B.Voc. Degree Course

in

FOOD PROCESSING TECHNOLOGY

under

CREDIT AND SEMESTER SYSTEM AND GRADING

Scheme for the Distribution of Credits, Period of Instruction and Syllabus

AIMS AND OBJECTIVES OF VOCATIONAL EDUCATION

AIM

The University Grants Commission (UGC) has launched a scheme on skills development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.) Degree with multiple exits such as Diploma/Advanced Diploma under the NSQF. The B.Voc. programme is focused on universities and colleges providing undergraduate studies which would also incorporate specific job roles and their NOSs along with broad based general education. This would enable the graduates completing B.Voc. to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

The main objectives of the scheme are:

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.

- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- To provide vertical mobility to students coming out of 10+2 with vocational subjects.

OBJECTIVES OF THE B.Voc. COURSE IN FOOD PROCESSING TECHNOLOGY

- To empower the students with the professional competence and expertise of food processing technology.
- To enable the students to understand food composition and its physicochemical, nutritional, microbiological and sensory aspects.
- To familiarize the students about the processing and preservation techniques of food products.
- To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

ELIGIBILITY

A pass in plus-two (Science group) or equivalent examinations (V.H.S.C.) recognized by the University.

DURATION OF THE COURSE

The course will be a **six semester full time programme** extending **three academic years** consisting of 90 working days of instruction in each semester including examination.

PROGRAMME

The programme is grouped under the Model III - New Generation Courses.

COURSE STRUCTURE

The curriculum is a suitable mix of **General Education** and **Skill Development** components. The General Education components emphasize and offer courses which provide holistic development. The focus of Skill Development components is to equip students with appropriate knowledge, practice and attitude, so as to become work ready. While designing the curriculum of Skill Development components, adequate attention has been given to practical work, industrial visit, internship, development of student portfolios and project work.

COURSE

The diploma **has 26 skill development courses, 20 general education courses, one choice based course, one open course, 6 skill development internships and one skill development project. The total credits is 180 for the entire programme**.

(*One Credit is equivalent to 18 periods of 60 minutes each, for theory, workshops/labs and tutorials. For internship/field work, the credit weightage for equivalent hours shall be 50% of that for lectures/workshops.*)

COURSE CODE

The following methodology is adopted for course codes.

(FPT-Food Processing Technology, HOR- Horticulture, EES-Energy and Environmental Studies, 1-First Semester, S-Skill Development, 1T-First Theory Paper, 2T- Second Theory Paper, P-Practical, G-General Education, I-Internship / training.)

EXAMINATIONS

The evaluation of each course shall contain two parts such as internal or In-Semester Assessment (ISA) and External or End-Semester Assessment (ESA). The external examination of all semesters shall be conducted at the end of each semester. Internal evaluation is to be done by continuous assessment. The ratio between internal and external examinations shall be 1:4. There shall be a maximum of 80 marks for external evaluation and maximum of **20** marks for internal evaluation. For all courses (theory & practical), grades are given on a 07-point scale based on the total percentage of marks. ***(ISA+ESA)*** as given below.

Percentage of Marks	Grade	Grade Point
90 and above	A+ - Outstanding	10
80-89	A - Excellent	9
70-79	B - Very Good	8
60-69	C - Good	7
50-59	D - Satisfactory	6
40-49	E - Adequate	5
Below 40	F - Failure	4

Note: Decimal are to be rounded to the next whole number

Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

For all courses without practical

a) Marks of external Examination : 80

b) Marks of internal evaluation : 20

Components of Internal Evaluation	Marks
Attendance	**5**
Assignment /Seminar/Viva	**5**
Test paper(s) **(1 or 2)** **(1x10=10; 2x5=10)**	**10**
Total	**20**

For all courses with practical

a) Marks of theory –External Examination : 60

b) Marks of theory –Internal Evaluation : 10

Components of Theory – Internal Evaluation	**Marks**
Attendance	**3**
Assignment	**2**
Test paper(s) **(1 or 2)** **(1x5=5; 2x2.5=5)**	**5**
Total	**10**

c) Marks of Practical –External Examination : 40

d) Marks of Practical- Internal Evaluation : 20

Components of Practical- Internal evaluation	**Marks**
Attendance	4
Record	10
Lab involvement	6
Total	**20**

Attendance Evaluation

1) **For all courses without practical**

% of attendance	Marks
90 and above	5

85 – 89	4
80-84	3
76-79	2
75	1

2) For all courses with practical

% of Attendance	**Marks for theory**
90 and above	3
80--89	2
75--79	1

% of Attendance	**Marks for practical**
90 and above	4
85--89	3
80--84	2
75--79	1

Assignments

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester.

Project Evaluation: (Max. marks100)

Components of Project-Evaluation	Marks
Internal Evaluation	20
Dissertation (External)	50
Viva-Voce (External)	30
Total	**100**

Credit point and Credit point average

Grades for the different Semesters and overall Programme are given based on the corresponding CPA, as shown in below

Credit point (**CP**) of a Course is calculated using the formula

$CP = C \times GP$**, where C = Credit; GP = Grade Point**

Credit Point Average (**CPA**) of a Semester or Programme etc. is calculated using the formula

CPA = $\frac{TCP}{TC}$**, where TCP = Total Credit Point;**

TC = Total Credit

CPA	Grade
above 9	A+ - Outstanding
above 8 but ≤ 9	A - Excellent
above 7 but ≤ 8	B - Very Good
above 6 but ≤ 7	C - Good
above 5 but ≤ 6	D - Satisfactory
above 4 but ≤ 5	E - Adequate
≤ 4	F - Failure

DETAILED SYLLABUS

CORE COURSE

SEMESTER – I

FPT1S1T- BASIC PRINCIPLES OF FOOD PROCESSING

Credit: 4 **72 Hrs**

Objectives

- To deliver a sequence of steps to produce an acceptable and quality food product from raw materials.
- Study of scientific and technological advancements in food processing.

Module 1- Classification of Food **15 Hrs**

Definition of food, classification of foods- based on origin, pH, nutritive value, functions of food, Health food, ethnic food, organic food, functional food, nutraceuticals, fabricated foods, convenience foods, GM food and space foods.

Module 2-Fundamentals of Food Processing **15 Hrs**

Steps involved in converting a raw harvested food materials to a preserved product with sound quality- harvesting, storage, manufacturing, preservation, packaging, distribution and marketing.

Module 3- Post Harvest Management **12 Hrs**

Chemical, enzymatic, physical and biological deterioration, implications and prevention.

Module 4-Ethnic Foods and its Processing **15 Hrs**

Banana products- banana puree, banana chips, banana powder, Banana figs, banana flour; Tapioca products- Tapioca chips, tapioca powder; Fermented Products- Dosa, Idli, Appam, Vada.

Module 5-Processing of Modern Foods **15 Hrs**

Pasta, Macaroni, Noodles, Mayonnaise, Salad Dressing, Margarine, Potato wafers, Potato chips, Corn flakes, Pop corn.

Text Books:

1. Brian E. Grimwood, Coconut Palm Products: Their Processing in Developing Countries, 1979.
2. Hui, Y H and Associate Editors; Hand Book of Food Products Manufacturing Vol I, Wiley- Interscience, New Jersey 2007.
3. Hui, Y H and Associate Editors; Hand Book of Food Products Manufacturing Vol II, wiley- Interscince, New Jersey 2007.
4. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
5. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
6. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

FPT1S2T- BASIC PRINCIPLES OF FOOD PRESERVATION

Credit: 4 **72 Hrs**

Objectives

- To enable the students to acquire knowledge on different preservation techniques used to enhance the shelf span of food product.
- To study the different mode of spoilage in foods and minimize the contamination by different preservation technology.

Module 1- Food Spoilage **10 Hrs**

Food spoilage- definition, types of spoilage- physical, chemical and biological.

Module 2- Basic Principles of Food Preservation **10 Hrs**

Definition, principles and importance of food preservation, general classification on the methods of food preservation, class I and class II preservatives, combination of preservatives, preservation by irradiation and fermentation.

Module 3- Preservation by use of High Temperature **12 Hrs**

Pasteurization, sterilization, canning- history and steps involved, types of cans and bottles. Spoilage encountered.

Module 4- Preservation by use of Low Temperature **20 Hrs**

Refrigeration- Advantages, mechanism of refrigeration factors to be considered during chilling, difference between refrigeration and freezing, methods of freezing, steps involved in freezing, types of freezing, common spoilage during freezing.

Module 5- Preservation by Removal of Moisture **20 Hrs**

Drying and dehydration-merits and demerits, factors affecting drying, preparation of food for drying, Freeze drying, dehydrofreezing-advantages, mechanism of freeze drying and dehydrofreezing, Concentration, principles and types of concentrated foods.

Text Books:

1. Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.
2. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
3. Potter, N.N. and Hotchkiss J. H. Food Science. CBS publishers and distributors. 1996.
4. Srivastava, R.PO and Kumar, S. Fruit and vegetable preservation, International Book distribution Company, Lucknow, 1994.
5. MC.Williams, M and Paine, H. Modern Food preservation. Surjeet Publications, Delhi, 1984.
6. Cruess, W.V. Commercial fruits and vegetable products, Anees Offset press, New Delhi.

FPT1S3T- FOOD CHEMISTRY

Credit: 4 **72 Hrs**

Objectives

- To acquaint various functional chemical constituents of food.
- To build a relationship between the dynamic forces of food and the dynamic forces of digestion and growth.

Module 1- Introduction **10 Hrs**

Introduction to chemistry of foods composition and factors affecting foods, chemistry of water, water activity, moisture determination.

Module 2- Carbohydrates **20 Hrs**

Properties and classification, starch, cellulose, pectic substances, enzymes and its use in foods, gel formation and starch degradation, dextrinization, Browning reactions – Enzymatic & Non-enzymatic browning.

Module 3 –Proteins **15 Hrs**

Classification, physical and chemical properties of proteins and amino acids, confirmation, functional properties, hydrolysis of proteins, changes of proteins during processing.

Module 4-Oils and Fats **15 Hrs**

Classification, composition, physical and chemical properties, hydrolysis, hydrogenation, rancidity and flavor reversion, winterization, refining of oils, rendering, emulsions.

Module 5- Vitamins & Minerals **12 Hrs**

Classification- Fat soluble & water soluble, structure, sources, functions, causes for losses of vitamins in foods, bioavailability. Minerals, classifications, sources, functions.

Text books:

1. Campbell, M K and Farrell, S O-Biochemistry 5th edition-international student, 2006
2. Damodaran,S., Parkin , K L.,Fennema, O R., Fennema's Food Chemistry- 4th edition, CRC press Taylor and Francis Group, New York 2008.
3. Fennema, O R. -Food Chemistry 3rd edition, Marcel Dekker Inc, New York., 1996.
4. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
5. Meyer, L H-Food Chemistry. CBS publishers & distributors, New Delhi. 2002
6. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
7. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

FPT1S3P- FOOD CHEMISTRY- Practical

Credit: 2 **36 Hrs**

Objectives

- To test the presence of carbohydrates and proteins in food samples.
- To estimate the nutrients in different food samples.

