शिकायत 6. सुझाव

संदर्भ ग्रंथ

5. प्रयोजनमूलक हिन्दी- डॉ. माधव सोनटक्के
6. प्रयोजनमूलक हिंदी - विनोद गोदरे
7. प्रयोजनमूलक हिन्दी के अधुनातन आयाम - डॉ. अंबादास देशमुख
8. प्रयोजनमूलक तथा व्यवहारिक हिंदी - डॉ. सुकुमार भंडारे

प्रश्नपत्र का प्रारूप तथा अंक विभाजन

प्र.1. मानक लिपि और शब्द-समूह पर विकल्प सहित

प्र.2. निबंध लेखन और पत्र लेखन पर विकल्प सहित

प्र.3. व्याकरण एवं संक्षेपण पर विकल्प सहित

प्र.4. टिप्पणियाँ लिखिएँ

अ. मानक लिपि अथवा शब्द-समूह

आ. निबंध लेखन अथवा पत्रलेखन

FPP-109- Communicative English-I

Credits- 3

- a) Vocabulary Practice: Spelling Words Passing on Letters and Sounds
- b) Naming the Objects and People Around
- c) Forming Sentences Based on Tenses
- d) Translating Words and Sentences into Marathi

Recommended Reading:

1. A Practical English Grammar (4th Ed.) by A. J. Thomson and A. V. Martinet (New Delhi: Oxford University Press, 1997)
2. A Communicative Grammar of English (3rd Ed.) by Geoffrey Leech (London: Routledge Publication, 2013)
3. Professional Communication Skills by A. K. Jain & Others (New Delhi: S. Chand & Company Pvt. Ltd., 2014)

FPP-Hindi-110

3 Credits

Practical's based on paper no. FPP-108

Semester-II

Skill Development Components

Semester-II

FPP-111: Food Biochemistry

Credits: 3

Learning Objectives:

1. To learn and understand the chemistry with respect to role and functionality of constituents of the food.

Learning Outcome:

1. To learn and understand the chemistry of various Food micronutrient used in foods along with their role and properties
2. Students will learn about basic reaction in food and their kinetics; nucleic acid, digestion and electrophoresis - protein electrophoresis, protein purification.

Unit-I

1. Nature scope and development of food Biochemistry, role of food chemist.
Moisture in foods.
2. Role and type of water in foods.
3. Functional properties of water, role of water in food spoilage and food safety.
4. Water activity and sorption isotherm.

Unit-II

Carbohydrates

- i. Classification and nomenclature of carbohydrates
- ii. Functional characteristics of different carbohydrates (sugar- water relationship, sweetness).
- iii. Structure and function of carbohydrates: monosaccharide, oligosaccharide and polysaccharide.
- iv. Browning Reactions .Enzymatic and non-enzymatic browning reation, Millard reaction, caramelization, method to control non enzymatic reaction
- v. Modification of carbohydrates- unmodified and modified starches, modified celluloses.
- vi. Dietary fibers NDF, ADF, Cellulose, hemicellulose, pectin and carbohydrates digestibility – sugars and starch and their energy values.

Unit-III

Protein in Food

- i. Role of proteins in foods.
- ii. Classification and structure of amino acids, essential amino acids, classification and structural organization of proteins-primary structure, secondary structure and tertiary structure.
- iii. Physicochemical properties- ionic properties, protein denaturation, gelation and hydrolysis.
- iv. Protein content and composition in various foods- cereal grains, legumes and oilseed proteins, proteins of meat, milk, egg and fish.
- v. Functional properties of proteins in foods – water and oil binding, foaming, gelation, emulsification.
- vi. Effects of processing on functional properties of proteins-heat processing alkali treatments, chilling, freezing, dehydration and radiations
- vii. Unconventional sources of proteins- SCP fish protein concentrates, leaf proteins.

Unit-IV

Lipids in food

- i. Role and use of lipids /fat, occurrence, fat group classification.
- ii. Physicochemical aspects of fatty acids in natural foods, hydrolysis, reversion, polymorphism and its application.
- iii. Chemical aspects of lipolysis, auto oxidation, antioxidants.
- iv. Technology of fat and oil processing
 - a. Refining
 - b. Hydrogenations
 - c. Inter esterification

Unit-V

Vitamin

- i. Definition of vitamin, type of vitamin,
- ii. Water soluble (Vit B-1, B-2, B-3, C) and Fat soluble (Vit A, D, E, K)- their structure and functions.

Unit-VI

Enzyme

- i. General properties of enzymes, enzyme action, classification and nomenclature of enzymes, coenzymes enzyme inhibition, isozymes.
- ii. Carbohydrases (Amylases, cellulases, pectinases, vertases) Proteases, Lipases and oxidases in food processing.
- iii. Enzyme applications in food industry

Nucleotides and Nucleic acids:

Building blocks- bases, sugars and phosphates, structure and nomenclature of nucleosides and nucleotides, polynucleotides - DNA (A, B, Z, DNA) and RNA (rRNA, mRNA, tRNA).

Reference Books:

1. Lehninger: Principles of Biochemistry, 4th edition, by David L, Nelson and M.M. Cox (2005) Maxmillan/Worth publishers/W.H. Freeman and Company.
2. Biochemistry, 2nd edition, by R.H. Garrett and C.M. Grisham (1999). Saunders college publishing, N. Y. Sons, NY.
3. Fundamentals of Biochemistry, 2nded, by Donald Voet, Judith G, Voet and Charlotte W. Pratt (2006), John Wiley and Sons, INC.
4. Biochemistry (2004) by J. David Rawn, Panima, Publishing Corporation, New Delhi.

FPP-112: Food Microbiology

Credits: 3

Learning Objectives:

Students will develop knowledge and understanding of different food microorganisms and different techniques used in its detection.

Learning Outcome:

1. Students will understand causes of food spoilage of different foods and its type.
2. To enable the students to gain an insight into basic aspects of food microbiology.
3. To understand the advanced techniques in microbial analysis of food.

Unit-I

- i. Introduction- definition, history of microbiology of food. Types of microorganisms normally associated with food- bacteria, yeast and moulds.
- ii. Spoilage of food; factors affecting spoilage of foods and associated micro flora.
- iii. Biochemical changes caused by microorganisms- putrefaction, lipolysis, etc.

Unit-II

Factors affecting growth and survival of microorganisms:

- i. Extrinsic factors- relative humidity, gaseous atmosphere.
- ii. Intrinsic factors- nutrient content, water activity, oxidation reduction potential.
- iii. Sources of contamination. Contamination of food-stuff, vegetables, fruits, cereals, pulses, oilseeds, milk and meat during handling and processing.

Unit-III

Deterioration and spoilage of various types of food products-

- i. Fruits, vegetables, cereal and cereal products, meat and meat products, fish and other sea foods
- ii. Prevention of spoilage of these foods

Unit-IV

Food borne infections and food poisoning:

- i. Bacterial with examples of infective and toxic types- *Clostridium*, *Salmonella*, *Shigella*, *Staphylococci*, *Compilobacter*, *Escerichia*, *Bacillu etc..*

- ii. Mycotoxins in food with reference to *Aspergillus species*.
Protozoae. Prevention of food borne diseases.

Unit-V

Principles of food preservation:

- i. Control of microorganisms by asepsis, use of low and high temperatures, water activity, preservatives.
- ii. Preservation and maintenance of industrially important microorganisms- serial dilution, oil layer, lyophilization, liquid nitrogen, etc.

Unit-VI

Indicator organisms, microbiological quality assurance systems in food industry, GMP, use of HACCP to ensure microbiological safety of food, food regulations and standards.

Reference Books:

1. Food Microbiology by M.R. Adams and M.O. Moss
2. Food Microbiology by W.C. Frazier
3. Dairy Microbiology by E .M. Foster.
4. Modern food Microbiology by James M. Jay.
5. Food borne bacterial pathogens by M.P. Doyle
6. Basic Food Microbiology by G.J. Banwart

FPP-113: Processing Technology of Fruits and Vegetables

Credits: 3

Learning Objective:

To enable the students to know the post-harvest management systems and processing technologies for preservation of fruits & vegetables and various value added products.

Learning Outcome:

1. To develop proficiency skill in producing different types of processed fruits & vegetables products.
2. Operating & maintenance the modern processing equipments & machineries
3. To make different processed fruit & vegetable based products with quality assurance and safety.
4. Process of packaging, storing & marketing

Unit-I

An over view of production and processing scenario of fruits and vegetables in India and World. Post harvest management of fruits and vegetables-control of losses in harvesting, and handling operations. Scope of fruit and vegetable preservation industry in India. Present status, constraints and prospects.

Unit-II

Morphology, structure and composition of fruit and vegetable Maturity standards: Importance, methods of maturity determinations, maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Fruit ripening: chemical changes, regulations, methods.

Unit-III

Storage practices: Modified & Controlled atmospheric storage, hypobaric storage, cool store.

Commodity treatments- chemicals, wax coating, pre-packaging.

Post Harvest handling, packaging & transport system for various fruits & vegetables and packaging house operations.

Unit-IV

Overview of principles and preservation methods of fruits and vegetables. Commercial processing of major fruits and vegetables (jam, jellies, marmalade, purees, concentrates, preserve, candy, toffee/bar etc.)

Unit-V

Processing technology for manufacturing of fruit juices, pulp, RTS beverage, nectars, squash, syrups, cordials, Carbonated.

Unit-VI

Processing of Tomato: paste, ketchup, sauce, puree, soup, chutney etc.

Drying and dehydration technology of fruits and vegetables: preparation of raisins, anardana, dried fig, dried leafy vegetables, juice powders, flakes, wafers, chips etc. Fermented fruits and vegetables products like sauerkraut, pickles, wines etc. Utilization of By-products and wastes from fruits and vegetables processing industry

Reference Books:

1. Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetable- E. B. Pantastico, AVI Publishing Company, INC.
2. Post Harvest: An Introduction to the Physiology and Handling of Fruits and Vegetables- R.B. Wills, M.B. Mc Glasson, D. Graham, T.L. Lee and E.G. Hall.
3. Post Harvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management Vol. I and II- Verma L. R. and Joshi V.K.
4. Fruit and Vegetable Preservation Principles and Practices -Srivastava R.P. and Sanjeev Kumar
5. Preservation of Fruits and Vegetables-Khader
6. Fruit and Vegetable Preservation -Bhutani R.C.
7. Principles of Fruit Preservation- Morris, Thomas Norman,.
8. Preservation of fruits and vegetables- Giridharilal, G.S. Siddappa and G.L. Tandon.
9. Fruit and Vegetable Technology- Duckworth.

FPP-114: Lab-Food Biochemistry

Credits: 3

1. Determination of moisture in food sample.
2. Determination of protein in food sample.
3. Determination of ash/minerals in food sample.
4. Determination of crude fat in food sample.
5. Determination of acidity & pH in food sample/beverages.
6. Determination of total, non-reducing and reducing sugars.
7. Determination of vitamin C content in food sample.
8. Determination of pigments in food sample.
9. Estimation of calcium, iron and zinc in food products.

FPP-115: Lab. - Food Microbiology

Credits: 3

1. Study of compound microscope.
2. Study of autoclave/retort
3. Cleaning and sterilization of glassware
4. Preparation of nutrient broth, potato dextrose and nutrient agar media.
5. Pure culture techniques(Streak plate and pour plate)
6. Gram staining and study of morphology of bacterial cell
7. Microbial examination of table containers and packaging materials.
8. Microbial examination of cereal and cereal products
9. Microbial examination of meat and meat products
10. Assessment of quality of raw milk by MBRT
11. Bacteriological analysis (*Coliform* count) of water by MPN method
12. Estimation of *Salmonella* from food sample.
13. Estimation of *Staphylococcus* from food sample.

FPP-116: Lab.- Processing Technology of Fruits and Vegetables

Credits: 03

1. Studies on maturity indices of fruits and vegetables.
2. Studies on extension of shelf life.
3. Studies on use of chemicals for ripening of fruits and vegetables
4. Studies on pre-packaging.
5. Studies on physiological disorders - chilling injury of banana and custard apple
6. Canning/bottling of mango/guava/papaya fruits
7. Preparation of fruit jam: apple/mango/guava/ papaya/aonla/ strawberry.
8. Preparation of fruit jelly/marmalade: wood apple/ sweet orange/mandarin/guava/ tamarind.
9. Preparation of fruit preserve and candy
10. Preparation of fruit RTS beverage.
11. Preparation of carbonated beverage.
12. Preparation of fruit squash
13. Preparation of fruit syrup.
14. Preparation of pickle/ mixed pickle
15. Preparation of grape raisin/ anardana/ dried fig etc..
16. Preparation of dried ginger/ amchur/ onion and garlic

Semester-II

General Education Components

FPP-117: Basics of Computer

Credits: 3

UNIT-I

Introduction to computers: Characteristics, history and evolution, generation and types of computers. Computer architecture; Input and output devices; primary and secondary storage devices; central processing unit. Operating system: Types, booting, DOS commands, Windows and its applications.

UNIT-I

M.S. Office: Word, Excel and Power Point. Computer virus: Symptoms, detection and protection. Introduction to internet: World Wide Web, database, e-mail and chat. Role and use of computers in aquaculture.

UNIT-III

Creating a database, modifying table creating forms, queries and reports and protecting the database Windows vista, MS-office 2007-2010, Internet explorer, online collaboration tools

FPP-118: Communicative English-II

Credits-03

Unit 1:

- a) Basic Phonetics: The Sounds, Syllable, Stress, Intonation
- b) Reading and Listening to a Text, Speech
- c) Basic Manners: Greetings, Self-Introduction, Acknowledgement, Request, Apology
- d) Preparing CV and Job Application; Drafting Complaint, Email, Letter
- e) Writing Paragraph, Report
- f) Drafting Conversation, Essay, Speech

FPP-119: Lab-Basics of Computer

3 credits

Practical/Tutorial

- 1 MS-DOS commands.
- 2 Windows and its applications.
- 3 MS Word and its applications.
- 4 MS Excel and its application.
- 5 MS Power Point and its applications.
- 6 Antivirus and its applications.
- 7 Internet – browsing, surfing, e-mail and chat.
- 8 Creating database
- 9 Windows vista, MS-office 2007-2010, Internet explorer
- 10 Uses and applications of computers in sericulture.

FPP-120: Communicative English-II

Credits-3

- a) Listening to a Text and Reproducing It
- b) Making a Full Self-Introduction, Acknowledgement, Request and Apology
- c) Group Discussion and Debate
- d) Taking a Career Interview
- e) Enacting Dialogues

Recommended Reading:

1. A Practical English Grammar (4th Ed.) by A. J. Thomson and A. V. Martinet (New Delhi: Oxford University Press, 1997)
2. A Communicative Grammar of English (3rd Ed.) by Geoffrey Leech (London: Routledge Publication, 2013)
3. Professional Communication Skills by A. K. Jain & Others (New Delhi: S. Chand & Company Pvt. Ltd., 2014)

Semester-III

Skill Development Components

Semester-III

FPP-201: Food Chemistry

Credits: 3

Learning objective:-

- To learn and understand the chemistry with respect to role and functionality of constituents of the food.

Unit- I

Water

The basic molecule of life, physical properties of water, properties of hydration, salivation, sorption isotherm, Bound water, free water, water activity, distribution of water in various foods and moisture determination, filtration Technology for water and foods: RO, UF, NF, etc.

Carbohydrates

General classification, distribution and importance, physical and chemical properties, synthesis and breakdown of glucose, starch, cellulose and pectic substances, Gums and mucilage etc.