1. **Standardization of Solutions** **5 Hrs**
    - Standardization of Fehling's solution.
    - Standardization of Sodium hydroxide with standard oxalic acid.
2. **Estimation of Sugar Solutions** **14 Hrs**
    - Estimation of Glucose by Lane and Eynon's method.
    - Estimation of Sucrose by Lane and Eynon's method.
    - Estimation of Aldose by Willstalter's Iodometric titration
    - Estimation of starch.
3. **Estimation of Protein** **7 Hrs**
    - Kjeldhal method.
    - Biuret method
    - Lowry's method
4. **Estimation of Vitamin.**
    - Estimation of vitamin C
5. **Qualitative Test** **4 Hrs**
    - Qualitative tests for carbohydrates
    - Qualitative tests for proteins. **6 Hrs**

Text books:

1. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003
2. Sadasivam,S. Manickam, A. Biochemical Methods, 2nd edition. New Age International (P) Limited, New Delhi. 2001

ENCN1- Communication Skills in English

(Adopted from existing M. G. University Syllabus)

Credits: 6 **90 Hrs**

Objectives

- To introduce the students to the speech sounds of English in order to enable them to listen to English and speak with global intelligibility.
- To enable the students to speak English confidently and effectively in a wide variety of situations.
- To help the students to improve their reading efficiency by refining their reading strategies.

Module 1– I Speech Sounds **18 Hrs**

Phonemic symbols - Vowels - Consonants - Syllables - Word stress - Stress in polysyllabic words – Stress in words used as different parts of speech - Sentence stress – Weak forms and strong forms – Intonation – Awareness of different accents: American, British and Indian – Influence of the mother tongue

Module 2 - Listening **18Hrs**

Active listening – Barriers to listening – Listening and note taking– Listening to announcements – Listen-ing to news on the radio and television

Module 3 Speaking **36 Hrs**

Word stress and rhythm – Pauses and sense groups – Falling and rising tones – Fluency and pace of deliv-ery – Art of small talk – Participating in conversations – Making a short formal speech – Describing people, place, events and things – Group discussion skills and telephone skills.

Module 4 Reading **18 Hrs**

Reading: theory and Practice – Scanning - Surveying a textbook using an index - reading with a purpose – making predictions – Understanding text structure – Locating main points – Making inferences - Reading graphics - reading critically – Reading for research.

Text books:

1. V.Sasikumar, P Kiranmai Dutt and Geetha Rajeevan, . Communication Skills in English. Cambridge University Press and Mahatma Gandhi University.

2. A Course in Listening and Speaking I & II, Sasikumar, V.,Kiranmai Dutt and Geetha Rajeevan, New Delhi: CUP, 2007.

3. Study Listening: A Course in Listening to Lectures and Note-taking Tony Lynch New Delhi: CUP.

4. Study Speaking: A Course in Spoken English for Academic Purposes. Anderson, Kenneth, Joan New Delhi: OUP, 2008.

5. Study Reading: A Course in Reading Skills for Academic Purposes, Glendinning, Eric H. and Beverly Holmstrom New Delhi: CUP, 2008.

6. Communication Studies. Sky Massan Palgrave, Macmillan. Effective Communication for Arts and Humanities Students Joan Van Emden and Lucinda Becker Palgrave Macmillan.

7. Effective Communication for Arts and Humanities Students Joan Van Emden and Lucinda Becker Palgrave Macmillan.

SEMESTER-2

FPT2S1T- FOOD ADDITIVES

Credit: 4 **72 Hrs**

Objectives

- To attain knowledge regarding the use of additives in the food industry, laws related to food additives and to prevent the involuntary infringement of analytical procedures.

Module 1- Introduction **10hrs**

Food additives, definition, objectives, functional classification, natural and synthetic additives, health and safety aspects of food additives

Module 2- Major Food Additives **15hrs**

Preservatives- class I&II, antioxidants, Sweetners- natural and artificial, permitted food colours- natural and artificial, Food flavours – natural and artificial, Stabilizers and thickeners

Module 3- Minor Food Additives **20hrs**

Aerating agents, Antistaling agents, Bodying agents, Clouding agents, Curing agents, Clarifiers, Dietary supplements, Dietary fibre, Emulsifiers, Enzymes, Fat replacers, Leavening agents, Surfactants, Tenderizers, Texurizers, Thickners, Viscosity modifiers, Whipping agents

Module 4- Food Laws and Standards **15hrs**

Food standards - Voluntary and mandatory food laws and Food Safety and Standards Act of India, 2006

Module 5- Permitted Levels **12hrs**

Permitted level of food additives, present status of various food additives, controversial food additives, GRAS

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Meyer, L H-Food Chemistry. CBS publishers & distributors, New Delhi. 2002.
3. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
4. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

FPT2S2T- BASIC PRINCIPLES OF FOOD ENGINEERING

Credit: 4 **72 Hrs**

Objectives

- Students will be able to apply material balances and energy balances to the field of food engineering.
- Students will be able to understand equipment used in the food industry.

Module 1- Engineering Units **12hrs**

Dimensions – Primary, secondary, engineering units- Base units, derived and supplementary units System – state of system, extensive properties, intensive properties.

Module 2- Heat Transfer in Food Processing **20hrs**

Modes of heat transfer -conductive heat transfer, convective heat transfer, radiation heat transfer Systems for heating and cooling food products, plate heat exchanger, tubular heat exchanger, scraped surface heat exchanger, steam infusion heat exchanger.

Module 3- Mechanical Operations **15hrs**

Mixing-different type of mixers used in food in industry, Clarification and concentration process- evaporation, diffusion concentration.

Module 4- Mechanical Separation **15hrs**

Ssedimentation, centrifugation, distillation, Filtration- batch filtration, continuous filtration, ultra filtration, reverse osmosis.

Module 5- Irradiation **10hrs**

Definition, principle, advantages and disadvantages, application of radiation in food industry, doses, effect of radiation in food- direct and indirect.

Text books:

1. Dincer, I. Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA. 1997.
2. Heldman, D. R. and Lund, D.B. Handbook of Food Engineering 2nd edition. CRC press, Newyork. 2007.

3. Singh, R.P. Introduction to Food Engineering 3rd edition. Academic Press, London. 2004

FPT2S3T- BASIC MICROBIOLOGY

Credit: 4 **72 Hrs**

Objectives

- Acquire an elementary knowledge about micro organisms.
- Develop an understanding of industry and in maintenance of health.

Module 1- Introduction to microbiology **15 Hrs**

Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa & algae.

Module 2- Microbial Growth **12 Hrs**

Growth curve, Effect of pH, Water activity, O_2 availability & temperature on the growth of microorganisms.

Module 3- Cultures and Media **15 Hrs**

Different type of media- Selective media and differential media; Preparation of media- PDA media, Nutrient agar, Mac Conkey agar, Culturing techniques- Spread plate and streak plate, pour plate.

Module 4- Beneficial microorganisms **15 Hrs**

SCP- Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP Micro organisms of industrial importance, biomass, fermentation, enzymes & hormones, Antibiotics & vaccines, Microorganisms & effluent treatment

Module 5- Food Borne Diseases **15 Hrs**

Food intoxication- Staphylococcal intoxication, botulism, Food infection- Salmonellosis, Clostridium perfringens, Bacillus cereus gastroenteritis, E. coli infection and others

Text books:

1. Frazier, W.C. Food Microbiology. 4th edition. Mc Graw Hill. New York, 2008
2. Khetarpaul, N. Food microbiology, Daya publishing house, New Delhi, 2009
3. Narayanan, L.M. and Mani,L. Microbiology.Saras Publications, Nagercoil.

4. Pelzar, H.J. and Rober, D. Microbiology 5th edition Mc Graw Hill. NewYork, 2009
5. Prescott, L.M., Harley, J.P. and Klein, D.A. Microbiology. 4th edition McGraw-Hill, NewYork. 1999

FPT2S3P- BASIC MICROBIOLOGY PRACTICAL

Credit: 2 **36 Hrs**

Objectives

- To study the basic rules and requirements of a microbiology laboratory.
- Give emphasis towards the preparation of biological stains, reagents, media and their composition.
- To get thorough different methods for staining of microorganisms.

Module-1 Microbiology laboratory basic rules and requirements 4 Hrs

Laboratory rules- basic rules of a microbiology lab, basic requirements of a microbiological lab- common glass ware; test tube, culture tube and screw capped tubes, Petri dish, pipette, Pasteur pipette, glass spreader, inoculation needle, Bunsen burner, water bath, autoclave, laminar air flow, incubator, hot air oven, Quebec colony counter, centrifuge, microscope. Disposal of laboratory waste and culture.

Module 2 Staining of microorganisms 11 Hrs

Methods for detection of specific bacteria: wet mount preparation for motile bacteria, hanging drop mount method, Methods for staining of micro organism: Simple staining (Monochrome staining) Gram staining for differentiation of bacteria Negative staining of bacteria Endospore staining.

Module-3 Composition, preparation and sterilization of media 7 Hrs

PDA media Nutrient agar media Mac-Conkey agar media

Module-4 Demonstration of techniques for pure culture of microorganisms 5 Hrs

Streak plate method, Pour plate method, Serial dilution agar plate method.

Module -5 Microbiology of milk: enzymatic test of milk by methylene blue reductase test, quality testing of milk by resazurin test, determination of phosphatase activity of milk, detection of mastitis through milk test.

Microbiology of Meat, Fish, Fruit, Egg, Vegetable, Canned Food, Spices 9 Hrs

Text Books:

1. Dubey, R.C. and Maheshwari, D.K. Practical microbiology. S.Chand and Company Limited, Ramnagar. New Delhi 2002.

ENCN2 - Critical Thinking, Academic Writing and Presentation

(Adopted from existing M. G. University Syllabus)

Credits: 6 **90 Hrs**

Objectives

- To make the students aware of the fundamental concepts of critical reasoning and to enable them to read and respond critically, drawing conclusions, generalizing, differentiating fact from opinion and creating their own arguments.
- To assist the students in developing appropriate and impressive writing styles for various contexts.
- To help students rectify structural imperfections and to edit what they have written.
- To equip students for making academic presentations effectively and impressively.

Module 1 Critical Thinking **18 Hrs**

Introduction to critical thinking – Benefits - Barriers – Reasoning—Arguments - Deductive and inductive arguments – Fallacies - Inferential comprehension- Critical thinking in academic writing - Clarity - Accu-racy – Precision - Relevance

Module 2 Research for Academic Writing and the Writing Process **18 Hrs**

Data collection - Use of print, electronic sources and digital sources—Selecting key points - Note making, paraphrasing, summary – Documentation - Plagiarism – Title – Body paragraphs - Introduction and con-clusion – Revising - Proof-reading

Module 3 Accuracy in Academic Writing **18 Hrs**

Articles - Nouns and prepositions - Subject-verb agreement - Phrasal verbs—Modals - Tenses - Condition-als – Prefixes and suffixes – Prepositions—Adverbs – Relative pronouns - Passives - Conjunctions - Em-bedded questions - Punctuation – Abbreviations

Module 4 Writing Models **18 Hrs**

Letters - Letters to the editor - Resume and covering letters - e-mail—Seminar papers - Project reports - Notices - Filling application forms—Minutes, agenda - Essays

Module 5 Presentation Skills **18 Hrs**

Soft skills for academic presentations - Effective communication skills – Structuring the presentation - Choosing appropriate medium – Flip charts – OHP - PowerPoint presentation – Clarity and brevity - Inter-action and persuasion - Interview skills –Group Discussions

Text books:

1. Marilyn Anderson, Pramod K Nayar and Madhucchandra Sen. Critical Thinking, Academic Writing and Presentation Skills. Pearson Education and Mahatma Gandhi University.