Unit- II

Lipids

General classification, structure, physical and chemical properties, components of fatty acid, Technology of edible fats and oils- Refining, Hydrogenation and Inter-esterification

Proteins

Importance, classification, structure of amino acid, peptide and proteins, primary, secondary, tertiary and quaternary structure of proteins, source and distribution, physical and chemical properties, Functional properties of proteins eg. organoleptic, solubility, viscosity, binding, gelation / texturization, emulsification, foaming etc.

Unit-III

Food Flavour and Colours

Definition and basic tastes, Chemical structure and taste, Description of food flavours and Flavour enhancers. Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel), application of food flavor and color in food industry.

Unit- IV

Food Additives:

Definition, Functions, legal approval, major additives used in food processing, nutrient supplements, functional foods, phytochemicals and nutraceuticals

Food Industry Enzyme

Introduction, nature, classification, nomenclature, role, specificity, hypothesis- lock and key, induced to fit, Enzymatic and Non-Enzymatic Browning, Maillard Reaction, Caramelization reaction, Enzymes in food industry. Industrial Uses of Enzymes.

Unit- V

Vitamins and minerals

Vitamin: Chemistry, bioavailability and role of vitamins in food- outline.

Minerals: Definition, trace elements, Toxic metals, occurrence, bioavailability and role of in food.

Reference Books for Food Chemistry:

1. Food Chemistry- Vol-I - Fennema O.R.
2. Food Chemistry - Mayer L.H.
3. Food Chemistry-H.-D. Belitz, Werner Grosch, Peter Schieberle

FPP- 202: Dairy Technology

Credits: 3

Learning Objectives:-

To get acquainted with the processing technology of milk and milk products

Unit- I

Livestock and dairy building:

Importance of livestock, their importance species and breeds, functional requirement, site selection, types of dairy barn, planning, layout and requirement of dairy barns.

Milk Societies, buying and collection of milk, transportation of milk, milk reception in dairies.

Quality and quantity test at reception

Unit- II

Dairy Chemistry and Microbiology

Introduction, Milk- Definition composition, food and nutritive value, physico-chemical properties. Microbiological Properties of milk, Judging and Grading of milk,

Unit- III

Milk Processing

Filtration / clarification, Storage of milk, Standardization – simple problems in standardization, Homogenization, Pasteurization-Types of pasteurization process, Sterilization of milk. Equipments used in each process-Cream separating centrifuges, Pasteurizers (Heat Exchangers), Homogenizers, Bottle and pouch fillers, Milk Chillers.

Unit- IV

Manufacture of Dairy Products

Manufacture of Ice Cream, Cream, Paneer, Butter, Ghee, Milk powder, Khowa, Cheese and milk based sweets (Only method of preparation)

Equipment used for manufacture of each product like Butter churn, ghee boiler, Evaporator, Nozzel, Spray and Drum Dryers etc.

Unit- V

Manufacture of other Dairy Products and sanitization

Manufacture of Homogenized, Standardized, rehydrated, Toned Milk and Sweetened Condensed milk, Extraction of casein from milk – properties - composition and industrial uses. Production of lactose and whey

Fermented products – Yoghurt, Curd, acidophilus milk, butter milk

Dairy plant sanitization – Cleaning in place – bottle and can washing, cleaning of tankers and silos – Detergents and sanitizers used.

Reference Books for Dairy Technology:

1. Outlines of Dairy Technology-Sukumar De
2. Technology of Milk Processing-Khan Q A and Padmanabhan
3. Principles of Dairy Processing-Warner J N
4. The Fluid Milk Industry Henderson J L
5. Indian dairy Products-Rangappa K S and Acharya K L

FPP-203: Processing Technology of cereals, Legumes & Oil seeds.

Credits: 3

Learning Objectives:

To get acquainted with the processing technology of cereals, legumes and oilseeds.

Unit-I

Present status and future prospects of cereals, legumes and oilseeds in India. Production, morphology, physicochemical properties, classification and types, composition and nutritive value.

Unit-II

Post harvest processing of cereals, legumes and oilseeds at home scale, cottage scale and commercial scale for drying, Parboiling of paddy, rice, corn sorghum, pearl millet processing, dal milling.

Unit-III

Wheat types, classification, milling of wheat, flour types, Physico-chemical properties of flours. uses for manufacture of cakes, breads, biscuits, macaroni products.

Unit-IV

Soaking, cooking, sprouting, fermentation of grains and manufacture of processed products. Oil extraction from oilseeds by different methods, oil refining, oilseeds and legumes meals and manufacture of different products.

Unit-V

Manufacture of different products from cereals, legumes and oilseeds flours such as bhakri, roti, traditional products, extruded food products etc.

Reference Books for Processing Technology of cereals & Legumes, Oil seeds:

1. Technology of Cereals- Kent
2. Post Harvest Technology of Cereals, legumes and Oilseeds- Chakrawarthy
3. Post harvest Biotechnology of Legumes-Salunkhe DK and Kadak SS
4. Post Harvest Biotechnology of Oilseeds - Salunkhe DK and Kadak SS

FPP-204: Lab - Food Chemistry

Credits: 3

1. Determination of moisture from food by different methods.
2. Determination of total carbohydrates, starch, sugars, dietary fibers.
3. Determination of crude proteins, amino acids,
4. Qualitative identification of proteins / amino acids
5. Determination of crude lipids, physicochemical constants.
6. Preparation of mineral solution by tri-acid digestion.
7. Estimation of different minerals from the food samples.
8. Smoking points at fats & oils
9. Assay of amylases, lipases, proteases.
10. Estimation of saponification value.

Note: Students should perform at least 08 practical

FPP- 205: Lab- Dairy Technology

Credits: 3

1. Sampling and analysis of milk-physicochemical properties, and tests for quality.
2. Clarification and separation of milk for cream.
3. Heat processing of milk-pasteurization by different methods.
4. Preparation of butter
5. Preparation of ghee
6. Preparation of ice-cream.
7. Preparation of dahi, shrikhand and lassi.
8. Preparation of khoa and khoa based sweets such as peda, gulabjamun.
9. Preparation of channa and channa based sweets such as rasogola.
10. Preparation of cheese and yoghurt.
11. Preparation of special milks
12. Visit to dairy plant

Note: Students should perform at least 08 practical

FPP- 206: Lab- Processing Technology of cereals, Legumes & Oils seeds. Credits: 3

1. Morphology and physicochemical properties of cereals, legumes and oilseeds.
2. Parboiling of paddy, rice milling and rice products, other cereal products.
3. Milling of wheat and wheat based products
4. Milling of sorghum, corn and millets.
5. Milling of legumes and legume based products
6. Extraction of oil from different methods.
7. Soaking, sprouting of legumes and cooking of dal.
8. Fermented products from legumes.
9. Production of breakfast cereals.
10. Production of traditional cereals, legumes and oilseed meals products

Note: Students should perform at least 08 practical

Semester-III

General Education Components

FPP-207: Personality Development

Credits: 3

Learning Objective:

The objective of the subject is bring about personality development with regard to the different behavioral dimensions that have far reaching significance in the direction of organizational effectiveness.

Learning Outcome:

To create awareness in the participants with regard to the different aspects of Interpersonal relations based on the ideas envisaged in Transactional Analysis and their relative significance in the context of the functional effectiveness of organizations.

Unit-I

Self-Analysis: SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem.

Unit-II

Creativity: Out of box thinking, Lateral Thinking.

Unit-III

Attitude: Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette.

Unit-IV

Motivation: Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators.

Unit-V

Goal Setting: Wish List, Smart Goals, Blue print for success, Short Term, Long Term, Life Time Goals. Time Management Value of time, Diagnosing Time Management, Weekly Planner to do list, Prioritizing work.

FPP-208: Human values

Credits: 3

Chapter I: Human values: Introduction, Concept, Types of values, Personality development:
Introduction, Meaning, Elements, Nature and Importance

Chapter II: Social work, Concept, Ideals of Social work objectives and nature, Need and
importance

Chapter III: Constitutional Values, Democracy, Types, Duties, Responsibilities Fundamental
Rights and Power Importance

Chapter IV: Self dependency and Self management Meaning Objectives/ Purpose, Importance
Self Strength and weaknesses.

FPP-209-Lab Personality Development

Credits: 3

1. A practical and activity oriented course which has continuous assessment for marks based on class room interaction, activities etc.
2. Extempore.
3. Technical Topic Presentation

FPP-210 Lab-Human Values

Credits: 3

1. A practical and activity oriented course which has continuous assessment for marks based on class room interaction, activities etc.
2. Seminar
3. Tutorial
4. Presentation

Semester-IV

Skill Development Components

Semester-IV

FPP-211: Food Biotechnology

Credit: 03

Learning Objectives:-

To study the biotechnological aspects involved in food and its application for development of food in relation to food security. It is expected to learn genetics, molecular biology and basis for developments of genetically modified foods and their safety issues involved in food biotechnology

Unit-I

Prospectus of Bio-Technology Molecular genetics i.e. fundamentals of molecular biology with special reference to chemistry and biology and DNA. (Primary secondary and tertiary) structures.

Unit-II

Biological role of DNA in cell metabolism, Genetic recombination mechanisms and technique used for improvement in microbial strains, Applications of genetical control mechanism in industrial fermentation process.

Unit-III

Recombinant-DNA technology (plasmids, plasmids vectors and cloning), Cell and tissue culture, Continuous cultures.

Unit-IV

Secondary metabolites synthesis, Application of Biotechnology in food industries, nutraceuticals, agriculture and Nutritional genomics. Genetically modified foods.

Unit-V

Application of biotechnology for food plant waste utilization, Bio-gas plant, Bio technology approach for the exploitation of food and industrially important microorganisms,

Reference Books for Food Biotechnology:

1. Advances in Biotechnology Vol.I Murayy Moo-Young (Scientific and Engineering principles) C.W. Gambell and C.Vezina
2. Advances in Biotechnology Vol-II Murayy Moo-Young (Fuels, chemicals, foods and waste treatments) C.W. Gambell and C.Vezina
3. Advances in Biotechnology Vol-III Muray Moo-Young (Fermentation Products)
4. Microbial Technology-Vol-I Peppler and Perlman (Microbial Process)
5. Industrial Microbiology- L.E. Casida
6. Modern Industrial Microbiology and Biotechnology-Neduka Okafor.

FPP-212: Animals Products Technology

Credits: 3

Learning objectives:

To learn and understand the processing technology of animal products and its preservation.

Learning Outcome: The students will get exposure in slaughtering techniques, processing and preservation of various meat, fish and poultry products.

Unit - I

Sources and developments of meat and poultry industries and importance in national economy, Definition, classification, structural and chemical classification of meat, and physic-chemical properties of meat muscle, abattoir design and layout.

Unit - II

Pre-slaughter transport and care and antimortem inspection, slaughtering of animals and poultry, post-mortem inspection and grading of meat, Factors affecting post-mortem changes, properties and shelf life of meat, Processing and preservation of meat

Unit - III

Poultry: Structure, composition and nutritional value anti and post mortem inspection of poultry, processing and preservation of poultry meat.

Egg structure: Composition, quality characteristics, processing and preservation of eggs

Unit - IV

Classification of fish, composition, structure and post mortem changes in fish and quality evaluation. Handling of fresh water fish, Processing and preservation of fish, FSSAI and BIS specifications of fish and fish products

Unit – V

Technology of manufacture of meat and poultry products, slaughter house By-products utilization and abattoir management.

Reference Books for Animals Products Technology:

1. Principles of Meat Science - F. J. Forrest
2. Meat Hand Book - Albert Levie
3. Developments in Meat Science Vol. I and II - Ralston Lawrie
4. Poultry Production - R. A. Singh
5. Meat Technology - Gerard F.
6. Fish Processing in India - M. N. Moorjani
7. Fish as a Food Vol. I, II and III - Borgstrom G
8. Fishery By-products Technology - Brody J
9. Outline of meat science and technology-B.D. Sharma
10. Modern abattoir practices and animal Byproducts Technology- B.D. Sharma

FPP-213: Bakery & Confectionary Technology

Credits: 3

Learning Objective:-

To get acquainted with the processing technology of Bakery and Confectionery products

Learning outcomes: the students will be familiar to various types of wheat flour, its application in bakery products and skill development in preparation of various bakery and confectionary products.

Unit-I

Wheat: Classification, grading systems, chemical constituents, Milling of wheat- Roller flour milling process, break rolls, reduction roll, design and operation of wheat milling process. Physico-chemical and Rheological properties of dough.

Unit-II

Bakery products-Role of bakery ingredients(Major & minor), bread making methods i.e. straight and sponge dough method, Quality control and testing of raw material, testing of final product, bread faults, staleness and ropiness in bread

Unit-III

Technology for preparation of various baked products from soft wheat viz. Cookies, Biscuits, cakes, role of ingredients, faults and remedies.

Unit-IV

Confectionery Technology- History, traditional confectionery goods, types of confectionery. Raw materials Ingredients-sugar, sugar qualities, physical, chemical properties dextrose, fructose, lactose, caramel, maltose, honey, sorbitol, mannitol, soya maltose, isomalt etc.

Unit-V

High boiled sweets, Toffee, Fondents-Fudge, Chocolate processing technology- Ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom. Packaging requirements of bakery and confectionery products.

Reference Books for Bakery & Confectionary Technology:

1. Bakery science and Cereal Technology- NeelamKhetarpaul
2. Technology of Cereals- Kent.
3. Basic Baking- S.C. Dubey.
4. Flour Milling Process-Scott
5. Sugar Confectionery and Chocolate Manufacture- R. Less and E.B. Jackson
6. Chocolate, Cocoa & Confectionery Sci. & Tech.- Bernared W. Minifie
7. Industrial Chocolate Manufacture and use-S.T. Beekelt I.
8. Bread-spensor.

FPP- 214: Lab-Food Biotechnology

Credits: 3

1. Study of auxotroph, Micro propagation through tissue culture
2. Strain improvement through U.V. mutation for lactose utilization
3. Chemical mutagenesis using chemical mutagens (Ethidium bromide)
4. Determination of survival curves using physical and chemical mutagens
5. Isolation and analysis of chromosomal / genomic DNA from *E.coli* and *Bacillus cereus*
6. Separation of protoplast using cellulytic enzymes
7. Introduction of ELISA / Southern blot / DNA finger printing etc
8. Agarose gel electrophoresis of plasmid DNA
9. Pesticide degradation by pseudomonas spp.
10. Study of enzyme activity in food products.

FPP- 215: Lab-Animals Products Technology

Credits: 3

1. Pre-slaughter operations of meat animals and poultry birds
2. Study of post-mortem changes
3. Evaluation of meat quality
4. Preservation of meat by different methods
5. Evaluation of quality and grading of eggs
6. Preservation of shell eggs
7. Quality evaluation of fish
8. Chilling and freezing of fish
9. Preparations of fish protein concentrate
10. Studies on by-products utilization
11. Study to modern slaughter house/abattoir/processing plant

FPP-216: Lab- Bakery & Confectionary Technology

Credits: 3

1. Determination of gluten content in wheat flour sample
2. Determination of dough raising capacity of wheat flour.
3. Manufacturing technology of bread making.
4. Manufacturing technology of cake and cookies making.
5. Manufacturing technology of biscuit making.
6. Manufacturing technology of different chikki.
7. Manufacturing technology of Chocolate.
8. Manufacturing technology of fruit toffee/ candy.
9. Manufacturing technology of high boiled sweets.
10. Visit to bakery and confectionery industry.

Semester-IV

General Education Component

FPP-217: Environmental Science

Credits: 3

UNIT-I

Environment: Environment Science, Scope and importance, Components of environment – i) Atmosphere, Composition of atmosphere, ii) lithosphere – Structure of lithosphere, soil formation, soil composition and properties of soil, iii) Hydrosphere – distribution of water on earth, global water balance and hydrological cycle.