SEMESTER-3

FPT3S1T- FOOD PROCESSING MACHINERIES

Credit: 4 **72 Hrs**

Objectives

- To study the design of food process and food plant design, based on the established chemical process designed.
- To discuss the various processing equipment on the basis of unit operations of mechanical processes.

Module 1-Design and selection of food processing equipment **15 Hrs**

Materials of construction-metals, steel, stainless steels, aluminium, copper, plastic, and glass, Fabrication of equipment-strength of construction, Fabrication and installation of equipment, hygienic design of food processing equipment

Module-2-Mechanical processing equipment **12Hrs**

Size reduction- cutting, crushing and grinding, size enlargement-agglomeration, homogenization-pressure homogenization, colloid mills, ultrasonic homogenizers, forming-extrusion and forming equipment

Module-3-Thermal Processing Equipment **15 Hrs**

Canning-basic canning operations, batch sterilizers-still retorts, batch rotary sterilizers, crateless retorts, retorts for glass and flexible containers, continuous flow sterilizers-direct heating and indirect heating

Module 4-Refrigeration and Freezing Equipment **15 Hrs**

Refrigeration –refrigeration cycle, compressors, evaporators, condensers, cooling equipment, hydrocooling, vacuum cooling, surface contact cooling, tunnel cooling, vacuum cooling freezing-air freezing, cold surface freezing, liquid freezing

Module 5-Food Dehydration Equipment **15 Hrs**

Principles of drying, commercial food drying equipment-sun dryers, solar dryers, bin, silo and tower dryers, tray/cabinet dryers, tunnel dryers, rotary dryers, drum dryers, spray dryers, vacuum and freeze dryers

Text books:

1. Dincer, I. Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA. 1997.
2. Heldman, D. R. and Lund, D.B. Handbook of Food Engineering 2nd edition. CRC press, Newyork. 2007.
3. Singh, R.P. Introduction to Food Engineering 3rd edition. Academic Press, London. 2004.
4. Saravacos,G D and Kostarapoulos A E.Handbook of Food Processing Equipment.2006.Brijbasi Art Press Ltd,New Delhi.

FPT3S2T- BAKERY AND CONFECTIONERY TECHNOLOGY

Credit: 4 **72 Hrs**

Objectives

- To highlight the processing methods used in confectionary and culinary industries

Module 1- Manufacture of Sugar **12 Hrs**

Sugarcane, gur, khandasari sugar, raw sugar, refined sugar, white sugar, beet sugar.

Module 2- Classification of confectionery **15 Hrs**

Sugar boiled confectionery- crystalline and amorphous confectionery, rock candy, hard candy, lemon drop, china balls, soft candy, lollypop, marshmellows, fondant, fudge, cream, caramel, toffee, lozenges, gumdrops, honeycomb candy.

Module 3- Cocoa processing **15 Hrs**

Processing of cocoa, manufacture of chocolate- conching, enrobing, milk chocolate, white chocolate, dark chocolate, cocoa butter, wafer coated chocolate, fat bloom, cocoa powder.

Module 4-Bread manufacturing **15 Hrs**

Ingredients, role of ingredients, dough development, molding, proofing, knock-back, baking, packing.

Module 5- Cake & Biscuit **15 Hrs**

Processing of cake and biscuit- Ingredients, role of ingredients, development of batter, baking, packing.

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000
3. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

FPT3S3T- FOOD ANALYSIS AND ADULTERATION TESTING

Credit: 4 **72 Hrs**

Objectives

To enable the students

- To understand different sampling techniques employed in chemical analysis of foods.
- To learn various chemical methods of food analysis.
- To be familiar with adulteration test used for quality control

Module 1- Introduction to food analysis **10 Hrs**

Proximate principles and analysis of food, official methods of analysis.

Module 2- Sampling techniques **15 Hrs**

Population and sampling, importance of sampling, types of sampling, sampling plan, preparation of samples, problems in sampling.

Module 3- Chemical analysis of moisture, carbohydrates and protein **20 Hrs**

Moisture assay – oven drying methods, Karl Fischer titration, Toluene distillation method

Carbohydrate- starch, crude fiber Protein- Kjeldhal method, Biuret method, Lowry's method.

Module 4- Chemical analysis of fat, vitamin C and minerals **15 Hrs**

Fat- soxhlet method, gerber method. Analysis of vitamin C. Estimation of minerals by ashing - dry, wet and low temperature plasma ashing.

Module 5- Food adulteration **12 Hrs**

Definition, classification – intentional & incidental, health hazards caused by various adulterants and the critical level of metals in various foods, common adulterants in food and their testing.

Text books:

1. Kalia, M. Food Analysis and Quality Control. Kalyani Publishers, New Delhi. 2002.
2. Winton, A.L and Winton, K.B. Techniques of food analysis. Allied Scientific Publishers, New Delhi. 1999.
3. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003.
4. Connell, J.J. Control of fish quality. Blackwell Scientific Publications, Cambridge. 2000.
5. PFA ACT.

FPT3S4P- FOOD PRODUCT DEVELOPMENT –PRACTICAL

Credit: 2 **36 Hrs**

Objectives

- To learn various processing aspects of food products having economic importance

1.	Manufacture of bread, biscuit and different types of cake.	8 Hrs
2.	Manufacture of different milk products.	6 Hrs
3.	Manufacture of jack fruit products.	8 Hrs
4.	Preparation of mayonnaise.	3Hrs
5.	Preparation of peanut butter.	4Hrs
6.	Preparation of potato chips and tapioca chips.	2 Hrs
7.	Preparation of RTS.	2 Hrs
8.	Preparation of new product development.	3 Hrs

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

2. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
3. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

FPT3S5T- FATS AND OIL PROCESSING TECHNOLOGY

Credit: 4 **72 Hrs**

Objectives

To enable the students

- To understand various aspects of oil processing technology employed in food industry.
- To learn various chemical and packaging of oils.

Module1- Introduction **12 hrs**

Fats and oils, classification, properties, uses in food industry, shortenings, recent processing techniques.

Module 2- Processing of oil **15hrs**

Steps involved in oil processing, oil extraction, methods of oil extraction, oil refining, hydrogenation, winterization, deodorizing, bleaching.

Module 3- Oil extraction from oil seeds **10hrs**

Major and minor oil seeds, sources, examples, Extraction of oil from oil seeds, hydrogenated vegetable oils, margarine.

Module 4- Fat Characterization **20hrs**

Importance of fat analysis, refractive index, melting point, solid fat index, cold test, smoke, flash and fire points, iodine value, saponification number, acid value and free fatty acids, polar components in frying fats, lipid oxidation, peroxide value, Thiobarbituric acid test, Schaal Oven test, active oxygen method.

Module 5- Packing and storage **15hrs**

Packing, packaging materials, factors to be considered during packing, antioxidants, storage.

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Meyer, L H-Food Chemistry. CBS publishers & distributors, New Delhi. 2002

3. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
4. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003
5. Lawson, G. L, Food oils and fats
6. Fereidoon Shahidi, Functional properties of proteins and lipids
7. Clyde, E. Stauffer, Fats and oils

FPT3S6T- CEREALS AND PULSES TECHNOLOGY

Credit: 4 **72 Hrs**

Objectives

- To give a general outline about the principles, structure and composition, economic importance and storage of different cereals, pulses and their products

Module 1- Rice **15 Hrs**

Cereal grain structure, composition of rice, Processing- Milling, parboiling– Avorio process, conversion process, Malek process and Fernandez process and its advantages, by-products of cereals– starch, gluten, dextrose, dextrin, bran, broken grains, parched rice, puffed rice, flaked rice, popped rice, hulls, rice pollards, bran oil, germ and germ oil, husk, straw.

Module 2- Wheat **15 Hrs**

Classification of wheat, structure and composition, Harvesting and storage: Harvesting the grain, cleaning the grain and storage, wheat milling, wheat products: whole wheat flour, maida, semolina, macaroni products and its method of preparation: macaroni, spaghetti and vermicelli.

Module 3- Millets **15 Hrs**

Corn- types of corn, structure and composition, nutritive value, processing of corn: dry milling, wet milling and alkali processing, products of corn: degerminated flour, corn germ oil, pop corn, corn starch. Jowar, Ragi, Bajra and Rye: Nutritive value and processing.

Module 4- Breakfast cereals **12 Hrs**

Definition, Nutritive value of breakfast cereals, and classification of breakfast cereals: uncooked breakfast cereals and ready to eat cereals: processing of ready –to-eat cereals (Batch cooking, continuous cooking and extrusion cookers) and products (flaked cereals, puffed cereals, shredded products, granular products).

Module 5- Pulses **15 Hrs**

Introduction, composition, processing, utilization of pulses, toxic constituents of pulses, important pulses- Bengal gram, red gram, black gram, green gram, moth bean, lentil, horse gram, field bean, pea, khesari dhal, cluster bean, cow pea, kidney bean, soyabean- processing, fermented products of soyabean.

Text books:

1. David Dendy A.V, etal; Cereals and Cereal Products: Technology and Chemistry, -2000
2. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
3. Potter, N.N. and Hotchkiss J. H. Food Science. CBS publishers and distributors. 1996.
4. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
5. Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.

SEMESTER – 4

FPT4S1T- DAIRY TECHNOLOGY

Credit: 4 **72 Hrs**

Objectives

- To know the importance of milk as an agricultural commodity
- To be innovative in exploring various traditional and nontraditional milk products

Module 1- Introduction **12 Hrs**

Definition, different sources of milk and their composition, factors affecting composition of milk. Physio-chemical properties of milk constituents. Microbiology of milk, Collection and transportation of milk. Grading of milk.

Module 2- Milk Processing **15 Hrs**

Pasteurized milk, Sterilized milk, Homogenized milk, Flavored milk, frozen concentrated milk, Fermented milk, Reconstituted milk, Recombined milk, Toned and double toned milk, Vitaminised/ Irradiated milk, milk powder.

Module 3- Butter and cream **15 Hrs**

Definition, classification, composition and nutritive value, method of manufacture, packaging & storage. Uses of butter and its defects.

Module 4- Cheese, Ice cream and condensed milk **15 Hrs**

Cheese: definition, classification, composition and nutritive value, Manufacture of cheddar cheese and cottage cheese, defects in cheese, their causes and prevention, uses of cheese.

Ice-cream: Definition, composition and nutritive value, role of constituents, method of manufacture & storage. Uses of ice-cream, defects in ice-cream Condensed& Evaporated milk- processing.

Module 5- Indigenous Dairy Products **15 Hrs**

Fat rich products- Ghee, Makkan and Malai.Concentrated Products- Khoa, Rabri and Basundi.Coagulated Products- Chhana and Paneer.Fermented Products- Dahi , Chakka, Shrikhand and Lassi.Frozen Products- Kulfi and Kulfa. Sweet dairy products - Gulab Jamun and Rasagulla.