UNIT-II

Environment Problems: A) Air pollution – concept, source of air pollution, major atmospheric pollutants, air quality standards monitoring of major air pollutants. B) Water pollution – sources of water pollution, river pollution, underground water pollution, oil pollution, thermal pollution, water pollution due to sewage, effects of water pollution, waste water treatment. C) Noise pollution – sources of noise, effects of noise pollution, noise pollution, noise pollution control equipment silencers and noise absorbing devices, noise standards and industrial noise control. D) Soil pollution – causes of soil pollution major soil pollutants, industrial waste and their role in soil pollution. E) Radiation pollution – sources of radioactive pollution, effects of radioactive pollution on health.

UNIT-III

Impact of industries on Environment: Water pollution episodes due to industrial pollutants, effects of industrial pollutants on aquatic organisms, industrial and underground water quality. Air pollution episodes due to industries-Bhopal gas tragedy, Photochemical smog, Acid Rivers etc. Industrial noise pollution and workers health problems.

UNIT-IV

Water Conservation: water use pattern-water use in industry, Water conservation-methods of water conservation, rain water harvesting, Reuse and recycle of water.

FPP-219 Lab- Environmental Science

Credits: 3

1. Major equipments available in environmental analysis laboratory
2. Preparation of charts and models of earth showing different layers
3. Determination of pollutions using various techniques/instruments
4. Demonstration of water cycle, rain harvesting methods
5. Internal assessment/Seminar/Tutorials
6. A visit to an industrial unit

Semester-V

General Education Components

FPP-501: Food regulation and quality control

Credits- 4

Learning Objectives:

2. To study in depth the theory and practice of food safety in food, beverage and allied industries.
3. To take cognizance of recent advances and the impact of genetic methods on the food industry.
4. To develop the students understanding of quality management, its role, its implementation in process management and the integration of management systems for product quality, safety and environmental care.

Learning Outcomes:

3. Be able to critically evaluate the recent developments in the control of food safety.
4. Have an integrated view of the issues involved.
5. Be able to conduct risk assessments of food safety problems including genetic modification.
6. Demonstrate detailed knowledge of the requirements for compliance with national and international food safety legislation.
7. Be able to explore the history and basic ideas underlying quality management and have a detailed knowledge of the role of Quality Management (QM) in modern management.
8. Demonstrate knowledge of quality management systems, their implementation and the practical steps needed for implementation.
9. Know how to control and maintain a quality management system.

Unit-I

Introduction

1. Food safety issues; physical, chemical and microbiological contaminants, bovine spongiform encephalopathy (BSE), genetically modified organisms and genetically modified foods and food safety system.
2. Definitions and terminology in Quality Management Systems
3. History of quality control and quality management
4. Quality management theories and their authors

Unit-II

Physical and Chemical Contaminants and Additives

1. Metals, mineral (soil, engine oil, stones), plant (leaves, twigs, pods and skins), animal (hair, bone, excreta, blood, insects, larvae).
2. Safety evaluation of food ingredients
3. Major pathways by which chemical residues and contaminants enter the food chain
4. Agrochemicals and veterinary drugs, packaging materials, process equipment and ingredient impurities.
5. The nature, properties and function of various classes of food additives (colorants, flavours, sweeteners, thickening and gelling agents, and antioxidant preservatives).
6. Radioactivity – residues as contaminants and residues from irradiation

Unit-III

Natural Toxic Substances

1. Mycotoxins
2. Marine and Freshwater toxins (formally known as Phycotoxins)
3. Plant toxins and toxic plants
4. Toxic Mushrooms

Unit-IV

Microbiology Food Safety

1. The significance of foodborne disease.
2. Recent emerging pathogens.
3. Non-bacterial agents – Protozoa; *Cryptosporidium parvum*., Toxigenic fungi; mycotoxins of *Aspergillus*. Foodborne viruses; gastroenteritis viruses.
4. Spongiform encephalopathies; bovine spongiform encephalopathy (BSE).
5. Factors affecting the emergence of pathogens.

Unit-V

Control of Food Safety and Quality Management

1. Protecting public health and eliminating risk.
2. Farm to table strategy and animal traceability
3. Good Manufacturing Practices (GMPs); Hazard Analysis and Critical Control Point (HACCP) concept; Quality Management Systems: ISO 9000.
4. Risk management, assessment and communication. Future trends in risk analysis.

Quality control and SPC

1. Statistical basis for SPC
2. Gathering data: control charts.
3. Interpretation of statistical data
4. Hypothesis testing.
5. Process potential index.

Quality Systems

1. Definition and aims
2. Levels and tasks in quality management
3. Quality standards: history and overview

ISO 9000 – ISO 2000

1. Setting up a product quality management system
2. Is there still life after ISO 9000?
3. World class manufacturing
4. Business excellence
5. Case study
6. Product quality management – ISO 9000 and ISO 2000
7. Environmental management – ISO 14000
8. Integration of QMS
9. Special applications
10. HACCP
11. HAZOP

Reference Books:

2. Schmidt, R.H. and Rodrick, G.E. (2005). Food Safety handbook. John Wiley & Sons, Inc.
- Altug, T. (2002). Introduction to Toxicology and Food. CRC Press.
3. Food Chemical Safety, Volumes 1 & 2 (2002), Edited by Watson, D.J., CRC Press.
4. Macdonald, John, (2003). Total quality management in a week / John Macdonald. 3rd ed. Hodder & Stoughton.
5. Oakland, John S. (2003). Total quality management: text with cases 3rd ed. Oxford; Burlington, MA: Butterworth-Heinemann.

FPP-502: FOOD PACKAGING

Credits: 4

Learning Objectives:

4. To impart comprehensive overview of the scientific and technical aspects of food packaging.
5. To provide knowledge on packaging machinery, systems, testing and regulations of packaging.

Learning Outcomes:

2. Understand the principles, the fundamentals and the importance of packaging systems in the supply chain of food
3. Acquire knowledge on major packaging systems for foods and beverages in what concerns the materials, properties and their relation with the foods shelf-life and performance in the supply chain.
4. Be able to design evaluation schemes and to interpret laboratory results in order to select optimized packaging systems
5. Have an overview of physical, mechanical and chemical properties of the materials
5. Understand the impact of packaging on the safety of the food product and the role regarding food security

Unit-I

Introduction & Impact on the environment

1. Packaging Functions and Requirements
2. Printing of packages
3. Barcodes & other marking
4. Labeling Laws

Unit-II

Glass bottles Metal packaging, Metals and internal coatings

1. Types and closure systems
2. Raw-materials and composition
3. Properties and uses
4. Types of cans and innovations
5. Properties and uses

Unit-III

Paper and board

1. Materials types
2. Construction and mechanical resistance

Unit-IV

Plastic packaging

1. Polymer properties and plastics
2. Types and production of packages

3. Properties and uses

Unit-V

Packaging and Preservation technologies

1. Frozen and dried
2. Thermal processing and aseptic filling
3. Modified atmosphere packaging

Food contact materials & Shelf-life

1. Chemical hazards
2. Overall and specific migration
3. Legislation and guidelines
4. Factors affecting shelf-life: temperature, light, oxygen, aw, packaging
5. Shelf-life estimation: direct and accelerated methods, mathematical simulation

Reference Books:

1. Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012
2. Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and 46 Professional, 1992
3. Coles R, McDowell D, Kirwan MJ Food Packaging Technology. Blackwell, 2003

FPP-503: PLANT DESIGN & TECHNOLOGY

Credits: 4

Learning Objectives:

1. To understand the basic concepts of flow sheeting, material and energy balances and process development.
2. To apply algorithms for feasibility and optimization of flow sheet,
3. To gain knowledge of estimation of capital investment, total product costs, depreciation, cash flows, and profitability,
4. To carry out process optimization based on economic profitability by connecting economics with design principles for real chemical engineering processes.

Learning Outcomes:

1. Understand concepts of process design and project management
2. Synthesize feasible and optimum flow-sheet
3. Estimation of capital investment, total product costs, and profitability.
4. Optimum design of equipments based on economics and process considerations.

Unit-I

Introduction

Basic concepts of plant layout and design with special reference to food process industries. Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design.

Unit-II

Plant Location

Influence of location on plant layout, location factors, location theory and models, of Economic plant size, types manufacturing processes like continuous, repetitive and intermittent processes.

Unit-III

Plant Layout

Preparation of a Plant Layout, Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of layout. Advantages of good layout

Unit-IV

Plant Building

Considerations in building design, type of factory buildings, choice of building construction, material for floors, foundation, walls, doors, windows, drains etc, ventilation, fly control, mold prevention and illumination in food processing industries.

Unit-V

Plant layout & Equipment Layout

Plant layout and design of bakery, fruits & vegetables processing industries including beverages; milk & milk products; meat, poultry and fish processing industries. Preparation of flow sheets for material movement and utility consumption in food plants.

Cost Analysis

Fixed cost, variable cost, depreciation, method of economic analysis, profitability analysis of a plant.

Reference Books:

1. Milk Plant Layout H.S. Hall (1963). FAO Pub., Rome
2. Plant Layout and Design James M. Moore (1962), Mac Millan, New York
3. Production Engg. & Industrial mgmt. O.P. Khanna Dhanpat rai & sons
4. Plant Design for Chemical Engg. Peterse & Timmerhaus, McGraw Hil
5. Project Engg. of process plan Rase & Brrow t John Willey & Sons.

Semester-V

Skill Development Components

FPP- 504 SPICES & FLAVOUR TECHNOLOGY

Credits: 4

Learning Objectives:

1. Gain knowledge about the basic types of spices and aromatic herbs
2. The relevant legislation and decrees hygienic and microbiological requirements for seasoning.
3. Acquire skills to distinguish - distinguish the different kinds of spices and a mixture recommend it for specific food applications (bakery and confectionery, meat products, ready meals, beverages, etc.)

Learning Outcomes:

1. Acquiring knowledge and skills in solving problems related to the preservation and use of spices
2. Ability to understand foreign cultures and customs
3. Ability to work independently
4. Professional knowledge
5. Skilled at utilizing and processing information

Unit-I

Introduction

Production and processing scenario of spice and its scope, Production and processing scenario of flavor.

Unit-II

Major Spices

Post-Harvest Technology, Composition, Processed products of spices: Ginger, Chill, Turmeric, garlic, Pepper and Cardamom.

Unit-III

Minor spices

Minor spices, Ajwan, coriander, cumin, cinnamon, fenugreek, garlic, mustard, mace, nutmeg, onion, saffron, tamarind, cloves, mint and asafetida

Unit-IV

Types and sources of flavours

Types of flavours, Sources of flavours (natural, processed and added), Flavour composites (natural, semi-synthetic and synthetic). Flavours production in fermented foods.

Unit-V

Extraction and analysis of flavor components

Extraction of flavours from various sources, conditions and extracting agents.
Analysis of flavours components (Subjective and objective)

Flavors in industries

Formulations of flavours. Flavours of soft drinks, Baking and confectionery industries,
Standard specification of flavours.

Reference Books:

1. Spices – vol. II - Parry J.W.
2. Spice and condiments - Pruthi J.S.
3. Herbs and spices - Rosemary Hemphill
4. The book of spices - Rosen garten, F. and Livingston Jr.
5. Spices and herbs for the Food Inudstry - Lewies, Y.S.
6. Spices Vol. I and II; Tropical Agril. Series - Purseglove, J.W. Brown E.G., Green C.L. And Robbins SRJ.
7. Food Flavourings - P.R. Ashust
8. Food Flavouring composition, - J.Merrory manufacture and uses

FPP – 505: Food Analytical Techniques

Credits-4

Learning Objectives:

At the end of the course, students should:

1. Be familiar with the current state of knowledge on food composition Identify reasons for determining composition and characteristics of food
2. Understand the principles behind analytical techniques associated with food
3. Know methods of selecting appropriate analytical techniques when presented with a practical problem
4. Demonstrate practical proficiency and teamwork in a food analysis laboratory
5. Be able to use library and internet resources pertaining to food analysis

Learning Outcomes:

After attending this course, students should be able to:

1. Provide an integrated picture of the field of food analysis with emphasis on its importance in food industry, governmental agencies and universities.
2. Provide students with an understanding of analytical methods used for measuring the chemical composition of food and the principles behind analytical techniques associated with food.
3. Understand methods for the measurement of the physical properties of food as well as the management systems used by the food industry to ensure consistently high quality products.
4. Describe the main groups of nutrient and non-nutrient chemicals in food
5. Identify those aspects of food composition that are relevant to individuals with special dietary needs

Unit-I

Introduction

Laboratory overview, Rationale for food composition knowledge and food analysis, Food standards and food regulations, Sampling and sample preparation, Statistical evaluation and reporting of analytical data, Scale of analytical measurements

Unit-II

Moisture determination

Factors to be considered when selecting a method for moisture analysis, Over- or under-estimation of the moisture content of a food being tested, Moisture determination by evaporative methods, distillation, and chemical reaction, Direct and indirect moisture methods, Conversion of analytic values from one moisture basis to another

Ash, Vitamins and total mineral analysis

Ash determination by dry and wet digestion, soluble or insoluble ash in acid or water and alkalinity of ash. Analysis of Minerals and vitamins.

Unit-III

Lipid analysis

Factors to be considered when selecting a method for lipid analysis, Sample preparation, Solvent selection, Lipid determination using Soxhlet, Goldfish, Babcock and other methods, Supercritical fluid extraction and accelerated solvent extraction techniques

Unit-IV

Protein analysis

Factors to be considered when selecting a method for protein analysis, Protein content from nitrogen content and conversion factors, Protein determination by Kjeldahl, nitrogen combustion, and colourimetric/spectroscopic methods

Unit-V

Carbohydrate analysis and Calorific value

Carbohydrate diversity and analytical challenges, Carbohydrate by difference, total carbohydrate by phenol-sulfuric acid method, Analysis of simple sugar content, Determination of reducing sugars, Enzymatic determination of starch, Evolution of dietary fibre analysis methodology; determination of selected fibre content (time permitting)

FPP – 506: Project – I

Credits-4

FPP – 507 Lab- Spices & Flavour Technology

Credits-2

1. Extraction of oleoresins-Turmeric, ginger, pepper, clove
2. Steam distillation of spices
3. Detection of microbial quality and adulteration in spices
4. Determination of curcumin content in turmeric
5. Study of standard specification of spices
6. Preparation of curry powder
7. Preparation of Indian Masala for different foods
8. Storage and packaging of spices
9. Storage and packaging of spices
10. Visit to spice industry

FPP – 508 Lab- Food Analytical Techniques

Credits-2

1. Assessment of lab accuracy and precision. includes safety review and chemistry essentials
2. Moisture determination of food samples.
3. Crude fat in ground beef by Soxhlet method
4. Protein determination of food sample by Kjeldahl method
5. Total carbohydrate determination in food beverages
6. Determination of major minerals viz. Ca, P, Fe, etc.
7. Estimation of total ash content
8. Determination of vitamin C content in food samples
9. Estimation of total sugar and reducing sugar in food samples.

Reference Books:

Food Analysis, 4th Edition. S. Suzanne Nielsen (ed.) 2010. Springer. 3rd Edition of same text is also a suitable reference, but 4th edition is preferable.