Text books:

1. Godbole, N.N; Milk – The Most Perfect Food ; Biotechnology books, 2007
2. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
3. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
4. Spreer E and Mixa, A; Milk and Dairy Product Technology; Marcel Dekker, 2005
5. Srilakshmi, B. Food Science (3^{rd} edition), New Age International (P) Limited Publishers, New Delhi, 2003.
6. Sukumar De; Outlines of dairy technology; Oxford University Press; 2001
7. Walstra A, Geurts T.J and Noomen, A; Dairy Technology – Principles of milk and Properties and Processes; Marcel Dekker, 2005

FPT4S1P- DAIRY TECHNOLOGY- PRACTICAL

Credit: 2 **36 Hrs**

Objectives

- To analyze the chemical constituents of milk as an agricultural commodity
- To be innovative in exploring various traditional and nontraditional milk products

1. **Analysis of milk** **15 hrs**
    - Estimation of acidity
    - Estimation of lactose
    - Estimation of protein by Sorenson formol titration
    - Estimation of milk fat
    - Adulteration testing- starch, cane sugar, water
2. Processing of ice cream **6 Hrs**
3. Manufacture of paneer **3 Hrs**
4. Manufacture of Rasogulla **6 Hrs**
5. Processing of gulab jamun **6 Hrs**

Text books:

1. Godbole, N.N; Milk – The Most Perfect Food; Biotechnology books, 2007.
2. Kalia, M. Food Analysis and Quality Control. Kalyani Publishers, New Delhi. 2002. Winton, A.L and Winton, K.B. Techniques of food analysis. Allied Scientific Publishers, New Delhi. 1999.
3. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003.
4. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
5. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.

FPT4S2T- MEAT FISH AND POULTRY PROCESSING TECHNOLOGY

Credit: 4 **72 Hrs**

Objectives

- To provide an extensive description of meat, fish and poultry processing
- To introduce the latest technologies , manufacturing processes and tools for effective control of safety and quality during processing.

Module 1- Meat Processing **15 Hrs**

Basic meat science: Chemical composition & structure of meat, Post-mortem changes in muscle & meat quality Classification, Meat preservation- chilling, freezing, curing, salting, pickling, smoking and canning. Abattoir practices.

Module 2- Fish Processing **15 Hrs**

Composition of fish, Preservation of fish by drying, salting and smoking, Chilling and freezing of fish and seafood, application of freezing system in fish processing- IQF method, Canning of fish and fish products, Packaging.

Module 3- Egg Processing **12 Hrs**

Egg formation and structure, composition, preservation: Refrigeration, drying and freezing. Egg quality parameters: interior and exterior. By-products and waste utilization.

Module 4- Poultry Processing **15 Hrs**

Poultry composition, classification, slaughtering techniques, preservation of poultry meat, Byproducts and waste utilization

Module 5- Quality Control in Meat and Fish **15 Hrs**

Meat**:** Test for assessment of raw meat-TVN, FFA, PV, Nitrate & nitrite in cured meat, Establishment of HACCP in meat industry. Fish: Quality assurance in sea food processing: GMP, HACCP, ISO 9000.

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
3. Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.

4. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003
5. Warriss P. D, Meat Science: An Introductory Text, Cambridge university press – 2010

FPT4S3T- FRUIT AND VEGETABLE PROCESSING TECHNOLOGY

Credit: 4 **72 Hrs**

Objectives

- To acquire knowledge about the selection of fruits for processing and value addition
- To introduce the latest technologies , manufacturing processes and tools for effective control of safety and quality during processing

Module 1- Introduction **12 Hrs**

Ripening and quality of fruits, harvesting and transportation, cold storage of fruits, selection and preparation of fruits for processing, deskinning, enzyme inactivation, packing and processing. Various fruit products- frozen whole fruits, slices, cubes, canned fruits, dehydrated fruits, fruit preserves, candied fruits.

Module 2- Processing of juice, jam and jelly **15 Hrs**

Fruit juice manufacture, Canning of fruit juices, freezing of fruit pulps. Asceptic processing of fruit juices. Packaging of asceptically processed juices and pulps. Concentrated fruit juices. Manufacture of jams. Theory of jelly formation, ingredients. Machinery. Jellies, marmalades, squashes, cordials, syrups, specifications.

Module 3- Processing of tomato, apple and orange **15 Hrs**

Tomato juice, canned whole tomatoes, tomato ketchup, tomato jams, tomato puree, tomato powder. Apple and apple product- Clarified apple juice, aseptically packed apple puree, apple cider, orange products- orange juice, concentrated orange juice, orange squash, orange jams.

Module 4- Processing of pineapple and mango **15 Hrs**

Pineapple products- juice, jam, canning Mango and mango products- raw unripe mango products: brined mango slices, dried green mango slices and powder (Amchur), canned mango slices in syrup, canned or frozen mango pulp, mango juice or mango nectar, mango jam, mango squash, mango juice powder, mango freeze dried products, mango syrup.

Module 5- Processing of vegetables **15 Hrs**

Processing of okra (ladies finger), potatoes, onions, carrots, green peas, procuring, transportation, storage, processing, packaging and ware housing.

Text books:

1. Siddappa and Bhatia, Fruits and Vegetable Processing Technology
2. Lea, R. A. W, Fruit juice processing and packaging
3. Hui, Y. H. Processing of fruits
4. Cash J. N. Processing of vegetables
5. Jongen, W. Fruit and vegetable processing

FPT4S3P- FRUIT AND VEGETABLE PROCESSING-PRACTICAL

Credit: 2 **36 Hrs**

Objectives

- To be innovative in exploring various processed and value added from agricultural commodities

1. Dehydration of carrot. **6 Hrs**
2. Processing of mango squash and mango pickle. **4Hrs**
3. Processing of pineapple jam. **6 Hrs**
4. Manufacture of tomato puree. **4 Hrs**
5. Manufacture of lemon pickle and lemon juice. **5 Hrs**
6. Manufacture of tomato ketchup and tomato sauce. **5 Hrs**
7. Manufacture of tutifruity. **6 Hrs**

Text books:

1. Siddappa and Bhatia, Fruits and Vegetable Processing Technology
2. Lea, R. A. W, Fruit juice processing and packaging
3. Jongen, W. Fruit and vegetable processing

FPT4S4T- FUNCTIONAL FOODS AND NEUTRACEUTICALS

Credit: 4 **72 Hrs**

Objectives

To enable the students

- To understand the basics of nutraceuticals and functional foods.
- To study the significance of nutraceuticals and their role in disease prevention.
- To identify new strategies for marketing of traditionally known nutraceuticals.

Module 1- Nutraceuticals: Historical, Teleological Aspects and Classification 12 Hrs

Introduction – Historical Reviews - Teleology of nutraceuticals -Organization models for nutraceuticals – Classification of Nutraceuticals based on the sources–Animal, Plant and Microbial – Nutraceuticals in specific foods - Mechanism of Action -Chemical nature.

Module 2- Flavonoids and Carotenoids as Antioxidants 15 Hrs

General background on phytochemicals as antioxidants – Flavonoids and Lipoprotein oxidation – Evidence for specific Antioxidant mechanisms of Flavonoids – Anticancer and Cholesterol-lowering effect of citrus flavoniods – Dietary carotenoid and carotenoid absorption – Approaches to measurement of absorption – Metabolism of Carotenoids – Carotenoids as anticancer agents.

Module 3- Omega – 3 Fatty Acids and CLA 15 Hrs

Introduction to Lipoprotein metabolism - PUFA and Cardiac Arrhythmias - Preventative role of n-3 fatty acids in cardiac arrhythmias – Mechanism, of action on n-3 PUFA's - ω – 3 fish oils and their role in Glycemic control- ω – 3 fatty acids and rheumatoid arthritis - Chemistry and Nomenclature of CLA – Analysis of CLA in food and biological samples – CLA in food products and biological samples –Biological actions and potential health benefits of CLA – Mechanisms of CLA action – Potential adverse effects of CLA.

Module 4- Lycopene, Garlic, Olive Oil, Nuts, Probiotics and Prebiotics 15 Hrs

Lycopene overview – lycopene and disease - Garlic – Chemistry – Implication in Health - Olive oil – CHD – Cancer - Nuts – Nutrient components and Composition - Nut Consumption and CHD epidemiological evidence, Human nutritional studies on nut consumption and serum lipid changes, Mechanism of action- Probiotics- criteria – products on market – probiotic products –Microbiology of the gastrointestinal tract - Prebiotics – future for probiotics and Prebiotics.

Module 5- Herbs as Functional Foods, Stability Testing and Marketing Issues for Nutraceuticals and Functional Foods **15 Hrs**

Herbal medicine – Herbs as ingredients in functional foods – actions of herbal and evidence of efficacy - Kinetic modelling of chemical reactions – Accelerated shelf life testing – Cruciferous vegetables and cancer prevention – Dietary fiber and coronary heart disease - Evolution of marketing environment for Functional foods and nutraceuticals - Regulatory background - Introduction to consumer marketing issues for nutraceuticals - Potential product positioning.

Text books:

1. Robert E.C Wildman. Handbook of Nutraceuticals and Functional Foods, Ed., Robert E.C. Wildman, CRC Press LLC. ISBN – 0849387345, 2001.
2. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

SEMSTER - 5

FPT5S1T- FOOD PACKAGING

Credit: 4 **72 Hrs**

Objectives

- To be familiar with different methods and materials used for packaging.
- To understand the technology behind packaging.

Module 1- Introduction to food packaging **12 Hrs**

Definition, functions and requirements for effective packaging, packaging criteria, Classification of packaging**-** Primary, secondary and tertiary packaging, Flexible, rigid and Semi- rigid packaging.

Module 2- Materials for food packaging **15 Hrs**

Paper, Glass, Tin, Aluminium: TFS, Polymer coated tin free steel cans, cellophane, plastics-LDPE, HDPE, LLDPE, HMHDPE, Polypropylene, polystyrene, polyamide, polyester, polyvinyl chloride.

Module 3- Different forms of food containers **15 Hrs**

Boxes, jars, cans, bottle. Interaction of packages with foods-Global migration of plastics, packaging requirements for various products- fish, meat, spices, vegetables & fruits, canned foods, dehydrated foods.

Module 4- Modern concepts of packaging technology **15 Hrs**

Aseptic packaging, Form–Fill–Seal packaging, Edible Films, Retort pouch packaging, Easy-Open–End, Boil–In-Bags, Closures, tetra-pack, vacuum-packaging, MAP & CAP, Hyper baric storage, insect resistant packaging, intelligent packaging.

Module 5- Food packaging Laws & Specifications **15 Hrs**

Quality testing of packaging materials

- Paper & paper boards-thickness, bursting strength, grammage, puncture resistance, Cobbs test, tearing resistance.
- Flexible packaging materials (plastics)-yield, density, tensile strength, elongation, impact resistance, WVTR, GTR, Overall Migration Rate, seal strength.
- Transportation hazards and testing.
- Oxygen interactions, moisture interchanges and aroma permeability.

Text books:

1. Cruess, W.V. Commercial Fruit & Vegetable Products. Allied Scientific Publishers, New Delhi. 2003
2. Davis, E.G. Evaluation of tin & plastic containers for foods. CBS Publishers, New Delhi. 2004
3. Gopal T.K.S. Seafood packaging, CIFT, Matsyapuri Cochin,2007
4. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
5. Sacharow, S., Griffin, R.C. Food Packaging. AVI Publishing Company, West Port, Connecticut. 2000
6. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003

FPT5S2T- TECHNOLOGY OF BEVERAGES

Credit: 4 **72 Hrs**

Objectives

- To enable the students to get an up to date knowledge about fermented foods and beverages.