FPT-509 Lab- Project-I

Credits-2

3. Drying and Dehydrations of fruits and vegetables
4. Fruits and Vegetable Products
5. Beverages and other Innovative Products
6. Spice Products
7. Postharvest management and marketing of Fresh Fruits and Vegetables
8. Egg, Poultry and Meat Processing
9. Bakery Products Grain based Products (Cereal, Legumes/pulses and oilseeds)
10. Chocolate, Confectionary and Snack Products
11. Traditional, Heritage Food Products
12. Milk and Milk products
13. Processing of Fish and Fish Products
14. Functional Foods and Nutraceuticals

Semester-VI

General Education Components

FPP-601: Entrepreneurship Development

Credits-4

Learning Objectives:

1. Students will have a strategic understanding of entrepreneurship and innovation and be able to take into account the relationships between this discipline and other areas of business to make holistic judgments when analyzing business situations.
2. Students will assess the interdependent, fast-changing, and diverse world of entrepreneurship and innovation, as well as global economic/financial interdependencies that signify current geopolitical, economic and financial relationships, to make business decisions that make a difference in the world.
3. Students will demonstrate critical thinking skills, making the intellectual connection between quantitative and qualitative tools, theories and context to properly and effectively solve problems and make decisions, as well as develop new and innovative business opportunities to strategically navigate the complex demands of the current and dynamic national and international business environments.

Learning Outcomes:

- i. Students understand different methods to assess the attractiveness of business opportunities.
- ii. Students understand what characterizes an attractive business opportunity and common pitfalls during the entrepreneurial process.
- iii. Students understand the key risks and the most effective processes in bringing different types of products or services to market.
- iv. Students understand different methods that can be used to minimize uncertainties at different stages of the entrepreneurial process.
- v. Students understand the dynamics of how teams develop and function as well as the various types of conflicts that can arise during teamwork.

Unit – I

Entrepreneurship: Importance and growth, characteristics and qualities of entrepreneur, role of entrepreneurship, ethics and social responsibilities; Entrepreneurship development:

Unit – II

Assessing overall business environment in the Indian economy; Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs; Globalization and the emerging business/entrepreneurial environment; Concept of entrepreneurship, entrepreneurial and managerial characteristics, managing an enterprise, motivation and entrepreneurship development, importance of planning, monitoring, evaluation and follow up, managing competition,

Unit – III

Entrepreneurship development programs, SWOT analysis, generation, incubation and commercialization of ideas and innovations;

Unit – IV

Women entrepreneurship: Role and importance, problems; Corporate entrepreneurship: Role, mobility of entrepreneur.

Unit – V

Government schemes and incentives for promotion of entrepreneurship; Government policy on small and medium enterprises (SMEs)/SSIs; Export and import policies relevant to food processing sector; Venture capital; Contract farming and joint ventures, public-private partnerships; Overview of food industry inputs; Characteristics of Indian food processing industries and export; Social responsibility of business.

Reference Books:

- i. Entrepreneurship Development C.B. Gupta and N.P. Srinivasan S. Chand & Sons, New Delhi. 2012
- ii. Entrepreneurship Development Anil Kumar, S., Poornima, S.C., Mini, K., Abraham and Jayashree, K New Age International Publishers, New Delhi. 2003
- iii. Management: Theory and Practice Gupta, C.B. Sultan Chand & Sons, New Delhi. 2001
- iv. Dynamics of Entrepreneurial Development and Management Vasant Desai Himalaya Publishing House, New Delhi. 2000

FPP -602: Food Safety, Hygiene & Sanitation

Credits- 4

Learning objectives:

- i. Knowledge Capability: This is the understanding of appropriate and relevant
- ii. fundamental and applied scientific knowledge with the ability to use and apply that

Learning outcomes:

On completion of this course, students should be able to:

- i. Identify food safety hazards and their control
- ii. Identify & prevent potential sources of food contamination
- iii. Apply a range of food quality systems
- iv. Prepare a food safety plan

Unit - I

Contamination

Introduction of sources of contamination, Concept of food Safety and Management.

Classification of food according to ease with which it spoils.

Conditions & signs of spoilage in fresh, dry & Preserved food.

Unit - II

Food Born Diseases

Mode of transmission of disease & food born illness, Bacterial & Viral food intoxications, Naturally occurring intoxications, Food allergies, control of food born illness

Unit – III

Personal Hygiene & safety

Necessity for personal hygiene, health of staff,

Personal appearance, sanitary practices habits protective clothing Importance of rest and exercise, Safety at the work place

Unit – IV

Sanitary procedures:

Importance of sanitary procedures in Food processing, Special Food Operations

Introduction, mobile food units, vending machines, street side foods and diseases,

Cleaning procedures – Cleaning & sanitizing , their importance.

Unit – V

Pest control

Importance, Classification of pest, effect of pesticides on pest & their methods of application , precaution to be taken while handling pesticides

Reference Books:

1. Food Hygiene & Sanitation S. Roday
2. Hospitality industry handbook on Hygiene & safety – Lisa Gordomn – Davis
3. Principles of food sanitation – Norman G .Marriott & Gravani
4. Essentials of food sanitation – Norman G .Marriott & Robertson

FPP -603: Waste & By-products Utilization

Credits-4

Learning Objective:

1. This subject is aimed to develop an understanding among the students on
2. Origin and type of waste and by products, waste identification, classification and composition.
3. Need for treatment and utilization. Impact of waste disposal on environment.
4. Food waste water treatments.
5. Legal and statutory requirements for food waste handling, treatment and disposal.

Learning Outcome:

On successful completion of this course, students will be able to;

1. Identify various waste from food industries and understand their characteristics
2. Understand various methods of waste treatment and disposal
3. Understand various by products from food industry waste
4. Design and develop a functional ETP plant to suit requirement.
5. Understand legal aspects related to food waste disposal.

Unit – I

Food industry By-products and Waste: Introduction, status in India, definition, origin and type of waste and by-products, their identification, classification, composition and characterization, need for treatment and utilization, impact on environment, food waste as source of biogenic raw material and energetic utilization.

Unit – II

Introduction to Food Waste treatments, basic unit operations, techniques & equipment for treatment, primary treatments like screening, sedimentation, skimming, floatation coagulation & flocculation, flow equalization, filtration, adsorption, chemical oxidation, membrane separation, ion exchange. Anaerobic & aerobic digestion of organic wastes, activated sludge process, biomass generation & its utilization.

Unit – III

Food Wastes and By-products Related to Specific Processing Industries like fruit and vegetables (apple, orange, mango, potato etc.), dairy industry, oil and oil seeds industry, sugar industry, grains and milling industry, fermentation (alcohol and beer), livestock and poultry, fish, meat.

Unit – IV

Brief Case Studies involving (i) utilization of whey from dairy industry, (ii) Utilization of specific plant by-products for recovery of proteins, pectins, dietary fibres, antioxidants,

colorants etc. (iii) Utilization of biomass for production of animal feed, compost and biogas.

Unit – V

Waste handling and treatment, Farm wastes, Incineration of solid food waste and its disposal. Future Trends, introduction to legal and statutory requirements for food waste handling, treatment and disposal.

Reference Books:

- 1 Waste Management for the Food Industries, by Ioannis S. Arvanitoyannis, First edition 2008, Elsevier Inc, USA.
- 2 Food and Agricultural Wastewater Utilization and Treatment, Sean X. Liu, First edition 2007 Blackwell Publishing, Iowa 50014, USA.
3. Managing Food Industry Waste, ROBERT R. ZALL, First edition, 2004, Blackwell Publishing Professional, Iowa, USA.
4. The Treatment and Handling of Waste by Bradshaw AD Chapman & Hali.
Alternative Strategies for the Treatment of Food Processing Waste by Rockey J.
5. Food Processing Waste Management by Green J.H. AVI Publication 7. Post harvest Technology of Fruits and Vegetables by L.R. Verma. Indus Pub

Semester-VI

Skill Education Component

Semester-VI

FPP-604: Novel Food Processing Technologies

Credit-4

Learning Objectives:

- iii. Provides insightful, first-hand experiences of many pioneering experts involved in the development and commercialization of foods produced by novel processing technologies
- iv. Presents case studies of commercial products preserved with the leading non thermal technologies of high pressure processing and pulsed electric field processing
- v. Features alternative novel techniques, such as dense phase carbon dioxide, ozone, ultrasonics, cool plasma, and infrared technologies utilised in food preservation sectors

Learning Outcome:

- 6. In depth understanding of novel and innovative food sciences and emerging technologies
- 7. Understanding and ability to apply these novel technologies and the underpinning science to preserve and control the nutritional, microbiological and functional properties of foods.
- 8. Ability to apply and adapt novel technologies to real-life innovative products and processes

Unit - I

Principles of high pressure processing (HPP), use of high pressure to improve food safety and stability. Effects of high pressure on food quality, Modeling High Pressure Processing Pressure effects on microorganisms, enzyme, texture and nutrients of food. Modeling HP processes.