Module 1- Introduction & Classification of Beverages **15 Hrs**

Introduction and classification of beverages, Mineral water-water source and deionization of mineral water, Water treatment process: Filtration, Adsorption, ion exchange, Chemical oxidation, Biological process, Remineralisation and microbiological treatments. Microbiology of bottled water.

Module 2- Alcoholic Beverages **15 Hrs**

Beer Making and Types of Beer: ale, lager, pilsner, stout and porter beer. Wine making and Types of wine: white wine, red wine, dry wine, sweet wine and sparkling wine. Whisky manufacture and types of whisky: Scotch whisky, malt whisky, Irish whisky and Canadian whisky, Manufacture of rum, vodka, brandy and gin.

Module 3- Carbonated Beverages **15 Hrs**

Carbonated soft drinks- Ingredients and preservatives used in carbonation. Syrup room operation and equipments involved.

Module 4 - Tea **12 Hrs**

Steps involved in processing of tea. Types of tea: Black tea, Green tea and Oolong tea.

Module 5 - Coffee **15 Hrs**

Manufacture of coffee, Types of coffee: Vaccum coffee, drip coffee, percolator coffee, steeped coffee, espresso coffee, iced coffee and Instant coffee. Decaffeination of coffee and types of decaffeination: Roselius process, Swiss water process, direct and indirect method, triglyceride method, carbondioxide method.

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Nicholas Dege. Technology of Bottled water. Blackwell publishing Ltd, UK.,2011
3. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
4. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003
5. Varnam A. H and Sutherland P.J., Beverages: Technology, Chemistry and Microbiology, Aspen Publications, 1999

FPT5S3T- DRYING TECHNOLOGY

Credit: 3 **54 Hrs**

Objectives

- To be familiar with different methods of drying.

- To understand the technology behind drying

Module 1- Introduction **12 Hrs**

Food dehydration, dehydration principles, selection of methods based on characteristics of foods to be produced, heat and mass transfer, difference between drying and dehydration

Module 2- Mechanism of drying **12 Hrs**

Drying curve, constant rate period, falling rate period, dry and wet bulb temperature, factors affecting dehydration, Physical and chemical changes during drying, Effect of food properties on dehydration, cell structure, case hardening, control of changes

Module 3- Driers used in food industry **12 Hrs**

Drying methods, equipments, sun drying, air convection driers, kiln drier, cabinet drier, tunnel drier, fluidized bed drier, spray drier, drum drier, vacuum drier, freeze drier, advantages and disadvantages of different methods

Module 4- Processing of some Dehydrated foods **12 Hrs**

Processing of milk powder, raisins, osmotic dehydrated foods, intermediate moisture food, dehydrofreezing

Module 5- Packing **6 Hrs**

Packaging materials for dried foods, storage, transportation

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
3. Singh, R.P. Introduction to Food Engineering 3rd edition. Academic Press, London. 2004

FPT5G1T- SENSORY EVALUATION

Credit: 4 **Hrs: 72**

Objectives

- To understand different aspects of sensory science and its application.

Module 1-Introduction **10 Hrs**

Sensory evaluation: Definition & Importance of sensory evaluation; Practical requirements for conducting sensory tests, limitations of sensory evaluation.

Module 2- Testing conditions **12 Hrs**

General testing conditions - Testing area, testing set up, lighting, testing schedule, Preparation of samples, sample coding, evaluation card preparation.

Module 3- Sensory assessment **20 Hrs**

Taste—Taste sensation on the tongue, Recognition test for the four basic tastes, Water quality for sample preparations, Standard compounds used for preparing basic tastes, Taste modifiers, Perception of sweet taste. Odour and Smell – Anatomy of nose, Smelling techniques, Vonskramlk, Test, Theories of olfaction Texture—Definition, Classification of textural characteristics, glossary of textural terms, Definition for mechanical properties, Texture measurement Colour vision and appearance measurement-Structure of eye, Visual perception and colour of foods. Flavour and aroma - aroma perception, Definition of flavour, Flavour profile methods, Flavour compounds Temperature sensation, pain sensation, touch sensation, kinesthetic sensations, and sound sensations.

Module 4- Sensory Tests **20 Hrs**

Threshold test, Difference test, Ranking test, Hedonic test, Acceptance and Preference test, scoring test, Sensitivity test Application of sensory analysis in food industry, trained panel members.

Module 5- Data analysis **10 Hrs**

Importance of data analysis, tests of significance, null hypothesis, mean, median, variance, standard deviation, t-test, chi-square test.

Text books:

1. Jellinek, G., Sensory Evaluation of Food-Theory and Practice. Elis Horwood Ltd., England, 1985.
2. Lawless H.T, Sensory Evaluation of Food, Food Science Text series, Springer Science, 2010
3. Srilakshmi, B., Food Science., New Age International (P) Limited., New Delhi, 2005

FPT5G1P- SENSORY EVALUATION- PRACTICAL

Credit: 2 **36 Hrs**

Objectives

- To understand different aspects of various sensory parameters and its application in food quality analysis.

The following tests will be done.

1. Triangle test
2. Single sample test
3. Paired comparison test
4. Duo- trio test
5. Hedonic rating test
6. Numerical scoring test
7. Ranking test
8. Overall acceptability
9. Flavor profile
10. Descriptive test

Text books:

1. Jellinek, G., Sensory Evaluation of Food-Theory and Practice. Elis Horwood Ltd., England, 1985.
2. Lawless H.T, Sensory Evaluation of Food, Food Science Text series, Springer Science, 2010.
3. Srilakshmi, B., Food Science. New Age International (P) Limited. New Delhi, 2005.

FPT5G2T- SANITATION AND HYGIENE

Credit: 4 **72 Hrs**

Objectives

- To know the principles and applications of sanitation in food industry

Module 1: **Sanitation; Introduction** **14 Hrs**

Definition and Application to Food Industry and Food service. Microorganisms and sanitation. Sources of food contamination. Prevention and control of contamination of food. Physical and chemical Disinfectants, Antiseptics, Bactericidal and Bacteriostatic agents used in food industry.

Module 2: **Food Sanitizers** **14 Hrs**

Sanitizers, Chemical and physical properties of sanitizers, Mechanism of activity of most frequently used sanitizers. Cleaning compounds, Chemical and physical characteristics of detergents. Sanitizing methods, handling precautions.

Module 3: **Sanitation equipments and systems in Food Industry** **16 Hrs**

Mechanized sweepers and scrubbers, high pressure cleaners, CIP and COP equipment. Membrane Cleaning. Quality of water used for food processing, Water quality standards. Waste product handling, Suspended solids, Total solids, BOD & COD requirements. Wastewater treatment and disposal.

Module 4: **Food handling and personal hygiene** **16 Hrs**

Food handling and personal hygiene. Hygenic food handling. Hand washing. Food service control points. Regulatory requirements. Hygiene monitoring tests (HMT). Food contact surfaces. Biofilms .Environmental sanitation- premises, equipment, furnitures and fixtures. Safety at work place.

Module 5: **Insect & Pest Control** **12 Hrs**

Pest control, insect, rodents, other pests. Sanitary Design and Construction for Food Processing., Sanitation programme and Quality assurance. Sanitation Regulation and Standards.

Text books:

1. Frazier, W.C. Food Microbiology. 4th edition. Mc Graw Hill. New York, 2008
2. Pelzar, H.J. and Rober, D. Microbiology 5th edition Mc Graw Hill. NewYork, 2009
3. Prescott, L.M., Harley, J.P. and Klein, D.A. Microbiology. 4th edition McGraw-Hill, NewYork. 1999
4. Hola, J. Hygiene in food processing

FPT5G3T

Open course (Course offered by other departments in the college)

Credit: 3 **54 Hrs**

FPT6SIT- ANALYTICAL METHODS IN FOOD PROCESSING

Credit: 4 **72 Hrs**

Objectives

- To know the principles and applications of different techniques used in food and nutrition research.
- To gain knowledge about different instruments used in food analysis.

Module 1- Chromatography **17 Hrs**

Introduction, principles of chromatography; Techniques and working principle and application in food industries of- Paper chromatography, GC, GLC, HPLC, TLC.

Module 2- Spectroscopy **17 Hrs**

Principles of spectroscopy, properties; Techniques and working of-Infrared spectroscopy, UV spectrophotometer, Atomic absorption, Atomic emission, Flourimetry and NMR.

Module 3- Radiotracer Techniques **14 Hrs**

Introduction, Nature of radioactivity, units, radioactive counters, solid, gas and liquid scintillation.

Module 4- Electrophoresis **12 Hrs**

Definition, types of electrophoresis methods, free solution electrophoresis, paper or gel electrophoresis, SDS-PAGE.

Module 5- Measurement of enzyme activity **12 Hrs**

Enzyme activity, basic principles, chemical reactions, catalytic effects, reaction rates, reaction mixtures.

Text books:

1. Mahindru, S.N. Food additives. Characteristics, detection and estimation. Tata McGraw-Hill Publishing Company Limited, New Delhi. 2000
2. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2004.
3. Pearson, D. The Chemical Analysis of Foods, Churchill Livingstone, New York, 2002.
4. Sharma, B.K. Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi. 2004.

5. Srilakshmi, B., Food Science., New Age International (P) Limited., New Delhi, 2005

FPT6SIP- ANALYTICAL METHODS IN FOOD PROCESSING- PRACTICAL

Credit: 2 **36 Hrs**

Objectives

- To gain knowledge about different instruments used in food analysis

1. Paper chromatography **8 Hrs**
2. Thin layer chromatography **8 Hrs**
3. Colorimetry **7 Hrs**
4. Refractomery **7 Hrs**
5. Centrifugation **6 Hrs**

Text books:

1. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2004.
2. Mahindru, S.N. Food additives. Characteristics, detection and estimation. Tata McGraw-Hill Publishing Company Limited, New Delhi. 2000
3. Pearson, D. The Chemical Analysis of Foods, Churchill Livingstone, New York, 2002.

FPT6S2T- PRINCIPLES OF THERMODYNAMICS

Credit: 5 **90 Hrs**

Objectives

- To enable the student to solve problems in Food engineering process of value addition and quality improvement

Module 1 **18 Hrs**

Zeroth law, Applications – Thermodynamics system and Surroundings – closed, open and isolated system. Thermodynamics properties- specific volume – density – pressure – Thermodynamics state and equilibrium – properties- state and path function – Zeroth Law. Ideal gas concept of continuum – work and heat resources.

Module 2 **16 Hrs**

First law, for a closed system – enthalpy- internal energy. First law for non flow process – for flow process – heat capacity – equation of state and its concept of ideal gas constant volume process – constant pressure process – constant temperature process – Adiabatic process.

Module 3 **16 Hrs**

Second law, Limiting first law of Thermodynamics -thermal efficiency-– Kelvin Planck statement – refrigerators – heat pump – Air conditioners –Clausis statement – Equivalence of two laws – – Carnot engine- carnot cycle-Vapor-compression refrigeration cycle.

Module 4 **16 Hrs**

Entropy, Clausis inequality -TS diagram- isentropic process – HS diagram-energy change for pure substances -solids and liquids – ideal gas. Joule-Thomson coefficient, Coefficient of volume expansion, adiabatic and isothermal compressibilities, Clapeyron equation.

Module 5 **14 Hrs**

Phases of a pure substance -phase change –properties diagram – T- V diagram -PV diagram - solid phase on process diagram -PT diagram – PVT surface. Equation of state and departure function, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria.

Text books:

1. Radhakrishna E, "Fundamental Engineering Thermo Dynamics", Printice Hall of India, New Delhi, 2005

2. Khurmi R.S and J.K. Gupta, "A Text book of Thermal Engineering" S. Chand & Company Ltd, New Delhi, 2002

FPT6S3- ENTREPRENEURSHIP DEVELOPMENT

Credits: 5 **90 Hrs**

Objectives:

To help students to

- understand the significance of entrepreneurs in the development of a country
- Familiarize with procedures and legal issues involved in setting up an enterprise.
- Get motivated to become an entrepreneur.

Module 1 Introduction **22 Hrs**

Concept of entrepreneurship, essential attributes of an entrepreneur, women entrepreneurs, intrapreneurs, entrepreneurs and economic development. Dynamic of opportunity identification, process of selection of the right business, decision making steps and caution. Types of enterprises – demand based, resource based, import substitution and export promotion. Large, Medium, SSI, Partnership and sole proprietorship, Problem solving skills and SWOT techniques, Legal issues and books to be maintained in an industry.

Module 2 Project formulation **18 Hrs**

Various approaches principles of product selection and development techno-economic feasibility of the project, structure of project report

Module 3 Financial management **18 Hrs**

Financial institutions, role of central and state governments in promoting entrepreneurship – incentives, subsidies and grants, fiscal and tax concessions. Agencies and their role – DIC, SISI, EDII, NIESBUD, NEDB.

Module 4 Resource management **16 Hrs**

Management of men, machine and materials. CPM and PERT as planning tools for establishing SSIs.

Module 5 Marketing management **16 Hrs**

Marketing for small business, strategies for sales promotion, pricing policy and its implications on sale, after sales service.

Text books:

1. Deshpande, M. R. Entrepreneurship of small scale industries concept growth and management. Deep & Deep publication, Rajouri, New Delhi. 2002.
2. Gupta, C. P. Entrepreneurship Development in India. Sultan Chand and Sons, New Delhi. 2005.
3. Abraham, M.M. Entrepreneurship Development & Management, Prakash Publications, Changanacherry. 2000.

FPT6G1T- FOOD TOXICOLOGY

Credit: 4 **72 Hrs**

Objectives

- Provide students with a basic understanding of the principles of toxicology.

- Provide students an in depth understanding of how the science of toxicology is applied to chemical food and feed safety, including food regulation and risk assessment

Module 1 **15 Hrs**

Scope, history and development of toxicology. Principles of food toxicology. Classifications and divisions in Toxicology. Classes of toxicants. Indicators of toxicity and their evaluation. Understanding about Safe Food and Nutrition. Further developments of Toxicology**.**

Module 2 **15 Hrs**

Plant and animal toxins, Natural toxicants present in foods (plants, animal, marine and microbial toxins). Phytoalexins, alcaloids, inhibitors of enzymes and toxic proteins, cyanogenic glycosides, phenols. Antagonists of vitamins. Xenobiotics. Natural carcinogens in animal and plant materials. Types of these dangerous chemical substances and their effects on living organisms

Module 3 **15 Hrs**

Microbial toxins, Food-borne disease agents among the major microbial groups: fungi, bacteria, algae viruses, protozoa and worms. food toxicants; Bacteriotoxins (botulin and other bacterial exotoxins). Mycotoxins (aflatoxins, trichothecenes, ochratoxins, and fumonisins); their production, properties and Parameters affecting microbial growth in food.

Module 4 **15 Hrs**

Environmental toxicants, Health Effects of Nitrate, Nitrite and N-Nitroso Compounds. Pesticides. Heavy metals and other toxic elements (lead, arsenic, mercury, cadmium and others). Radionuclides. Organic environmental contaminants of industry (polycyclic aromatic hydrocarbons, diphenyls, dioxins and pentachlorophenol)

Module 5 **12 Hrs**

Toxicants formed in processed foods, Hazardous chemical compounds arising from processing and storing of foods. Heating and Chemical Changes. Changes to Frying Food and Frying Oil. Conservation. Radiation and Microwave Energy. Nitrosamines and other biologically active nitro compounds. Polycyclic aromatic hydrocarbons.

Text books:

1. Schlegel H., 1988: General Microbiology. - Cambridge, New York, New Rochelle, Melbourne, Sydney.: Cambridge University Press.

2. Chelkowski J. (ed.), 1991: Cereal grain. Mycotoxins, Fungi and Qality in Drying and Storage. – Elsevier, Amsterdam.

3. Booth C. (ed.), 1981: Methods in Microbiology. – London – New York.

FPT6G2T- COMPUTER HARDWARE AND NETWORKING

Credit: 4 **72 Hrs**

Objectives

- Understand the hardware components of a system.
- Understand basic issues in installing and using software.
- Understand how a network functions and the issues of network security.

Module 1- Basics of Computer and Hardware **10 Hrs**

Input & Output Devices, their types and specifications, CPU**,** Memory devices- types primary and secondary, BIOS/ CMOS setting.

Module 2- Mother Board **10 Hrs**

Study of Motherboard RAM,ROM,CMOS,POST, BUS, (Address, Data, SYSTEM), Connections of various devices such as Display Adapter, Ports (Serial, Parallel) , Modem on the Mother Board, Importance of CPU cooling, Motherboard troubleshooting.

Module 3- Serial Devices **10 Hrs**

Key Board: Switches, Keyboard organization, Key board type, Wireless Keyboard Trouble shooting. Mouse: Mouse type- Scroll & Optical Mouse, Function Connecting Mouse, Trouble shooting Mouse. FILE SYSTEM: Types of file Sequential, index, direct access, creation and updates of file and access method.

Module 4- Storage Devices **13 Hrs**

HDD: HDD types, integrated, SCSI, Magnetic recording, Formatting (Track, Sector) Cluster, Bad Sector, Jumper Setting, Common Problem and its trouble Shooting, External Drive (HDD), Optical Drives. FDD: FDD types and working and its related problem, CD and DVD drives- ROM and Writer, USB Devices, Hub, Pen Drives.

Module 5-Parallel Devices **13 Hrs**

Printers: Working of DMP, Ink Jet, Laser Printer, line printer, MFP (Multi Functional Printer and its Trouble shooting, Scanners, BOOT PROCESS, POWER SUPPLY, TYPES OF PC'S : Desktop, Laptop, Palmtop.

Module 6 - Introduction to LAN and WAN networking 16 Hrs

Emergence and history of network, What is network, Need of network or benefits of network, Types of networks –LAN and wan, How to assign IP address mask and gateway, Familiar with ping, IPconfig/all netstat and tracert commands, Types of wan technologies, Explain about structure of intranet and internet.

Text books:

1. The Indispensable PC Hardware Book (4th Edition) by Hans-Peter Messmer.
2. USB Mass Storage by Jan Axelson.
3. Bigelow's PC Hardware Desk Reference – 2002 by Stephen J. Bigelow.
4. PC Architecture. An online book in by Michael Karbo.

COMPLEMENTARY COURSE

HORTICULTURE

SEMESTER-1

HOR1G1T-Fundamentals of Horticulture

Credits: 2 **36 Hrs**

Objectives

- To acquaint with importance, division and classification of horticultural crops.
- To understand the basic principles and types of plant propagation.

Module 1 **6 Hrs**

Horticulture - definition, importance, division and classification of horticultural crops. Importance of horticulture in India and Kerala. Orchard planning, layout, planting systems - management practices. Tree forms and functions - Training and pruning in horticultural crops - principles and methods, techniques of training and pruning, fruit thinning.

Module 2 **6 Hrs**

Phases of growth and development - vegetative/ reproductive balance; Flowering in plants - bearing habit and its classification- factors associated with flowering and fruit set. Fruit set and development - structure and process concerned with setting.

Module 3 **6 Hrs**

Plant propagation - definition and basic concepts, sexual and asexual types - advantages and disadvantages. Asexual propagation -propagation by cuttings, types of cuttings, factors affecting rooting of cuttings. Propagation by layering - types of layering.

Module 4 **9 Hrs**

Propagation by grafting - methods of grafting Propagation by budding, methods of budding - A comparative study between grafting and budding.

Module 5 **9 Hrs**

Nursery - site selection, layout - components of a nursery - production unit, sales unit, display area, management and maintenance, propagation unit .Plant propagating structures-. greenhouse, glasshouse, hot bed, cold frame, net house, mist chamber.

Text books:

1. Bose, TK., Mitra, SK. and Sadhu, K. 1986.*Propagation of tropical and subtropical horticultural crops*.NayaProkash, Calcutta.

2. Denixon, RI. 1979. *Principles of Horticulture*. Mac Millan, New York.
3. Edmond, JB., Sen, TD, Andrews, TS and Halfacre, RG. 1977. *Fundamentals of Horticulture.* Tata McGraw Hill, New Delhi.
4. Hartmann, HT. and Kester, DE.1986.*Plant propagation - Principles and practices*. Prentice-Hall, New Delhi.
5. Leopold, A.C. and Kriedeman, P.E. 1975.*Plant Growth and Development.* Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Chadha, K. L. 2003. Handbook of Horticulture, ICAR, New Delhi.Choudhury, B.1983. Vegetables. National Book Trust, New Delhi.
7. Das, P. C.1993. Vegetable crops in India. Kalyani Publishers
8. Gopalakrishnan, T. R. 2007. Vegetable Crops.New India Publishing Agency, New Delhi.
9. Hazra, P. and Som, M. G. 1999. Technology for vegetable Production and Improvement.NayaProkash, Calcutta
10. Peter, K. V. 1998. Genetics and Breeding of vegetables. ICAR, New elhi.

HOR1G1P -Fundamentals of Horticulture -Practical

Credits: 1 **18 Hrs**

Objectives

- To develop skill in propagation and cultivation aspects of horticultural crops.

1. Familiarization to Different planting systems and layout **2 Hrs**
2. Propagation methods - sexual propagation -seed viability tests, dormancy breaking methods. **2 Hrs**
3. Propagation structures - mist chamber, green house, hot beds etc. **2 Hrs**
4. Propagation by cuttings. **2 Hrs**
5. Propagation by layering - types of layering. **3 Hrs**
6. Propagation by grafting - methods of grafting **4 Hrs**
7. Propagation by budding, methods of budding **3 Hrs**

SECOND SEMESTER

HOR2G1T- Plantation Crops, Spices and Fruits

Credits: 2 **36 Hrs**

Objectives

- To acquaint with the cultivation aspects of Plantation crops, spices and fruit crops.

Module1 **8 Hrs**

Introduction - importance - area, production - origin, distribution , varieties , climate, propagation, production of quality planting materials and hybrids - nursery management - layout, planting, aftercare - irrigation, and uses of coconut and Rubber

Module 2 **8 Hrs**

Definition - classification - importance to the state. Origin - distribution - area, production. varieties - climate, soil - propagation, nursery management - site selection, layout, planting - crop management including manuring, irrigation, shade regulation, harvesting, yield of the following crops: Pepper and cardamom

Module 3 **5 Hrs**

Importance and scope of commercial fruit production - Global scenario of fruit production and export - Present status of fruit production in the state and in the country - problems and prospects.