Unit - II

Pulsed electric fields processing Historical background, PEF treatment systems, main processing parameters. PEF for processing of liquid foods and beverages, PEF Processing for solid foods.

Unit – III

Food Safety aspects, Mechanisms of microbial and enzyme inactivation by HPP and PEF, Food safety aspects of pulsed electric fields, and high pressure processing.

Unit – IV

Osmotic dehydration, Mechanism of osmotic dehydration, effect of process parameters on mass transfer, determination of moisture and solid diffusion coefficient, application of osmotic dehydration, Athermal membrane concentration, Athermal membrane concentration of liquid foods and colours: osmotic membrane distillation, direct osmosis, membrane modules, Applications of membrane concentration.

Unit – V

Radio frequency electric fields Processing by radio frequency electric fields equipments, RFEF non-thermal inactivation of yeasts, bacteria and spores, electrical costs, Ultrasound processing, Fundamentals of ultrasound, ultrasound as a food preservation and processing aid, effects of ultrasound on food properties, Alternate thermal processing: Microwave heating: dielectric properties of foods, heat and mass transfer in microwave processing, application of microwave processing for foods.

Reference Books:

1. Sun, Da-Wen, Emerging Technologies for Food Processing, Academic Press, 2005
2. Barbosa-Canovas, Tapia & Cano, Novel Food Processing Technologies, CRC Press-2004
3. Ohlsson, Minimal Processing technologies in the food industry, Wood head Publishing Limited, 2002
4. Rao E. S. Food Quality Evaluation. Variety Books. 2013
4. Pomeranz Y and Meloan CE. Food Analysis – Theory and Practice, CBS Publishers and Distributors, New Delhi. 2002.
5. Meilgard, Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999.
6. Amerine, Pangborn & Roessler, Principles of Sensory Evaluation of food, Academic Press, London, 1965.

FPT – 605: Fermentation Technology

Credits-4

Learning Objectives

1. To understand the principles of food fermentation technology
2. To study the types of starters used in Food Industry
3. To study the production of various fermented food

Learning Outcomes:

1. Understanding the various concepts of fermentation;.
2. Knowing the differences between aerobic and anaerobic fermentation and the classification of microorganisms based on their respiratory action.
3. Understanding the growth of microorganism and their role in producing foods and drinks.
4. Isolating and identifying microorganisms from fermenting fruits, cereals and milk;
5. Producing some drinks and foods e.g. bread, beer, wine and vinegar resulting from alcoholic fermentation.
6. Producing some foods and drinks e.g. cheese, butter, yoghurt resulting from acidic fermentation; and design a simple containment system (Bioreactor / fermentor).

Unit I

Introduction and general overview of the course synopsis, Aerobic and Anaerobic respiration, fermentation and Bioprocess technology (Definition and concepts).Types of Bioreactor, design, standards of materials used.

Unit II

Products derived from microbial fermentations, primary metabolites, secondary metabolites and industrially useful enzymes.

Unit III

Classification of microbes according to their respiratory actions (Strict aerobes, anaerobes, fermentative organisms, Pasteur effects.

Unit IV

Principles of microbial growth. Lag phase to death phase. Advantages and Disadvantages of producing organic compounds by Biological rather than chemical means.

Unit V

Industrial products of alcoholic fermentation. Production of Bread, beer, wine, and vinegar. Industrial products of acidic fermentation. Production of cheese, butter, yoghurt. Malolactic fermentation.

Reference Books:

1. Food Microbiology. 2nd Edition By Adams M & Moss, M. 2008. RSC Publishing.
2. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 by Joshi V. K. & Pandey, A., Sanjanya Books 1999.
3. Essentials of Food Microbiology. Edited by John Garbutt. Arnold International Students Edition. 1997
4. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood. Elsevier Applied Science Publication. 1997
5. Principles of Fermentation Technology by Stanbury, P.F., Whitekar A. and Hall. 1995., Pergaman. McNeul and Harvey. (AC) NEW

FPP-606: Lab- Novel Food Processing Technologies

Credits-2

1. Dehydration of the vegetables in microwave oven.
2. Recognition tests for various food flavors.
 3. Osmotic dehydration.
4. Texture evaluation of various baked foods.
5. Texture evaluation of various fruits.
6. Texture evaluation of various blanched foods.
7. Textural measurement of various food products using Texture Analyzer.
8. Measuring the BOD level of the waste water.
9. Measuring the COD level of the waste water.
10. Measuring solid waste and liquid waste from the waste water.
11. Measuring the microbial flora in industrial waste water.

FPT- 607: Lab- Fermentation Technology

Credits: 2

1. Studies on parts of fermentors.
2. Lab scale production of ethyl alcohol from molasses.
3. Studies on Down Stream Processing and Product recovery.
4. Starter cultures.
5. Production of Baker's Yeast
6. Production of yoghurt using DIV cultures
7. Development of a fermented food/drink utilizing plant products /animal products or by-products as substrate

FPT-609: Lab Project-II

Credits-4

1. Drying and Dehydrations of fruits and vegetables
2. Fruits and Vegetable Products
3. Beverages and other Innovative Products
4. Spice Products
5. Postharvest management and marketing of Fresh Fruits and Vegetables
6. Egg, Poultry and Meat Processing
7. Bakery Products
8. Grain based Products (Cereal, Legumes/pulses and oilseeds)
9. Chocolate, Confectionary and Snack Products
10. Traditional, Heritage Food Products
11. Milk and Milk products
12. Processing of Fish and Fish Products
13. Functional Foods and Nutraceuticals

Project Report & Seminar

Project Report The structure of the project report shall be in the format is as follows:

- i) The Cover Page - It should have ☐ Title of the project ☐ Name and address of Group Leader and team members ☐ Name and address of Supervisor/Guide teacher
- ii) Abstract - 500 words
- iii) Contents
- iv) Introduction- Description on background of the study
- v) Aims and Objectives
- vi) Relevance of the project work
- vii) Methodology
- viii) Observations: This shall include the observations during the experiment. Observation can be both qualitative as well as quantitative.
- ix) Data analysis and interpretation: The data generated/ obtained from the experiments/observations should be processed for better understanding in a more structured manner. Tools and methods (e.g. statistical methods) may be used for analysing data to understand the patterns that emerges from it to form results and conclusions.
- x) Results: Results are the output of compilation of the data into meaningful outcomes/ interpretations and sometimes, there is a need to redo the experiments to get consistent results. In case it is not possible to "repeat the experiments", there should be adequate replicates so that adequate data is available for interpretation, and arriving at results.
- xi) Conclusions: This is the logical end of the project to arrive at specific conclusions from the observed phenomena. In a way, the whole objective of the project is to arrive at

some conclusion, either positive or negative which would lead to a better understanding of the problem.

xii) Acknowledgement

xiii) References

Seminar

Seminar on Technical Topic of Food Technology shall be delivered by individual student. The Seminar topic shall be decided by respective Guide/Advisor. Students will be responsible for collection of necessary information, preparation of synopsis and Power Point Presentation and discussion by each student allotted topic. The evaluation of Seminar shall be done by Team of Academic members (at least 3) nominated by Associate Dean & Principal/University.