Module 4 **10 Hrs**

Crop management practices - selection and preparation of planting materials, field preparation and planting, manuring, and other cultural operations of Crops-Banana, and pineapple.

Module 5: **5 Hrs**

Management practices of crops gaining importance in the state recently (mangosteen, rambutan, durian).

Text books:

1. Chadha, K.L.2001. Hand Book of Horticulture,ICAR, New Delhi.
2. Kumar.N, Abdul Khader.J.B.M.Rangaswami.P. and Irulappan., 1993. Introduction to spices
3. Menon.K.P.V. and Pandalai.K.M. 1960. The coconut Palm - a monograph. Indian Central Coconut Committee, Ernakulam.
4. Purseglove. J.W., Brown, E.G.Green, C.L. and Robbins, S.R.G.1981.SpicesVol-I & II.

5. Pruthi.J.S. 1993.Major Spices of India, Crop Management - Post Harvest Technology, ICAR, New Delhi.
6. Pruthi, J.S.2001 Minor Spices and Condiments-Crop Management and Post HarvestTechnology, ICAR, New Delhi, India.
7. Amar Singh, 1986. Fruit Physiology and Production.Kalyani Publishers, New Delhi.
8. Bose, T.K, Mitra,S.K. and Sanyal, D. 2002. Fruits: Tropical and Subtropical. Vol. I & II, Nayaprakash publications, Calcutta.
9. Hayes,W.B. 1957. Fruit Growing in India.Kitabitan, Allahabad.
10. Kumar, N. 1997 (6th Edition).Introduction to Horticulture.Rajhalakshmi Publications, Nagercoil.
11. Mitra,S.K, Bose,T.K and Rathore, D.S. 1991. Temperate Fruits. Horticulture and Allied Publishers , Calcutta.
12. Naik,K.C. 1949. South Indian Fruits and Their Culture.Varadachari Co., Madras.
13. Samson, J.A. 1980. Tropical Fruits. Longman group, London.

HOR2G1P- Plantation Crops, Spices and Fruits- Practical

Credits: 1 **18 Hrs**

Objectives

- To acquire skill on cultivation aspects of Plantation crops, spices and fruit crops.

Plantation Crops **8 Hrs**

1. Coconut: Nursery techniques, Seedling selection, Production of quality planting materials and hybrids and mother palm selection,
2. Familiarization with varieties, Moisture conservation methods in coconut plantations.
3. Spices **5 Hrs**
   Morphology, nursery techniques, planting in main field, cultural operations and harvesting of pepper and cardamom
4. Fruits **5 Hrs**
   Familiarization with important varieties. Practice in propagation, selection of good planting materials, field preparation and planting and manuring of banana and pineapple

THIRD SEMESTER

HOR3G1T- Protected cultivation of Horticultural crops

Credit: 2 **36 Hrs**

Objectives

- To familiarize with protected cultivation structures and cultivation practices

Module1 **8 Hrs**

Introduction - scope and importance - problems and prospects of protected cultivation in India - growing structures - green house - polyhouse - net house - basic considerations in establishment and operation of greenhouses - maintenance .

Module 2 **8 Hrs**

Advantages of growing plants in a greenhouse - functioning and maintenance. Manipulation of environmental factors - environmental control systems in green house. Maintenance of cooling and heating system in green houses.

Module 3 **8 Hrs**

Type of containers used in protected culture. Substrate -Use of substrate and preparation of substrate for protected cultivation, soil decontamination. Water management - nutrient management (fertigation).

Module 4 **8 Hrs**

Crop regulation – special horticultural practices in protected cultivation for commercially important crops: vegetable crops, seedlings, etc.

Module 5 **4 Hrs**

Harvesting methods – postharvest handling – standards – grading – packing and marketing.

Text books:

1. Foja Singh., 1997. Advances in Floriculture.Media Today Pvt. Ltd., New Delhi-17.
2. Prasad, S. and U.Kumar. 1998. Commercial floriculture. Agro Botanica. Bikaner - 334 004.
3. Roy. A. Larson., 1992. Introduction of Floriculture.International Book Distributing Co., Lucknow.
4. Vishnu Swarup., 1997. Ornamental Horticulture. Macmillan India Ltd., New Delhi-2.Wltez, S., 1972.The world gladiolus, NAGG, USA.
5. Yadav, L.P. and Bose, T.K., 1986. Biology, conservation and culture of orchids. East-West Press Private Limited, New Delhi.
6. Yadav.I.S. and M.L. Choudhary., 1997.Progressive floriculture.The House of Sarpan, (Media), Bangalore.

HOR3G1P-Protected cultivation of Horticultural crops-Practical

Credit: 1 **18 Hrs**

Objective

- To practice with protected cultivation practices of important crops

1. Study of structures utilized for protected culture. **2 Hrs**
2. Design and orientation of poly/green houses. **2 Hrs**
3. Type of containers used in protected culture. **2 Hrs**
4. Use of substrate and preparation of substrate for protected cultivation **3 Hrs**
5. Fertigation system in green houses **3 Hrs**
6. Maitenance of cooling and heating system in green houses. **3 Hrs**
7. Special horticultural practices in protected cultivation **3 Hrs**

FOURTH SEMESTER

HOR4G1T-Landscape designing and indoor gardening

Credit: 2 **36 Hrs**

Objectives

- To get awareness on designing and laying out of a landscape.
- To familiarise with different types and features of garden.

Module 1 **7 Hrs**

Designing of landscape: Principle of landscape design. Selection and use of plants in the landscape. Preparation of landscape plan.

Module 2 **7 Hrs**

Maintenance of plants in landscape: Planting and maintenance of plants in the landscape. Methods of irrigation - sprinkler and drip irrigation-pot irrigation, wick irrigation etc. Methods of application of fertilizers to garden plants.

Module 3 **7 Hrs**

Garden tools: Use of tools and implements. Use of different types of sprayers, lawn mowers, hedge cutters, tree cutters, leveling methods.

Module 4 **7 Hrs**

Garden structures and garden types: Garden structures, roads and paths, enclosures, paving, garden lights, furniture. Different types of garden and features. Establishment and maintenance of lawn.

Module 5 **8 Hrs**

Indoor gardening: Selection of indoor plants. Layout and designs of indoor gardens - types of containers used, media composition, preparation of media, planting and placement of plants. Models for interior plant scaping - vertical garden, miniature garden and terrariums. Manuring, irrigation, illumination, grooming and holiday care of indoor plants.

Text books:

1. Edmond, JB., Sen, TD, Andrews, TS and Halfacre, RG. 1977. *Fundamentals of Horticulture.* Tata McGraw Hill, New Delhi.
2. Janick, J. 1963.*Horticultural Science*. W.H. Freeman, Sanfrancisco.
3. Kumar, N. 1990.*Introduction to Horticulture*, Rajalekshmi Publication, Nagercoil.
4. Carpenter, P.L., Walker, T.D and Lanphear, F.O. 1975.*Plants in the Landscape*.W.H. Feeman and Co., San Francisco
5. Desai, B.L. 1979. *Planning and Planting of Home Gardens*. Indian Council of Agricultural Research, New Delhi.
6. Joiner, J.N. 1981.*Foliage Plant Production.* Prentice Hall Inc. London
7. Nambisan, K.M.P. 1991. *Design elements of landscape gardening*. Oxford & IBH Publishers Pvt. Ltd Calcutta
8. Swarup, V. 1993.*Indoor Gardening*. ICAR, New Delhi
9. Trivedi, P.P. 1983.*Home Gardening*. Indian Council of Agricultural research, New Delhi

HOR4G1P - Landscape designing and indoor gardening-Practical

Credit: 1 **18 Hrs**

Objectives

- To develop skill in planning and planting of garden lawn.
- To develop skill in preparation of different types of gardens.

1. Preparation of landscape plan, identification of plants. **3 Hrs**
2. Planting of lawn **2 Hrs**
3. Rolling and mowing of lawn - use of different types of lawn mowers**.** **2 Hrs**
4. Preparation of flower beds. Pruning of shrubs, hedges and trees. **4 Hrs**
5. Application of manures and fertilizers to garden plants. **2 Hrs**
6. Designing indoor garden **2 Hrs**
7. Preparation of miniature garden and vertical garden. Preparation of terrarium **3 Hrs**

COMPLEMENTARY COURSE

ENERGY AND ENVIRONMENTAL STUDIES

SEMESTER-1

EES1G1T - RENEWABLE ENERGY SOURCES

Credits: 3 **54 hrs**

Course Objectives:

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications

Module 1 **12 hrs**

Indian Energy Sector – Organizational Structure – Energy Supply -Coal, Lignite, Oil, Gas and Powers – Hydro, Nuclear, Thermal – Energy Demand -Agriculture, Industry, Transport, Domestic, etc – Renewable Energy Sources and Technology - Renewable Energy Programmes -Energy Issues and Policy Options for India.

Module 2 **12 hrs**

Solar Energy, Solar Energy potential, solar radiation and Measurement, types of solar energy collectors. Solar water heating systems, Solar air heating and cooling systems. Solar thermal energy conversion, solar photo voltaic system.

Module 3 **12 hrs**

Wind Energy, Scope for Wind energy in India, Basic principles of wind energy conversion, Site selection considerations, Basic components of wind energy conversion system, Types of wind machines, Performance of Wind machines, Application of Wind Energy.

Module 4 **12 hrs**

Biomass and Biogas energy, Introduction, Biomass conversion technologies, Methods of obtaining energy from biomass, Biogas generation, Classification of biogas plants, Factors affecting yield of biogas plants, Properties & Characteristics of Biogas, Utilization of Biogas.

Module 5 **6 hrs**

Other sources of renewable energy, Tidal Energy, Geothermal Energy, Magneto – Hydro Dynamic energy, Chemical energy Sources, Hydrogen Energy.

Text books:

1. Solar Energy Utilization,G. D. Rai, Khanna & Khanna , New Delhi.

2. Non conventional energy source, G. D. Rai, Khanna & Khanna, New Delhi.
3. Sustainable Energy, J. W. Tester & M. Drate, Prentice Hall of India, New Delhi.
4. Principles of Power system, V. K. Methta, S.Chand Co.Ltd., New Delhi.
5. Raikhy, P.S. and Parminder Singh, (1990): Energy Consumption in India – Pattern and Determinants, Deep and Deep, New Delhi.

SEMESTER-2

EES2G1T -INTRODUCTORY ENVIRONMENTAL STUDIES

Credits: 3 **54 hrs**

Course Objectives:

- To create awareness about the importance of environment, its ecological balance and make him/her sensitive to the environment issues in every endeavor that he/she participates.

Module 1 **20 Hrs**

Environmental studies, Definition, Scope and Importance – Need For Public Awareness – Forest Resources:- Use and Over - Exploitation, Deforestation, Case Studies, Mining, Dams and their Ground Water, Floods, Drought, Conflicts Over Water, Dams – Benefits and Problems – Mineral Resources:- Use Effects on Forests and Tribal People – Water Resources:- Use and Over-Utilization of Surface and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies – Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity, Case Studies – Land Resources:- Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources – Equitable use of Resources for Sustainable Lifestyles.

Module 2 **20 Hrs**

Concepts of an Ecosystem – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the Forest Ecosystem Grassland Ecosystem Desert Ecosystem Aquatic Ecosystems – Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Bio-geographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts –

endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.

Module 3 **14 Hrs**

Environmental pollution Definition – Causes, Effects and Control Measures of:- Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards – Soil Waste Management:- Causes, Effects and Control Measures of Urban and Industrial Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management:- Floods, Earthquake, Cyclone and Landslides.

Text Books:

1. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.

2. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co.

3. Townsend C., Harper, J. and Begon, M., "Essentials of Ecology", Blackwell Science, 2003.

4. Trivedi, R.K., and Goel, P.K., "Introduction to Air Pollution", Techno- Science

SEMESTER-3

EES3G1T - ENVIRONMENTAL IMPACT ASSESSMENT

Credits: 3 **54 hrs**

Course Objectives:

- To have an assessment of the impacts of manmade activities on the environment.
- To have and understanding of the possible remedies in this regard.

Module 1 **13 Hrs**

Social issues and the environment, From Unsustainable To Sustainable Development – Urban Problems Related To energy – Water conservation, Rain Water Harvesting, Watershed Management – Environmental Ethics:- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies – Wasteland Reclamation – Consumerism and Waste Products.

Module 2 **13 Hrs**

Basic concept of EIA: Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods,

Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Module 3 **14 Hrs**

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

Module 4 **14 Hrs**

E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact. Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Text books:

1. Y. Anjaneyulu, *Environmental Impact Assessment Methodologies,* B.S. Publication, Sultan Bazar, Hyderabad. 2002

2. J. Glynn and Gary W. Hein Ke *Environmental Science and Engineering*, Prentice Hall Publishers 2000

3. Suresh K. Dhaneja – S.K., *Environmental Science and Engineering,* Katania & Sons Publication., New Delhi.1998

4. Dr H.S. Bhatia *Environmental Pollution and Control,* Galgotia Publication (P) Ltd, Delhi, 1996

SEMESTER-4

EES4G1T -ENERGY AND ENVIRONMENT MANAGEMENT

Credits: 3 **54 hrs**

Course Objectives:

- To understand the methodology of energy management.
- To understand the methodology of environment management.
- To understand energy and environment audit.

Module 1 **12 Hrs**

Energy Crisis – Causes and Consequences – Remedial Measures – Environmental Crisis – Causes and Consequences – Remedial Measures – Impact of Energy Consumption and

Production on Environment with illustrations – Role of Energy and Environmental Economists in solving Energy the crises.

Module 2 **12 Hrs**

Energy Planning and Energy Conservation – Meaning, Objectives and Importance – Energy Management – Meaning, Objectives and Importance – Recent Developments – Energy Auditing – Energy Accounting – Energy Pricing and Taxes – Role of Economists in Promoting Sustainable Energy Management.

Module 3 **20 Hrs**

Internal Audit, External Audit, Energy Audit: Preliminary Energy Audit, Detailed Energy Audit, Investment Grade Energy Audit, Industrial Energy Audit, Utility (Services) Energy Audit, Commercial Energy Audit, Residential Energy Audit. Energy Audit Strategies: Monitoring and Control, Questioning the Need, Minimizing the Need of End Use, Minimizing the Losses, Operating the Equipment at Optimum Efficiency, Operating the Most Efficient Equipments from Set of Equipments, Minimizing the Idle Redundant Running, Proper Maintenance of the Equipment, Fuel Substitutions, Quality Control and Recycling.

Module 4 **10 Hrs**

Environmental Auditing: Types of audits: EMS audits, performance audits, compliance audits; ISO 19011and environmental auditing; Methodologies for Environmental Auditing: Objectives, audit teams, planning audits, conducting audits, reporting audit findings; Legal Requirements relating to Environmental auditing. Post Audit activities, The Environmental pollution Act.

Text Books:

1. Instructions to Energy Auditors, Vol. - I & Vol. - II –National Technical Information Services U. S. Dept. Of Commerce Springfield, VA 22161.

2. Energy Auditing, The Fairmont Press Inc. Published by Atlanta, Georgia

3. Albert Thumann, P.E., C.E.M. , Plant engineers & Managers Guide To Energy Conservation 8th edition-2002, Published By The Fairmont Press , Inc 700 Indian Trail Liburn, GA30047

4. Karpagam, M. (1991): Environmental Economics, Sterling, New Delhi.

5. Raikhy, P.S. and Parminder Singh, (1990): Energy Consumption in India – Pattern and Determinants, Deep and Deep, New Delhi.

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B.Voc Food Processing Technology

Detailed Scheme for the Distribution of Credits and Period of Instruction

(Total Credits for the course = 180, Total contact hours per week = 25, Total contact hours per semester = 450)

(Course Code details: FPT-Food Processing Technology, HOR- Horticulture, EES-Energy and Environmental Studies, 1- First Semester, S-Skill Development, 1T-First Theory Paper, 2T- Second Theory Paper, P- Practical, G-General Education, I- Internship/training.)

First Semester								
Sl. No	**Type of course**	**Course code**	**Title of course**	**Exam duration**	**Credit per course**	**Contact hours per week**	**Total contact hours for the course**	**Total credits for the semester**
1	Skill Development (Core)	FPT1S1T	Basic Principles of Food Processing	3	4	4	72	
2	Skill Development (Core)	FPT1S2T	Basic Principles of Food Preservation	3	4	4	72	
3	Skill Development (Core)	FPT1S3T	Food Chemistry	3	4	4	72	
4	Skill Development Core- Practical	FPT1S3P	Food Chemistry - Practical	3	2	2	36	
5	General Education (Common course)	ENCN1	Communication skills in English	3	6	5	90	
6	General Education (Complementary) Horticulture	HOR1G1T	Fundamentals of Horticulture	3	2	2	36	
7	General Education (Complementary-Practical)	HOR1G1P	Fundamentals of Horticulture - Practical	3	1	1	18	

	Horticulture							
8	General Education (Complementary) Energy and Environmental studies	EES1G1T	Renewable Energy sources	3	3	3	54	
9	Skill Development	FPT1S1I	Internship/field work	Internal Evaluation	4			
TOTAL					**30**	**25**	**450**	**30**

Second semester

Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
10	Skill Development (Core)	FPT2S1T	Food Additives	3	4	4	72	
11	Skill Development (Core)	FPT2S2T	Basic Principles of Food Engineering	3	4	4	72	
12	Skill Development (Core)	FPT2S3T	Basic Microbiology	3	4	4	72	
13	Skill Development (Core- Practical)	FPT2S3P	Basic Microbiology - Practical	3	2	2	36	
14	General Education (Common course)	ENCN2	Critical Thinking, Academic Writing & Presentation	3	6	5	90	
15	General Education (Complementary) Horticulture	HOR2G1T	Plantation crops, spices and fruits	3	2	2	36	

16	General Education (Complementary – Practical) Horticulture	HOR2G1P	Plantation crops, spices and fruits- Practical	3	1	1	18	
17	General Education (Complementary) Energy and Environmental studies	EES2G1T	Introductory Environmental Studies	3	3	3	54	
18	Skill Development	FPT2S1I	Internship/field work		4			
TOTAL					**30**	**25**	**450**	**30**

Third Semester

Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
19	Skill Development (Core)	FPT3S1T	Food Processing Machineries	3	4	4	72	
20	Skill Development (Core)	FPT3S2T	Bakery and Confectionary Technology	3	4	4	72	
21	Skill Development (Core)	FPT3S3T	Food Analysis and Adulteration Testing	3	4	4	72	
22	Skill Development (Core- Practical)	FPT3S4P	Food Product Development - Practical	3	2	2	36	
23	Skill Development (Core)	FPT3S5T	Fats and oil processing Technology	3	3	3	54	
24	Skill Development	FPT3S6T	Cereals and Pulses Technology	3	2	2	36	

	(Core)							
25	General Education (Complementary) Horticulture	HOR3G1T	Protected cultivation of horticultural crops	3	2	2	36	
26	General Education (Complementary – Practical) Horticulture - Practicals	HOR3G1P	Protected cultivation of horticultural crops-Practical	3	1	1	18	
27	General Education (Complementary) Energy and Environmental studies	EES3G1T	Environmental Impact Assessment	3	3	3	54	
28	Skill Development	FPT3S1I	Internship/field work	Internal evaluation	5			
TOTAL					**30**	**25**	**450**	**30**

Fourth Semester

Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
29	Skill Development (Core)	FPT4S1T	Dairy technology	3	4	4	72	
30	Skill Development (Core - Practical)	FPT4S1P	Dairy technology - Practical	3	2	2	36	

31	Skill Development (Core)	FPT4S2T	Meat Fish and Poultry Processing Technology	3	4	4	72	
32	Skill Development (Core)	FPT4S3T	Fruit and Vegetable Processing Technology	3	4	4	72	
33	Skill Development (Core - Practical)	FPT4S3P	Fruit and Vegetable Processing- Practical	3	2	2	36	
34	Skill Development (Core)	FPT4S4T	Functional Foods & Neutraceuticals	3	3	3	54	
35	General Education (Complementary) Horticulture	HOR4G1T	Landscape designing and indoor gardening	3	2	2	36	
36	General Education (Complementary – Practical) Horticulture - Practical	FPT4G1P	Landscape designing and indoor gardening- Practical	3	1	1	18	
37	General Education (Complementary) Energy and Environmental studies	EES4G1T	Energy and Environment Management	3	3	3	54	
38	Skill Development	FPT4S1I	Internship/field work	Internal evaluation	5			
TOTAL					**30**	**25**	**450**	**30**

Fifth Semester

Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
39	Skill Development (Core)	FPT5S1T	Food Packaging	3	4	4	72	
40	Skill Development (Core)	FPT5S2T	Technology of Beverages	3	4	4	72	
41	Skill Development (Core)	FPT5S3T	Drying Technology	3	3	3	54	
42	General Education	FPT5G1T	Sensory Evaluation	3	4	4	72	
43	General Education – Practical	FPT5G1P	Sensory Evaluation -practical	3	2	2	36	
44	General Education	FPT5G2T	Sanitation and Hygiene	3	4	4	72	
45	General ducation OPEN COURSE	FPT5G3T	Course offered by other departments in the college	3	3	4	72	
46	Skill Development	FPT5S1I	Internship/field work	Internal evaluation	6			
TOTAL					**30**	**25**	**450**	**30**

Sixth Semester

Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester

47	Skill Development (Core)	FPT6S1T	Analytical methods in food Processing	3	4	4	72	
48	Skill Development (Core - Practical)	FPT6S1P	Analytical methods in food Processing - Practical	3	2	2	36	
49	Choice based Core Course Skill development	FPT6S2T or FPT6S3T	Principles of Thermodynamics or Entrepreneurship Development	3	5	5	90	
50	General Education	FPT6G1T	Food toxicology	3	4	4	72	
51	General Education	FPT6G2T	Computer Hardware and Networking	3	4	4	72	
52	Skill Development Internship/field work	FPT6S1I	Internship/field work	Internal evaluation	4			
53	Skill Development Project/Dissertation	FPT6SP1	Project/Dissertation	Viva voce	7	6	108	
TOTAL					**30**	**25**	**450**	**30**